SECOND BIENNIAL UPDATE REPORT OF THE REPUBLIC OF SERBIA

to the UN Framework Convention on Climate Change

1. SUMMARY

The Republic of Serbia has been a Party to the United Nations Framework Convention on Climate Change (UNFCCC) since 2001, and Party to the Paris Agreement since August 24, 2017.

In 2010, the Republic of Serbia submitted the Initial National Communication under the UNFCCC (INC). The First Biennial Update Report (FBuR) was submitted in 2016, and the Second National Communication (SNC) in 2017 to the UNFCCC Secretariat.

All the reports were prepared with the financial support of the Global Environment Facility (GEF) and the technical support of the United Nations Development Programme (UNDP).

In June 2015, the Government of the Republic of Serbia submitted its Intended Nationally Determined Contributions (INDCs) foreseeing a 9.8% GHG emission reduction by 2030 compared to base-year (1990) emissions. In its Nationally Determined Contribution (NDC), updated in 2022, the Republic of Serbia increased its ambitions, to reduce GHG emission by 33.3% by 2030 (without the LULUCF sector) compared to base-year (1990) emissions, in accordance with Articles 3 and 4 of the Paris Agreement and paragraphs 22 and 24 of Decision 1.CP21.

The Second Biennial Report (SBUR) to the Framework Convention was also developed with the financial support of the Global Environment Facility (GEF), and UNDP's technical assistance. In compliance with the Law on Ministries, the Ministry of Environmental Protection (MoEP) is responsible for reporting under the UNFCCC, while the Serbian Environmental Protection Agency (SEPA) is responsible for the preparation and improvement of the Greenhouse gases Inventory. SEPA collects part of data on activities and obtains the rest from government organizations and institutions.

The development of Biennial Reports and National Communications under the UNFCCC is led by the MoEP. This Ministry established a Technical Working Group for reports development, which includes representatives of a broad range of stakeholders (government institutions, economic undertakings, civil society organisationss, etc.) and coordinates its work. This working group is project based and exists during the report development process; ensures the availability of data and information, supports the development of and provides suggestions and comments on the draft biennial reports and national contributions.

Despite visible progress, there is still a need to improve the legal, procedural and institutional framework for reporting on climate change. The Law on Climate Change ("Official Gazette of the Republic of Serbia", 26/21) provides the basis for the establishment of an efficient, transparent and cost-effective monitoring, reporting and verification (MRV) system that will provide credible information on progress in the fulfilment of domestic and international commitments and ensure monitoring of NDC achievement. It needs to be mentioned in that context that the Law ensures the identification of areas where the implemented measures have not yielded results, as well as the identification of alternative development paths that will secure achievement of GHG emissions reduction in accordance with the NDC.

2.1 National Circumstances

The Republic of Serbia is a landlocked country covering the area of 88,361 km^2.

Serbia's climate is moderate continental, with gradual transition between seasons. Continental climate prevails in the mountainous regions of above 1,000 m altitude. The southwestern part of the country borders the Mediterranean, subtropical and continental climate.

Since 2006, the Republic of Serbia is an independent democratic state with a multiparty parliamentary system. In March 2012, Serbia was granted the status of a European Union (EU) candidate country.

According to the 2022 Census, Serbia has a population of 6,647,003 (51.4% women and 48.6% men). In 2015, Serbia's population was estimated at 7,095,383 (with women accounting for 51.3% and men for 48.7% of its residents).

According to the data of the Statistical Office of the Republic of Serbia (SORS), the unemployment rate of the working age population stood at 19.2% in 2014, at 17.7% in 2015, 15.3% in 2016, 13.5% in 2017, 12.7% in 2018, 10.4% in 2019, and 9.0% in 2020. There are pronounced gender disparities in employment. Men account for most of the active working population. In 2014, the employment rate of working age women was much lower than that of men (43.7% vis-à-vis 57.7%). The situation in the labor market improved after 2015 when Serbia recovered from the economic crisis and the floods, with employment rates of both women and men increasing (to 52.0% and 65.6% respectively), but the gender gap persisted.

Serbia's economy is a service-based upper middle-income free-market economy, with the tertiary sector accounting for two-thirds of the total gross domestic product (GDP). Energy, machinery, mining, and agriculture are the strongest sectors of Serbia's economy.

Due to heavy floods, the GDP dropped by 1.8% in real terms in 2014 over 2013. The GDP registered a real year-on-year growth of 0.8% in 2015 and of 2.8% in 2016. The GDP registered real year-on-year growth of 2.0% in 2017 and 4.4% real year-on-year-growth in 2018. It registered nominal growth of 6.8% and real growth of 4.2% in 2019 over 2018. The GDP dropped by 0.9% in 2020 over 2019. GDP breakdown by sector is: services 67.9%, industry 26.1%, and agriculture 6%. Energy is one of the largest sectors of the Serbian economy, accounting for around 10% of the national GDP. This sector comprises of the oil and gas industry, coal mines, the electric power system, the decentralized district heating system and industrial energy.

The share of industry in the GDP stood at 25.8% in 2015; the following sectors accounted for the highest shares in the GDP: the manufacturing industry (15.6%), retail and wholesale trade (10.1%), real estate (8.6%) and the agriculture, forestry and fishery sector (6.5%). The following sectors had the largest shares in the GDP in 2020: manufacturing industry – 13.3%; wholesale and retail trade and repair of motor vehicles – 11.3%; real estate industry – 7%; agriculture, forestry and fishing – 6.3%; information and communication industry – 5.4%; and construction industry – 5.4%.

Transport in Serbia includes transport by road, rail, water and air. Increased activity was registered in all modes of transport in 2016 over 2015, except railway and public transport. Road transport has traditionally been the most developed mode of transport. The road network is well developed but its quality has diminished. Fleet age is the main problem when it comes to environmental protection and traffic safety. According to SEPA, of the 2,047 million passenger vehicles in 2015, 22.7% were between 15 and 25 years old, while 18% were over 25 years old. SORS data show an increase in the number of registered road vehicles in all categories (except buses and working vehicles) in 2020 over 2019. A total of 2,164,818 passenger vehicles were registered.

Agriculture's share in Serbia's GDP is traditionally high. In 2016, agriculture accounted for 11.9% of GDP, a 2.4% increase over 2015, mostly due to very favorable weather conditions and record crops. It is also the leading export sector in Serbia. In 2016, agriculture and food production accounted for 19.4% of all Serbian exports. The GDP fell in real terms by 1.6% in 2019. According to the 2012 Serbian Agriculture Census, there are approximately 630,000 registered agricultural holdings; around 99.6 percent of them are family farms and 0.4 percent are holdings owned by legal entities. Land in Serbia is rarely owned by women, i.e., 84% women do not own agricultural land. A new census is under way.

Identification of land use change was performed by use of CORINE land cover mapping. Serbia's forest cover is close to the global average and stands at 39,3%, but is much lower than the European average. The preliminary results of the Second National Forest Inventory show that Serbia's forest cover stands at 39.3%, that 57.5% of the forests are now private and 42.5% are state owned, whereas the First National Inventory showed that state-owned forests dominated over private ones (53% to 47%). According to the national Spatial Plan for the 2010-2020 period, Serbia's forest cover should optimally be 41.4%. Gross wood volume was higher in 2016 than in 2014, standing at 3.1 million m^3; gross wood volume in 2020 was lower than in 2019 and stood at 3.18 million m^3. On the other hand, a total of 11,320 ha was afforested in the 2011-2016 period, while the total area afforested in 2020 stood at 1,481 hectares.

Waste management accounted for 1.2% of the national GDP in 2016. There are 123 controlled non-compliant municipal landfill sites and around 3,450 illegal dumpsites in Serbia. In 2016, 474,018 tonnes of waste were landfilled; around 3% of municipal waste were recycled, while the bulk of the generated waste ended up in landfills. A total of 11,658 tonnes of hazardous waste were deposited in 2020. Serbia processes only 5-10% of its wastewater and needs to build 320 wastewater treatment facilities. More than 50% of the industrial facilities in Serbia do not treat wastewater, because there are no treatment systems in place. The percentage of households connected to the sewage system ranges from around 85% in Belgrade and 45% in Vojvodina to around 37% in central Serbia.

2.2 Greenhouse gases Inventory

The Serbian Environment Protection Agency (SEPA) is the national entity responsible for monitoring greenhouse gases emissions (GHG) and preparation of national GHG inventories. SEPA prepared the GHG Inventories for the 1990-2020 period that include: CO_2, CH_4, N_2O,

HFCs, PFCs, SF_6 and NF_3. The GHG Inventories have been prepared in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Also, a QA/QC plan has been developed. The UNFCCC QA workshop held within QA activities for the SBUR in January 2019 resulted in the formulation of short-, medium- and long-term recommendations for the improvement of GHG inventories. This SBUR includes some of the short-term recommendations for improving the GHG inventories, while other recommendations specifically addressing AFOLU will be included in the Third National Report.

In 2020, national GHG emissions excluding removals stood at 64,072 Gg CO_2 eq, while total GHG emissions including removals stood at 58,644 Gg CO_2 eq.

In 2020, 79.2% of all GHG emissions originated from the energy sector, followed by 7.2% from the AFOLU sector (excluding removals), due to relatively intensive agricultural production (biochemical processes in stockbreeding and farming). IPPU accounted for 7.2% of all GHG emissions. GHG emissions from the waste management sector accounted for 4.9% of all GHG emissions in 2020. In the 2010-2020 period, AFOLU sector saw a 16.2% drop in removals, mainly due to greater use of biomass and natural disasters (e.g., fires, strong winds, insect damage and diseases).

In 2020, the main GHG was carbon dioxide (CO_2) accounting for 82.2% of all GHG emissions expressed in CO_2 equivalent (CO_2 eq). Then methane (CH_4) with 13.1% and nitrous oxide (N_2O) with 4.3%.

Removals by sinks in the IPCC sector, 3.B.1 Forest land, stood at 5,043 Gg CO_2 eq in 2020, i.e., dropped by 17.6% over 2010.

2.3 GHG Mitigation Scenarios

To identify potentials for low-carbon economic development and enhance its NDC ambitions, the Ministry of Environmental Protection implemented EU-IPA 2014 project[1], during the 2016-2019 period in collaboration with other institutions and organizations.

The SBUR relies on the findings of the above-mentioned project and shows the GHG projections up to 2025 and 2030. Three different models were used for GHG emissions projections within the above-mentioned EU-IPA 2014 project and during the development of the SBUR: the PRIMES-GEM-E3 suite comprising the PRIMES energy system model and the GEM-E3 model for macroeconomic projections; CAPRI- the model for agriculture and land use, land use change and forestry (LULUCF); and the IPCC 2006 Waste model, for the waste sector (excluding wastewater, which was estimated using a distinct, simplified approach).

GHG scenarios cover a broad range of the main driving forces of future GHG emissions in Serbia, from policy, social, economic to environmental ones. Modelling was conducted from 2015 onwards. The following three scenarios were important from the perspective of the SBUR:

[1] Project Identification Number: EuropeAid/1365966/DH/SER/RS

- Without Measures (WOM), so-called Baseline (Business as Usual, BaU) - excludes all policies and measures (PAMs) implemented, adopted and planned after 2015; [2]
- With Existing Measures (WEM) – considers PAMs envisaged in the Low Carbon Development Strategy of the Republic of Serbia for the period 2023-2030 with projections until 2050
- With Additional Measures (WAM) - considers ways of Serbia individually achieving the EU 2030 targets (at least 40% cuts in GHG emissions compared to 1990; 32% RES by 2030 and 32.5% improvement in energy efficiency). [3]

All sectors recognized by the IPCC methodology (Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use and Waste) were taken into account during the assessment of mitigation potential until 2030, as shown in Table 1.1.

Table 1.1 GHG Emissions for All Scenarios and GHG Emission Trends for Different Periods

GHG Emissions for All Scenarios (kt CO2 eq)						**GHG Emission Trends**	
	1990	**2010**	**2020**	**2025**	**2030**	**2030/2010**	**2030/1990**
WOM	81,526	62,650	63,204	64,218	64,650	3.2%	-20.7%
WEM	81,526	6,.650	62,931	59,790	54,396	-13.2%	-33.3%
WAM	81,526	62,650	63,357	54,525	44,692	-28.7%	-45.2%

[2] The Baseline B2 Scenario set out in the Low Carbon Development Strategy of the Republic of Serbia for the period 2023-2030 with projections until 2050

[3] The M3 Scenario set out in the Low Carbon Development Strategy of the Republic of Serbia for the period 2023-2030 with projections until 2050

In terms of implementation costs, Serbia's costliest scenario in the long term (until 2050) would be to ignore climate related costs, continuing along the emissions trajectory assumed in the WOM scenario (Figure 1.2).

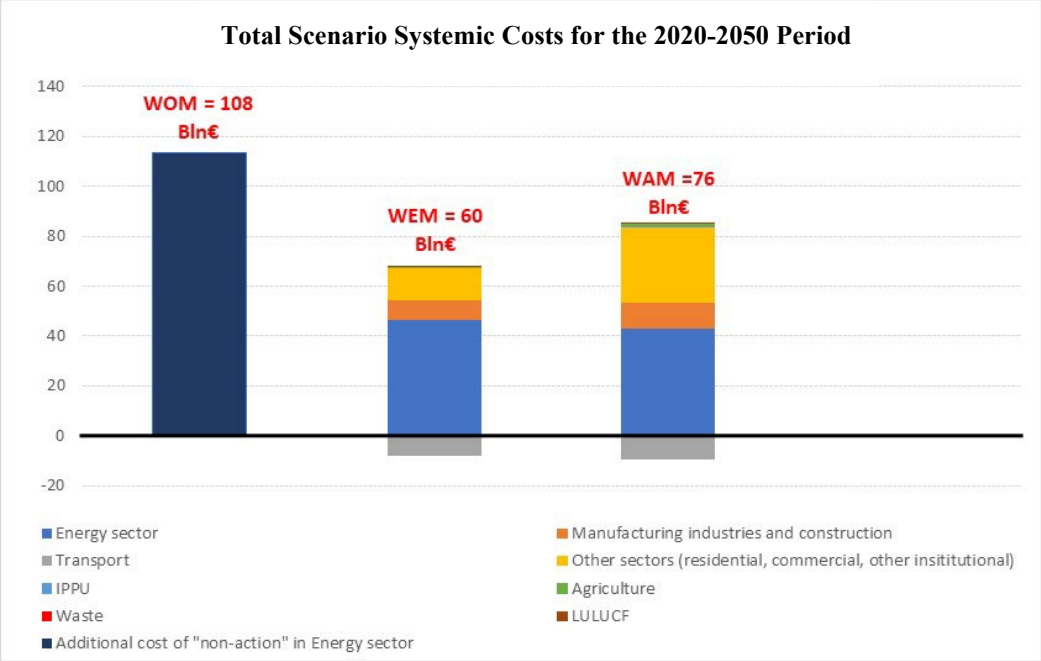

Figure 1.1. Total Scenario Systemic Costs for the 2020-2050 Period

Slightly higher investments in the shorter term (until 2030) would simultaneously lead to substantially lower total costs, and definitely to a significant reduction of losses and damages.

Table 1.2 Estimated Additional Costs of Implementation of Each Scenario per Sector (in million €) (Compared to WOM)

	2020–2025		**2026–2030**		**2020–2030**	
	WEM	WAM	WEM	WAM	WEM	WAM
TOTAL	1,893	6,650	4,618	12,589	6,511	19,239
Energy (total costs will be determined in the Integrated national energy and climate plan of the Republic of Serbia until 2030 for the period until 2050)	1,825	6,531	4,510	12,388	6,335	18,919
IPPU	2	3	2	3	4	6
Agriculture	20	31	60	93	80	121
Waste	0	39	0	59	0	98
Forestry	46	46	46	46	92	92

2.4 Mitigation Actions and Their Effects

Since the WOM scenario includes already initiated or planned mitigation actions addressing sectoral priorities or required for alignment with the EU acquis for which funding has been secured, this chapter presents PAMs described in Serbia's LCDS and included in the WEM scenario that will require substantial financial, technical and capacity building support (Chapter 5). Therefore, the expected and achieved GHG emission reductions are additional to those in the WOM. The objectives are expressed as targeted GHG emissions reduction in 2030 compared to 2010. Resources for their achievement will be planned in accordance with the decision of the Ministry of Finance and provided by the responsible ministries. A share of state costs will be covered through loans, wherefore the implementation of mitigation actions will require financial support of the international community, in accordance with the Paris Agreement and Serbia's status under the UNFCCC.

2.5 Monitoring, Reporting and Verification

The Law on Climate Change lays the grounds for the establishment of an MRV system in accordance with the Paris Agreement requirements, as a key instrument for tracking progress in the implementation of the NDCs and the fulfilment of the country's obligations under the UNFCCC. This system will become complete and functional through the adoption of bylaws and reporting templates; and through capacity building of institutions involved in MRV.

2.6 Support Received and Needs

Support received from multilateral and bilateral sources has substantially contributed to addressing the country's climate change mitigation and adaptation needs. The project "Establishing a Transparency Framework for the Republic of Serbia", implemented by the Ministry of Environmental Protection with GEF's financial support and UNDP's technical assistance, has played an important role in establishing a complete MRV system. Even though country's progress towards low-emission and climate resilient development is noticeable, there is still a need to further strengthen the technical capacity of institutions and experts at the national level for the preparation of biennial reports/NCs; establish a system for collecting information on financial and technical support for climate change mitigation (and adaptation) activities; operationalize the MRV system; create domestic sustainable financial mechanisms for climate change mitigation and adaptation.

3. NATIONAL CIRCUMSTANCES

The Republic of Serbia is an independent democratic state (since 2006) with a multiparty parliamentary system. In March 2012, Serbia was granted the status of a European Union (EU) candidate country.

The Republic of Serbia has been a party to the United Nations Framework Convention on Climate Change (UNFCCC) since 2001. In June 2015, the Government of the Republic of Serbia submitted its Intended Nationally Determined Contributions (INDCs) defining a 9.8% GHG emission reduction by 2030 compared to base-year (1990) emissions. Serbia's first NDCs also contains a section on losses and damages caused by extreme weather events and indicates the need to adjust to changed climate conditions. In August 2022, the Serbian Government adopted the Revised National Determined Contributions (NDC) and vowed to reduce its GHG emissions by 33.3% (without the LULUCF sector) by 2030 compared to the base-year (1990), whereby it tripled its initial contribution.

The Republic of Serbia has been a party to the Paris Agreement since August 24, 2017.

In 2010, the Republic of Serbia submitted the Initial National Communication under the UNFCCC (INC). It submitted its First Biennial Update Report (FBUR) in 2016, and the Second National Communication (SNC) in 2017, to the UNFCCC Secretariat.

All the reports were prepared with the financial support of the Global Environment Facility (GEF), with the United Nations Development Programme (UNDP) as the implementing agency.

The Republic of Serbia adopted the Law on Climate Change on March 18, 2021. The Law envisages the establishment of mechanisms for timely, transparent, accurate, consistent, comparable, and complete reporting and verification of information on the fulfillment of requirements under the UNFCCC and the Paris Agreement.

3.1. Geographic and Climate Profile

Serbia is a landlocked country situated at the crossroads of Central and Southeast Europe, covering the far southern edges of the Pannonian Plain and the central Balkans. Serbia has an area of 88,361 km^2 (including the territory of Kosovo and Metohija* UNSC Resolution 1244 of 1999 refers to), rendering it the 111^{th} largest country in the world. Arable land covers 24.8% and forests 39.3% of Serbia's territory. Protected areas cover 7.66% (677,950 ha) of Serbia's territory.

The Pannonian Plain stretches in the north of Serbia, while hills and mountains stretch in the south. The north part of Serbia is dominated by lowlands. Hills and high mountains characterize the central part of Serbia. Its western margins include sections of the Dinaric Alps, and its eastern borderlands are part of the Carpathian and Rhodope mountain systems. The highest mountain peak is Đeravica in the Prokletije Range (2,656 m). The northeastern border follows the Danube River Iron Gate (Đerdap) gorge.

Serbian rivers belong to the Black, Adriatic and Aegean Sea basins, and the Danube is the longest river.

Serbia's climate is moderate continental, with more or less pronounced local characteristics and a gradual transition between seasons. Continental climate prevails in the mountainous regions of above 1,000 m altitude. The southwestern part of the country borders the Mediterranean, subtropical and continental climate.

Most of Serbia has a continental precipitation regime with higher quantities during the warmer parts of the year, except for southwestern parts where the highest precipitation is measured in autumn.

An east and southeast wind (koshava) dominates during the colder part of the year. Northwest and west winds prevail in the mountainous parts of southwestern Serbia.

3.2 Population

Serbia's population was estimated at 7,095,383 in 2015, with women accounting for 51.3% and men for 48.7% of its residents. In the 2005-2015 period, the number of Serbia's residents decreased by 345,386 and the average annual population growth rate stood at -4.75 per 1,000 inhabitants. According to the 2022 Census, Serbia has 6,647,003 inhabitants (51.4% women and 48.6% men).[4]

Urban population accounts for up to 59.44% of the population. The largest cities are Belgrade (the capital, 1,659,440 inhabitants), Novi Sad (341,625), Niš (260,237) and Kragujevac (179,417).

In 2015, the average age of the population was 42.7 (44.1 of women and 41.3 of men), while, in 2022, the average age of the population was 43.8 (45.2 of women and 42.4 of men).

Table 3.1 Estimated Population by Type of Settlement, SORS, 2015

Type of settlement	Gender	Number of Inhabitants	Average Age (in Years)	Ageing Index[5]	Rate of Population Aged 65+
Total	**Total**	**7,095,383**	**42.7**	**136.6**	**28.0**
	Male	3,455,335	41.3	116.6	23.8
	Female	3,640,048	44.1	157.9	32.1
Urban	**Total**	**4,267,079**	**41.8**	**124.2**	**25.3**
	Male	2,033,446	40.2	102.8	21.6
	Female	2,233,633	43.2	146.8	28.8
Other	**Total**	**2,828,304**	**44.2**	**156.6**	**32.3**
	Male	1,421,889	42.9	138.7	27.1
	Female	1,406,415	45.5	175.7	37.8

[4] https://popis2022.stat.gov.rs/en-US/

5 The Ageing Index is the ratio of old (aged 60 and above) to young (0-19) populations estimated in the middle of the year of observation.

3.3 Economy

Serbia's economy is a service-based upper middle-income free-market economy, with the tertiary sector accounting for two-thirds of the total gross domestic product (GDP). Energy sector, machinery, mining, and agriculture are the strongest sectors of Serbia's economy. Trade plays a major role in Serbian economic output. SORS data show that the manufacturing industry grew by 5.3%, the mining sector by 4% and the electricity, gas, steam and air conditioning supply sector by 2.7% in 2016 over 2015.

Due to heavy floods, the GDP dropped by 1.8% in real terms in 2014 over 2013. The GDP registered a real year-on-year growth of 0.8% in 2015 and of 2.8% in 2016 compared to the previous year. GDP breakdown by sector is: services 67.9%, industry 26.1%, and agriculture 6.0%.

The following sectors had the largest shares in the GDP in 2020: manufacturing industry, 13.3%, wholesale and retail trade and repair of motor vehicles, 11.3%, real estate industry, 7.0%, agriculture, forestry and fishing, 6.3%, information and communication industry, 5.4%, and construction industry, 5.4%.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Rate (%)	7.8	5.0	7.1	4.4	9.0	5.5	9.7	6.4	5.7	-2.7	0.7	2.0	-0.7	2.9	-1.6	1.8	3.3	2.0

The total financial impact of the 2014 floods in the 24 hardest hit municipalities was €1,525 million; the value of destroyed physical assets accounted for 57% and production losses for 43% of total damages and losses. Together with the losses in the other affected municipalities, the financial impact of the floods totaled to €1.7 billion. Seventy percent of all flood damage were registered in manufacturing activities, 16% in social protection services and 12% in infrastructure. In terms of economic and social activity, the mining and energy sectors (32%), housing (15%), agriculture (15%), trade (15%) and transport (11%) were hit the hardest.

According to SORS data, the unemployment rate of the working age population (15-64) stood at 19.2% in 2014, at 17.7% in 2015 and at 15.3% in 2016, 13.5% in 2017, 12.7% in 2018, 10.4% in 2019 and 9.0% in 2020.

There are pronounced gender disparities in employment. Men account for most of the active working population. In 2014, the employment rate of working age women (15-64) was much lower than that of men (43.7% vis-à-vis 57.7%). The situation in the labor market improved after 2015 when Serbia recovered from the economic crisis and the floods, with employment rates of both women and men increasing (to 52.0% and 65.6% respectively and to 43.2% and

57.9% respectively in 2022), but the gender gap persisted (SORS, Labor Force Survey database[6]).

The level of absolute poverty stands at 8.9% and is much higher in rural areas. The relative median at risk of poverty rate stood at 25.4%, with a threshold of 60% middle income (SORS). Children and youth under 24, the unemployed, households with three or more children and single-parent households are at higher risk of poverty and social exclusion. The at risk of poverty rate stood at 21.2% in 2021, i.e., was 0.5% lower than in 2020.

Food and non-alcoholic beverages account for the largest share of individual consumption (household expenditure) (34.9%), followed by expenditures for housing, water, electricity, gas and other fuels (16.7%), as well as transport expenses (9.3%).

The main economic challenges ahead include: stagnant household incomes; the need for private sector job creation; structural reforms of state-owned companies; strategic public sector reforms; and the need for new foreign direct investments.

3.4 Energy

Energy is one of the largest sectors of the Serbian economy, accounting for around 10% of the national GDP. This sector comprises of the oil and gas industry, coal mines, the electric power system, the district heating system and industrial energy.

Most of Serbia's energy infrastructure is state-owned and operated by companies. The company *Elektroprivreda Srbije* (EPS) owns most of Serbia's energy production infrastructure, while the electricity transmission system is operated by the company *Elektromreža Srbije* (EMS).

In 2020, EPS produced 34 TWh of electricity, while final electricity consumption stood at 27.9 TWh. Most of the electricity was produced by thermal power plants (around 69.6% of all electricity) and, to a lesser degree, by hydro power plants (around 25.7%).), the thermal power plants had an installed active power of 4,079 MW, while the nine hydro power plants (HPPs) had a total installed power of 2,937 MW. The gross annual production of electricity averaged 37646 GWh in the 2012-2020 period.

[6] https://data.stat.gov.rs/Home/Result/2400020102?languageCode=en-US

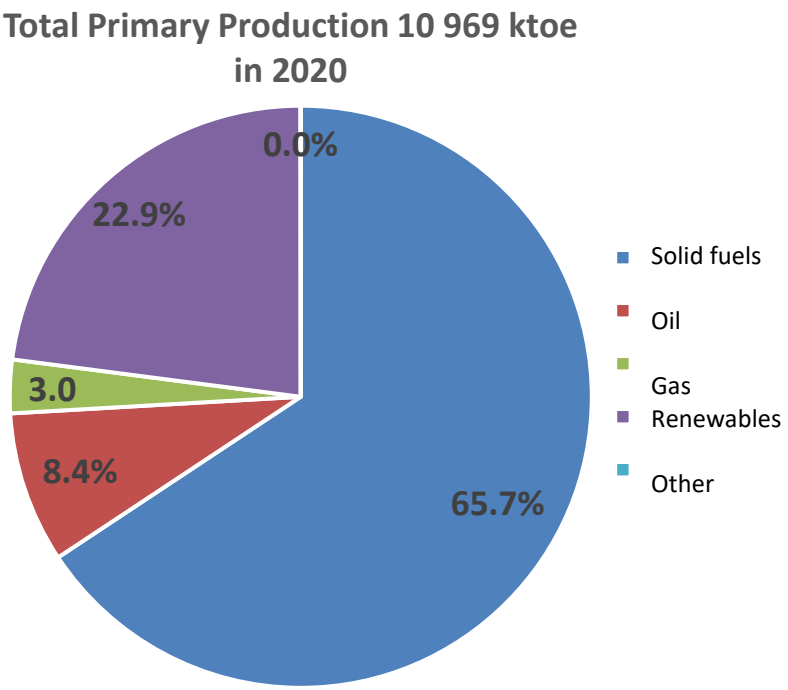

Figure 2.1 Primary Fuel Mix in Serbia in 2020, Source: Eurostat

Pursuant to Directive 2009/28/EC and the Decision of the Ministerial Council of the Energy Community of 18 October 2012 (D/2012/04/MS-EnC), Serbia committed to increase its share of renewable energy sources (RES) to 27% in gross final consumption in 2020 and to 10% of the share of energy from RES in the transport sector. The share of energy from RES in gross annual consumption of energy stood at 26.3% in 2020.
The consumption of electricity in Serbia's households is very high compared to the EU average (+18.7%) despite the better climate conditions, mostly due to use of electricity for heating and very low energy efficiency levels, as well as due to the higher number of household members. The average annual production of electricity is still for the most part sufficient to satisfy national consumption, but, as a rule, specific quantities are imported during high consumption periods during the cold winter periods, and exported during the summer periods.

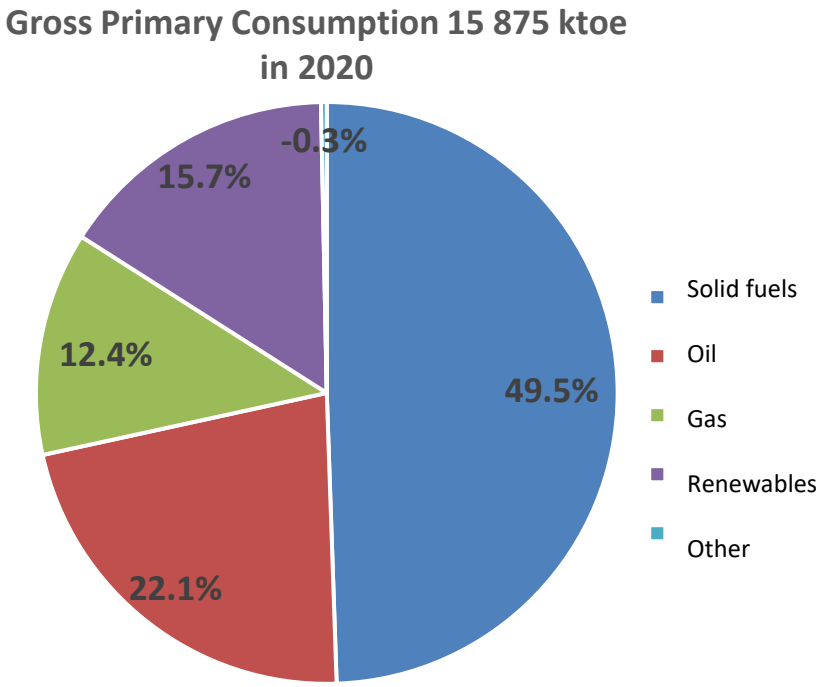

Figure 3.1 Gross Domestic Consumption in Serbia in 2020, Source: Eurostat

3.5 Industry

The following sectors account for the highest shares in the GDP: the manufacturing industry (15.6%), retail and wholesale trade (10.1%), real estate (8.6%) and the agriculture, forestry and fishery sector (6.5%). The share of industry in the GDP stood at 25.8% in 2015 and at 25.1% in 2014 ; the manufacturing industry accounted for the highest share in the GDP in 2019 13.7%. GDP shares by sector are as follows: services (approximately 62%), industry including mining, and electricity, gas, and steam production (approximately 24%), agriculture, forestry and fishery (approximately 10%) and construction (up to 4%). The service sector is primarily based on the consumer-oriented industry, such as finance, trade, real estate, telecommunications and communications, as well as the public sector (state administration, social security and defense).

Six sub-sectors dominate the manufacturing industry's contribution to the Serbian GDP: food processing (14.4%), production of motor vehicles and trailers (6.9%), steel production (4.6%), textiles (2.46%), and the chemical industry (0.6%). The food industry is one of the main areas of Serbian industry.

3.6 Transport

Transport in Serbia includes transport by road, rail, water and air. Increased activity was registered in all modes of transport in 2016 over 2015, except railway and public transport. An increase in passenger transport was registered only in air transport. As per freight transport, an

increase was registered in road, inland waterway and air transport compared to 2011, while a decrease was registered in railway transport.

Serbia has fairly developed inland water transport, which carried over two million tonnes of cargo in 2016. There are 1,716 kilometers of navigable inland waterways (1,043 km of navigable rivers and 673 km of navigable canals); nearly all of which are located in the northern third of the country. The most important inland waterway is the Danube (part of Pan-European Corridor VII). Other navigable rivers include Sava, Tisza, Begej and Tamiş, all of which connect Serbia with North and West Europe through the Rhine–Main–Danube Canal and the North Sea route, Serbia is connected to East Europe via the Tisza, Begej and Danube Black Sea routes, and with South Europe via the Sava River.

Figure 3.2 Rivers and River Basins

The river ports on the Danube include: the Novi Sad Port (1.18 million tonnes of cargo in 2016) and the Port of Belgrade, which are the largest ones, and other river ports in Pančevo, Smederevo, Prahovo, Apatin and Bačka Palanka. The Šabac Port is the largest port on the Sava and the Senta Port is the largest port on the Tisza.

Road transport has traditionally been the most developed mode of transport. The road network is well developed but its quality has diminished. The Republic of Serbia has approximately 30,000 km of local roads and 15,874.625 km of first and second order roads under the authority of the Public Company *Putevi Srbije*.

Freight transport increased in 2016 over 2010. As for air transport, the number of passengers transported and passenger-kilometers increased. Furthermore, so did freight transport. Freight transport fell by 8.1% t km in 2020 compared to 2019. This happened due to the decrease in freight transport in all modes of transport, except air transport, which remained at the same level.

Fleet age is the main problem when it comes to energy efficiency, environmental protection and traffic safety. Of the 2,047 million passenger vehicles in 2015, 5.5% were less than five years old, 53.8% were between 5 and 15 years old, 22.7% were between 15 and 25 years old, while 18% were over 25 years old[7].

3.7 Agriculture

Agriculture's share in Serbia's GDP is traditionally high. In 2016, agriculture accounted for 11.9% of GDP, a 2.4% increase over 2015, mostly due to very favorable weather conditions and record crops.

According to the Serbian Statistical Office, 680,000 people, or 21% of the country's labor force, were employed in agriculture in 2015. According to the Report on the State of Agriculture in the Republic of Serbia, the country's labor force employed in agriculture and food processing fell by 5% (27.4 thousand people) during 2020 compared to the previous year. Agriculture is also the leading export sector in Serbia. In 2016, agriculture and food production accounted for 19.4% of all Serbian exports and made a surplus of $1.4 billion, $130 million more than in 2015 (mostly due to an increase in processed fruit and vegetable exports).

In 2020, the share of crop production in the total value of agricultural production equaled 67.5% and that of livestock production equaled 32.5%. Crop production increased by 4.6% over the previous year. Within crop production, the value of crop farming grew by 4.4% and the value of fruit growing increased by 6.0%, while the value viticulture fell by 2.0%. The value of livestock production decreased by 0.3% year on year. In the structure of livestock production, the value of cattle breeding dropped by 1.1%, of sheep breeding by 5.9%, and of poultry breeding by 0.1%, while the value of pig breeding increased by 0.8%.

In 2020, arable land accounted for 74.3%, orchards for 5.3%, vineyards for 0.6%, permanent grassland for 9.7% and pastures for 9.5% of all agricultural land. Cereals accounted for 66.8%, industrial crops for 18.9%, vegetables for 1.8%, and fodder crops for 9.0% of sown arable land. Total production registered a year-on-year increase in 2020: of wheat by 13.4%, of corn by 7.2%, while production of sunflower fell by 12.7% and the production of sugar beet by 12.4% in 2020 compared to 2019. Compared to the previous year, the number of livestock units

[7] According to the data of the Serbian Environment Protection Agency (SEPA)

decreased (by 1.6%) and the production of cow's milk fell (by 0.9%), while meat production increased.

Most of the agricultural land is in the northern part of the country; 84% of all cultivable land in Serbia is located in Vojvodina. The country has 5.05 million ha of arable land. Approximately 90% of arable land is privately owned and 10% is state-owned.

According to the latest available national Agriculture Census, conducted in 2012, there are approximately 630,000 registered agricultural holdings; around 99.6 percent of them are family farms and 0.4 percent are holdings owned by legal entities. The average size of a family holding is only 4.5 ha, while the average size of a registered commercial farm is 10.6 ha. Land in Serbia is rarely owned by women. In 2015, the percentage of male owners of agricultural land was twice as high as the percentage of female owners, i.e., 84% women do not own agricultural land. A national agriculture census is under way for 2023.

The food processing industry - including confectionery, the sugar industry, breweries, and flour and meat production - remains an attractive sector for investment, given the country's natural resources and traditional production background, but the industry still lacks modern technology.

3.8 Land Use Change and Forestry

Identification of land use change between 1990 (reference year) and 2000 was performed in the 2015-2016 period, by use of CORINE land cover mapping. The mapping results are presented in Table 3.2.

Table 3.2 CORINE Level 1 Changes 1990 – 2000 (in hectares)

Class	**In Class**	**Decrease (ha)**	**Increase (ha)**
Artificial Surfaces	198	1,974	5,921
Agricultural Areas	19,392	12,819	4,346
Forest and Seminatural Areas	43,369	4,695	6,670
Wetlands	0	103	0
Water Bodies	0	1,333	3,676

In general, there was an increase in artificial surfaces, forest and seminatural areas and water bodies and a decrease in agricultural areas and wetlands in the reference period.
A total of 2,254,000 ha of land in Serbia are under forests according to the First National Forest Inventory, while, according to the preliminary data of the Second National Forest Inventory, a total of 3,049,502.10 ha of land are under forests. Preliminary data of the Second National Inventory show a change in the structure of ownership of forest land – while state-owned forests dominated over private forests according to the First National Inventory (53% vs. 47%), the Second National Inventory indicates that 57.5% of the forests are now privately owned, while 42.5% of them are state owned. Serbia's forest cover is close to the global average and stands at 39.3%, but it is much lower than the European average standing at around 46% (TBFRA 2000). According to the national Spatial Plan for the 2010-2020 period, Serbia's forest cover should optimally be 41.4%. Volume of felled timber in state forests stood at 143,007 m^3 in 2020.

Afforestation decreased by 456 ha (around 26%) in 2016 over 2015. A total of 1,481 ha was afforested in 2020. The volume of afforestation fell by 52% in 2020 compared to 2019; 538 ha were afforested with conifers. A total of 1,402 ha was afforested in the state sector and 79 ha were afforested in the private sector. In the 2017-2020 period, 8,089 hectares of new forests were established through afforestation.

In 2020, total damages in state forests amounted to approximately 143,007 m^3 of wood volume, out of which. man-made disasters caused damage to 26,000 m^3. Natural disasters (wind, rain, hail and snow) caused damage around 75,000 m^3 of the wood volume, which is around 53% of all damages in state-owned forests. In state-owned forests 26 forest fires registered in 2020 caused damage to 3,525 m^3 of wood volume . In 2020 , pest diseases caused damage around 26,000 m^3 of wood volume in state forests.[8]

3.9 Waste Management

Waste management accounted for 1.2% of the national GDP in 2016. According to the data submitted to the National Register of Pollution Sources, a total of 12,495,392 tonnes of waste were generated in 2020. The morphological structure of municipal waste in 2020 indicates the largest share of biodegradable waste of 48.4%. The following types of waste accounted for much smaller shares: paper and cardboard, fine elements and other (leather, diapers, rubber, etc.). In 2020, the amount of generated waste still stood at around 1.8 tonnes per capita a year and it slightly increased vis-à-vis the GDP, to around 227.1 t/million $. A Serbian Environmental Protection Agency (SEPA) report shows that a total of 2.15 million metric tonnes of waste were generated in the 2011-2017 period, of which 1.80 million metric tonnes, or 83.7%, were collected by public utility companies. The average per capita amount of landfilled municipal waste stood at 0.84 kg per day, and the annual quantity at 0.30 metric tonnes. This does not include some 20% of generated municipal waste ending up at illegal dumps. Biodegradable waste (31%), garden waste (11,9%) and fine elements (8.,%) account for the largest shares of total waste.

There are 123 controlled non-compliant municipal landfill sites and around 3,450 illegal dumpsites in Serbia. In 2016, only 10 landfills fulfilled the sanitary standards, while three regional sanitary landfills were under construction. The three largest cities in Serbia (Belgrade, Novi Sad and Niš) do not have sanitary landfills.

In 2016, 474,018 tonnes of waste were landfilled; around 3% of municipal waste were recycled, while the bulk of the generated waste ended up in landfills. Due to poor service coverage in rural areas, it is likely that large amounts of waste end up in non-compliant landfills or illegal dumpsites. Thus, about 20% of generated communal utility waste is disposed at illegal dumpsites, beyond the control of public utility companies. A total of 558,658 tonnes of waste ended up in landfills in 2020. Large quantities of waste still end up in non-compliant landfills.

[8] According to SORS data

Public utility companies in urban areas collect most of the generated waste, while coverage of rural areas by an organized waste collection system is much smaller.

Wastewater is one of the main polluters of surface and groundwater, which are natural sources of drinking water. This especially holds true for industrial waste and landfill leachate much of which remain untreated. Wastewater mainly comes from households (67%), much less from the industry (19%), while 14% is generated by other users.

Serbia processes only 5-10% of its wastewater and needs to build 320 wastewater treatment facilities. More than 50% of the industrial facilities do not treat wastewater, because there are no treatment systems in place. Belgrade, the country's capital with over two million inhabitants, does not treat wastewater since it does not have a wastewater treatment plant. Twenty-one municipalities have wastewater treatment plants, but even the largest cities discharge wastewater into the rivers.

The percentage of households connected to the sewage system ranges from around 85% in Belgrade and 45% in Vojvodina to around 37% in central Serbia.

The total amount of residential wastewater dropped by 0,7% in 2020 over 2019, while the amount of wastewater discharged into the public sewerage fell by 1,3% year on year. A 16,5% year on year increase in the treatment of wastewater was registered in 2020; secondary treatment dominated.

3.10 Institutional, Legal and Procedural Reporting Framework

In its reports under the UNFCCC, including this one, the Republic of Serbia has been presenting the initiated and implemented climate change-related activities at the national level in the reporting periods.

In compliance with the Law on Ministries, the Ministry of Environmental Protection (MoEP) is in charge of inspection, protection and improvement of the environment including cross-border pollution and climate change, air protection, environmental impact assessments (EIA) and strategic environmental assessments (SEA), protection from chemical incidents, noise and vibration, waste management and protected plant and animal species. The MoEP is the UNFCCC national Focal Point. The MoEP's Climate Change Department (CCD) is responsible for climate change issues, including the preparation of biennial reports (BURs) and national contributions (NCs).

The Serbian Environmental Protection Agency (SEPA) is responsible for the establishment and maintenance of the GHG Inventory and it prepares the Reports on the GHG Inventory.[9] SEPA collects some data on activities and obtains the rest from government organizations and institutions.

[9] Law on Climate Change (Official Gazette of the RS, No. 26/2021).

The Ministry of Mining and Energy (MoME) drafts and implements strategic documents and regulations on energy, energy efficiency and renewable energy sources, funds energy efficiency projects via its Directorate for Funding and Encouraging Energy Efficiency, and deals with climate change issues in the energy sector.

The Ministry of Agriculture, Forestry and Water Management performs state administration tasks related to: agriculture, forestry and water management development strategies and policies, including land policy in agriculture and rural development; incentives and systemic solutions for the improvement and development of these three sectors; the information system on farms, agricultural land, the forestry inventory etc. This Ministry established the Unit for Climate Change in Agriculture in 2019. This Ministry is the National Designated Authority for the Green Climate Fund (GCF), as it is responsible for the sectors most vulnerable to climate change.

The Statistical Office of the Republic of Serbia (SORS) is tasked with the development of methodologies for creating, collecting, processing, statistical analysis and publication of statistical data, including annual energy balances; the preparation and adoption of statistical standards; the development, maintenance and use of administrative and statistical registers; and the establishment and maintenance of the system of national accounts. SORS also collects data and reports on Sustainable Development Goals.

The Government of the Republic of Serbia adopted a decision on the establishment of the National Climate Change Council (NCCC) on November 20, 2014. This body is chaired by the minister in charge of environmental protection. NCCC members include representatives of all the relevant ministries and other government institutions, as well as representatives of universities and research institutions, economic undertakings and civil society organizations. The NCCC monitors the development and implementation of national climate change policies, compliance of sectoral policies and other planning documents with climate change policies, and Serbia's fulfilment of its international obligations in the field of climate change; reviews reports to the UNFCCC; initiates updating of climate change adaptation and mitigation policies, legislation and measures; and, monitors the implementation of national policies and legislation and proposes corrective measures to improve them. The National Climate Change Council has been established under the Law on Climate Change (Official Gazette of the RS, No. 26/2021).

The development of national communications and biennial reports to the UNFCCC is led by the MoEP. The Ministry established a Technical Working Group charged with drafting the reports includes representatives of a broad range of stakeholders (government institutions, economic undertakings, CSOs, etc.) and it is coordinated by the MoEP. This working group ensures the availability of data and information, supports the development of and provides suggestions and comments on the draft biennial reports and national reports. This working group is project based and exists during the report development process. Preparation of the Greenhouse gases Inventory is within SEPA's remit, while the preparation of projections and identification of mitigation potentials were conducted by the Ministry of Environmental Protection, in cooperation with other relevant bodies and organizations, in the 2016-2019 period, within the EU IPA 2014 project "Climate Change Strategy with Action Plan".

During their development, the reports are presented to the general public at various stages of development and across the country.
To ensure a participatory approach, several thematic workshops were organized a during the development of this BUR for consultations with stakeholders, including two-day biannual meetings of the Working Group to obtain inputs for improving the biennial report, consultations with civil society organisations, ahead of UNFCCC COPs, a side event during Belgrade Security Forum 2019, etc. Finally, the final Draft of the SBUR was presented and discussed at a validation workshop with the members of the working group and other stakeholders held on 1 June 2020.
Despite visible progress, there is still a need to improve the legal, procedural and institutional framework for reporting on climate change, which also applies to the biennial reports and the NCs. Specific shortcomings, concerning competences for the development, monitoring and reporting on GHG emission projections, were identified during the development of this biennial report.
The capacities of the sectoral ministries, especially those responsible for the key emitting and the most vulnerable sectors, need to be strengthened.
Given that most of these elements, especially those regarding monitoring and reporting, are requirements arising out of the EU *acquis*, Serbia, as an EU candidate country, transposed these legal obligations into the national Law on Climate Change (Official Gazette of the RS, No. 26/21). The Law on Climate Change provides the basis for the establishment of a fast, efficient, transparent and cost-effective monitoring, reporting and verification (MRV) system that will provide credible information on progress in the fulfilment of domestic and international commitments and ensure monitoring of NDC achievement.
This Law is:

- Improving the collection, quality and timeliness of data and information;
- Improving coordination among the relevant authorities; and
- Helping raise awareness of climate change issues.

International institutions and donors have been extending significant support to Serbia for combating climate change. The Global Environmental Facility (GEF), with the United Nations Development Program (UNDP) as the implementing agency, has provided financial and technical support for the preparation of the biennial reports and national reports. Moreover, the support provided by the GEF in the climate change field has been of crucial importance over the past decades.
In addition, the EU has recently invested major resources, including technical assistance, in the establishment of a legal and institutional framework for climate change monitoring, reporting and verification/evaluation.
All National Communications, the FBUR, background reports contributing to this biennial report and other climate change-related documents and information, as well as information on previous events, are publicly available on the national climate change website: www.klimatskepromene.rs.

GHG National Inventory

According to the Law on Climate Change (Official Gazette of the RS, No. 26/21), the Serbian Environment Protection Agency (SEPA) is the national entity responsible for monitoring GHG emissions and removals and for the preparation of national GHG inventories.

Regulation on Types of Data, Bodies and Organizations and Other Natural and Legal Persons that Submit Data for the Preparation of the National Inventory of Greenhouse Gases ("Official Gazette of the Republic of Serbia" No. 43/2023) lays down the obligation of government agencies and organizations, public institutions, local self-governments, associations, businesses and other entities to submit activity data to SEPA. The activity data providers and the types of data they provide, including for the preparation of the SBUR are presented in **Error! Reference source not found..**

Table 3.3 Activity Data Sources and Responsible Entities

IPCC sector	Activity Data Source	Responsible Entity
Energy	National energy balance	Ministry of Mining and Energy
	Registered motor vehicles	Ministry of the Interior (database)
	Fuel characteristics data	Ministry of Mining and Energy, NIS (oil company)
	Natural gas processing	NIS (oil company)
Industrial Processes and Product Use	Production and use of raw materials for various industrial processes; use of products; population	Statistical Office of the Republic of Serbia (Statistical Yearbook)
Agriculture, Forestry and Other Land use (AFOLU)	Number of different categories of livestock	Statistical Office of the Republic of Serbia (Statistical Yearbook)
	Consumption of mineral fertilizers	Statistical Office of the Republic of Serbia (Statistical Yearbook)
	Land areas; annual increment, harvest	Corine Land Cover database
Waste	Amounts of landfilled municipal solid waste	Statistical Office of the Republic of Serbia (Statistical Yearbook)
	Waste composition	University of Novi Sad
	Wastewater treatment	Statistical Office of the Republic of Serbia (Statistical Yearbook)

Important sources of activity data also include official statistical publications (annual Statistical Yearbooks, annual industrial reports) and already collected activity data used for other reporting

purposes (CLRTAP, CORINE, FAOSTAT). Alternative estimation methods (interpolation and extrapolation) were used to bridge activity data gaps in some years in the reporting period.

SEPA archives all information for the 1990-2020 time series, including emission factors and activity data. The Regulation tasks SEPA with performing quality control (QC) procedures for activity data and calculating GHG emissions and removals. Some of the inventory improvements are made based on the QC checks. Importantly, the national CO_2 emission factor for lignite, the most commonly used fossil fuel in Serbia, was determined for the category of electricity and heat production.

The Rulebook on the Content of the National GHG Inventory and Content of the National GHG Inventory Report was adopted in June 2023.

4.1 Methodologies

SEPA prepared the GHG Inventories for the 1990-2020 period that include: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6. The other gases that are not included do not occur. The GHG Inventories have been prepared in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, with specific improvements in accordance with the 2019 Refinement to the 2006 IPCC Guidelines. GHG emissions are expressed in CO_2 equivalent (CO_2 eq) considering the 2006 IPCC global warming potential (GWP) values (Assessment Report 5).

During the preparation of the SBUR, a revision was performed of activity data used for developing GHG inventories and a recalculation was conducted for the 1990-2020 time series. GHG Inventories for 1990, 2000, 2005, 2010 and the 2015-2020 time series are reported.

The following GHGs are included in the Inventory: CO_2, CH_4, N_2O, HFCs and SF_6. These GHG emissions and removals are divided into the following sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste. Each sector is comprised of categories and sub-categories, so that the Inventory is compiled at the subcategory level.

The transition of the format needed for the IPCC Inventory Software[10] into MS Excel has been completed. Thus, the GHG Inventory results are in compliance with the Common Reporting Format (CRF).

The GHG emissions were calculated by using either the Tier 1 or Tier 2 method, depending on data availability. The Tier 1 method, the internationally recommended values of emission factors for all fossil fuels (solid, liquid and gaseous) was used, except for the low calorific open-pit lignite. For the combustion of Serbian lignite, which has a much lower net calorific value and a higher emission factor (EF) value, national emission factors were used[11],. National EFs for lignite combustion were applied to the entire 1990-2020 time series for the production of

[10] http://www.ipcc-nggip.iges.or.jp/software/index.html

[11] Annex I of the Initial National Communication of the Republic of Serbia under the United Nations Framework Convention on Climate Change: Net calorific value and emission factor of raw lignite from pit-mine exploitation in the Republic of Serbia

electricity and thermal energy category. The Tier 2 method was applied to sub-category 2F1a – Stationary air conditioning and sector 3A2 – Manure management.

Compared to the FBUR, the process of preparing the SBUR involved:

- Application of the national EFs for lignite consumption for the production of electricity and thermal energy category;
- Format needed for IPCC Inventory Software[12] was changed to MS Excel;
- Application of the higher Tier 2 to HFCs (in 2F1a) and CH_4 (in 3A2).

The process of preparation of the FBUR, including consultations with data holders, showed that activity data for 2010 were of the best quality, especially in the energy sector (the key emitting sector). Therefore, the mitigation potential is shown vis-à-vis 2010, and then expressed as a percentage of GHG emissions in 1990.

Also, a QA/QC plan has been developed. The UNFCCC QA workshop held within QA activities for the SBUR in January 2019 resulted in the formulation of short-, medium- and long-term recommendations for the improvement of GHG inventories related to the need to increase the number of experts dealing with GHG inventories, especially those specializing in AFOLU and HFCs. This SBUR includes some of the short-term recommendations for improving the GHG inventories, notably those related to the description of the reasons for livestock population decrease, inclusion of natural disturbances in assessments of biomass carbon losses and calculation of emissions from 'Other use of carbonates' so as not to subtract use of dolomite and limestone in glass production, while other recommendations will be reviewed during the development of the Third National Communication.

4.2 Key Categories

Key categories from the national GHG Inventory, both sources and sinks, identified by using Approach 1 level (2020) and trend (1990-2020) assessments, are presented in Table 3.4, by IPCC category.

Table 3.4 Key Categories, Level and Trend Assessments

Key Categories of Emissions and Sinks	Gas	Level Assessment (L)	Trend Assessment (T)
1.A.1 Energy Industries – Liquid Fuels	CO_2	L	T
1.A.1 Energy Industries – Solid Fuels	CO_2	L	T
1.A.1 Energy Industries – Gaseous Fuels	CO_2	L	T
1.A.2 Manufacturing Industries and Construction – Solid Fuels – Liquid Fuels	CO_2	L	T

[12] http://www.ipcc. -nggip.iges.or.jp/software/index.html

Key Categories of Emissions and Sinks	Gas	Level Assessment (L)	Trend Assessment (T)
1.A.2 Manufacturing Industries and Construction – Solid Fuels	CO_2	L	T
1.A.2 Manufacturing Industries and Construction – Gaseous Fuels	CO_2	L	T
1.A.3.b Road Transport	CO_2	L	T
1.A.4 Other Sectors – Liquid Fuels	CO_2	L	T
1.A.4 Other Sectors – Solid Fuels	CO_2	L	T
1.A.4 Other Sectors – Gaseous Fuels	CO_2	L	T
1.A.4 Other Sectors –Biomass	CH_4	L	T
1.B.1 Fugitive Emissions from Solid Fuels	CH_4	L	T
1.B.2.a Fugitive Emissions from Liquid Fuels and Natural Gas	CO_2		T
1.B.2.a Fugitive Emissions from Liquid Fuels and Natural Gas	CH_4	L	
2.A.1 Cement Production	CO_2	L	T
2.A.2 Lime Production	CO_2		T
2.B.1 Ammonia Production	CO_2		T
2.B.2 Nitric Acid Production	N_2O		T
2.C.1 Iron and Steel Production	CO_2	L	T
3.A Enteric Fermentation	CH_4	L	T
3.D.1 Direct N_2O Emissions from Managed Soils	N_2O	L	T
3.D.2 Indirect N_2O Emissions from Managed Soils	N_2O	L	T
3.X Urea application	CO_2		T
4.A.1 Forest Land, Remaining Forest Land	CO_2	L	T
4.A.2 Land Converted to Forestland	CO2		T
4.C.2 Land Converted to Grassland	CO2		T
4.G Wood Products	CO2		T
5.A Solid Waste Disposal	CH4	L	
5.D Wastewater Treatment and Discharge	CH4	L	T

According to the 2006 IPCC Guidelines on Approach 1, key categories are those that, when summed together in descending order of magnitude, add up to 95 percent of the total level of emissions in level or trend analysis.

This (Approach 1) level analysis identified 21 key categories including LULUCF for 2020. i.e., 19 key categories excluding LULUCF. Approach 1 trend analysis identified a total of 27 key categories (including LULUCF) i.e., 23 categories (excluding LULUCF).

A comparison of the key-category analysis carried out within CRF Reporter and Serbia's key-category analysis (KCA) shows that the differences between the two analyses arise from the different definitions of category levels for the KCA. Indeed, the differences in approach are apparent; for example, Serbia divides agricultural or F-gas sectors into sub-sectors (e.g., the 2.F.1 approach within CRF Reporter is split into two sub-sectors within Serbia's KCA approach, etc.). The resulting numbers of key categories are consequently quite different between these two approaches.

In 2020, the main contributors were electricity and heat production (CO_2 emissions from solid fuel combustion), accounting for 44.7% (including LULUCF).

CO_2 emissions from liquid fuel consumption in the road transport sector were the second key category with a share of 9.4% in total emissions and they were followed by CO_2 sinks from forestland, with a share of 7.1% CO_2 emissions. They were followed by process emissions from the iron and steel production, the share of which stood at 3.8%.

CH_4 emissions from enteric fermentation, accounting for 3.5% share of total emissions, were the fifth key category, followed by CH_4 emissions from solid waste disposal, accounting for 3.3% of total emissions.

Among the 21 key categories (95% of total emissions), CO_2 accounted for 81.0% of total emissions (excluding LULUCF), with 13 categories.

The main categories contributing to the total GHG emission trend are CO_2 emissions from liquid fuels in the transport sector, CO_2 sinks from forestland, CO_2 emissions from liquid fuels from the industry and process emissions of CO_2 from iron and steel production.

The greatest share of non-CO_2 emissions account N_2O emissions in the 3.D.1 sub-category, Direct N_2O Emissions from Managed Soils, which are the result of emissions from inorganic N Fertilizers, while 3.A.1. Enteric Fermentation is the most important sub-category of CH_4 emissions.

The key category analysis results are presented in Annex I.

4.3 Greenhouse gases Inventory and Trends by Sectors

In 2020, national GHG emissions excluding removals stood at 64,592.63 Gg CO_2 eq, while total GHG emissions including removals stood at **59,164.24** Gg CO_2 eq (Table 3.5).

Table 3.5 GHG Emissions by Source and Removal by Sinks, by Sector, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO_2 eq)

Source and Sink Category	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
Emissions										
Energy	66,312.63	48,269.89	54,537.58	50,242.34	49,881.69	50,662.30	50,907.12	49,726.08	49,312.80	50,739.92
Industrial Processes and Product Use	5,515.64	3,063.06	4,973.26	4,971.72	4,078.93	4,391.84	5,283.24	5,967.72	5,234.33	4,623.91
Agriculture, Forestry and Other Land Use	7,325.38	7,281.95	6,861.21	5,973.31	6,191.03	6,449.28	6,109.94	5,598.39	5,666.84	6,097,95
Waste	4,300.39	3,380.55	3,111.69	3,033.70	3,012.02	3,019.90	2,920.92	2,994.21	3,069.97	3,130.85
Removals[13]										
Agriculture, Forestry, and Other Land Use	-2,199.16	-5,670,56	-6,627.67	-6,480.19	-5,906.89	-5,462.84	-5,544.18	-5,302.99	-5,579.23	-5,428.39
Total GHG Emissions excluding Removals	83,454.05	61,995.44	69,483.73	64,221.07	63,163.67	64,523.32	65,221.21	64,286.40	63,283.94	64,592.63
Total GHG Emissions including Removals	81,254.90	56,324.89	62,856.07	57,740.88	57,256.77	59,060.47	59,677.04	58,983.41	57,704.70	59,164.24

In 2020, 78.6% of all GHG emissions originated from the energy sector, followed by 9.4% from the AFOLU sector (excluding removals), due to relatively intensive agricultural production (biochemical processes in stockbreeding and farming). Throughout the 1990s, emissions from the AFOLU sector were primarily the result of the timber and paper industry. Later on, these activities diminished due to former SFRJ conflicts and UN sanctions and remained more or less the same. In 2012, the disastrous forest fires further impinged on emissions from this sector.

IPPU, including production and consumption of mineral raw materials (such as cement, lime, limestone and sodium carbonate), production of chemicals (primarily ammonia), iron and other metals and other products, accounted for 7.2% of all GHG emissions. GHG emissions from the waste management sector accounted for 4.8% of all GHG emissions in 2020.

The sectors' contributions to total GHG emissions were almost the same in 2010: energy 78.2%, IPPU 7.7%, AFOLU (excluding removals) 9.3% and waste 4.7%.

The shares of sectoral emissions in total GHG emissions remained almost the same throughout the 1990-2020 period (Figure 2.1). GHG emissions form the energy sector predominated due to electricity production from domestic low calorific open-pit lignite. The contribution of electricity production to energy sector emissions and consequently total national GHG emissions is visible in the 2014 inventory year, when floods in coal-mining areas prevented the

[13] Removals are removals from the IPCC 3B Land category (which includes Forest land, Cropland, Wetlands, Settlements and Other land) and IPCC Category 3 D Other

power sector from using domestic lignite, resulting in a 15% drop in emissions compared to 2013.

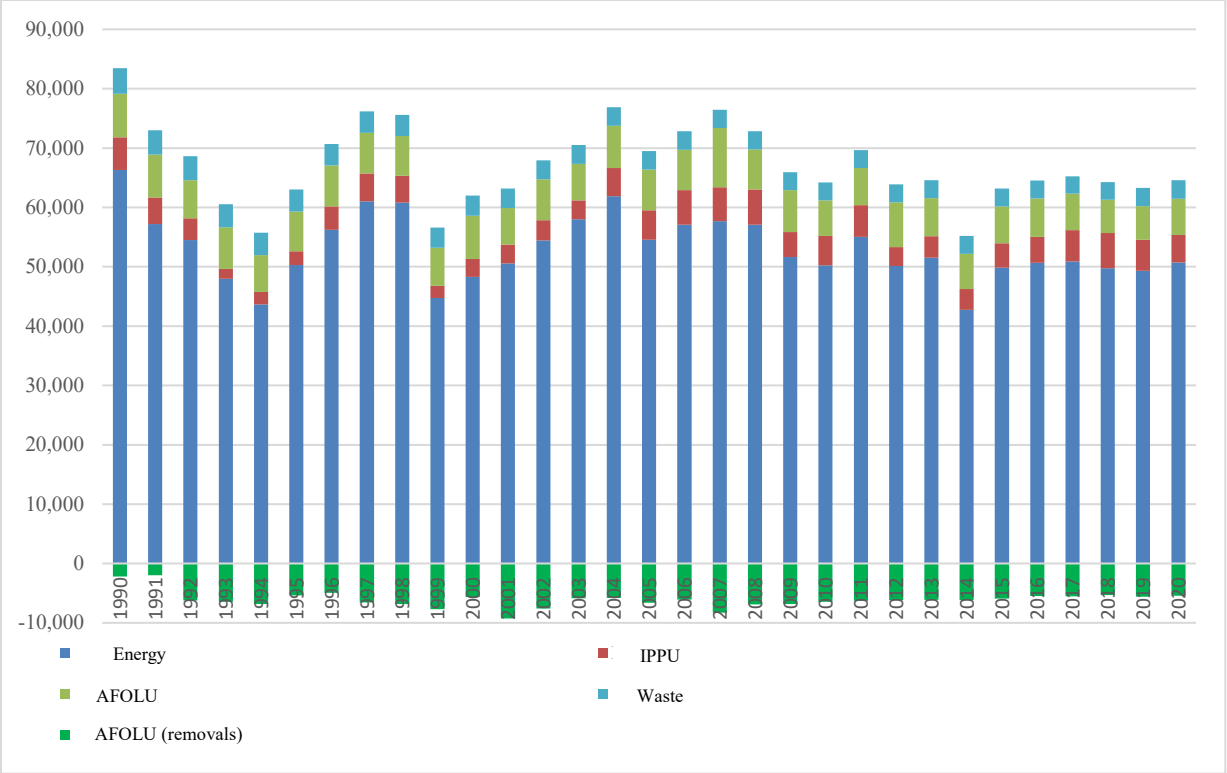

Figure 3.3 GHG Emissions by Sources and Removals by Sinks, by Sector, 1990-2020 (Gg CO_2 eq)

Total GHG emissions excluding removals increased by 0.6%, while emissions including removals increased by 2.5% since 2010. All the trends are presented in Table 3.6.

Table 3.6 GHG Emission Trends

Source and Sink Category	2020/1990	2020/2000	2020/2005	2020/2010	2020/2019
Energy	-23.5%	5.1%	-7.0%	1.0%	2.9%
Industrial Processes and Product Use	-16.2%	51.0%	-7.0%	-7.0%	-11.7%
Agriculture, Forestry and Other Land Use	-16.8%	-16.3%	-11.1%	2.1%	7.6%
Waste	-27.2%	-7.4%	0.6%	3.2%	2.0%
Removals					
Agriculture, Forestry and Other Land Use	146.8%	-4.3%	-18.1%	-16.2%	-2.7%
Total GHG Emissions Excluding Removals	-22.6%	4.2%	-7.0%	0.6%	2.1%
Total GHG Emissions Including Removals	-27.2%	5.0%	-5.9%	2.5%	2.5%

The economy's slow recovery from the global economic crisis in the 2010-2020 period did not significantly affect the GHG emissions profile. Emissions from the energy sector were quite stable (+1.0% in 2020 compared to 2010), while emissions from industrial processes dropped

by 7.0% in the same period, due to lower production in the energy intensive industry (fewer products such as: clinker, lime, ammonia, bricks, adipic acid).

The entire AFOLU sector slightly reduced its GHG emissions since 1990 mainly due to a combination of reduced emissions from animal husbandry, reflecting a decrease in activity in this source category, and increased emissions from agriculture soils. After 2010, increment in the total GHG emissions trend prevailed due to the increasing emissions from agriculture soils, therefore, the emissions rose 2.1% in the 2010-2020 period . Waste sector emissions remained practically unchanged in the 2010-2017 period and increased in the 2018-2020 period (rose by 3.2% in the 2010-2020 period) since Serbia is still moving from the concept of regional sanitary landfills to the model of regional waste management centers, which includes waste sorting, separation and recycling, as well as non-recyclable waste treatment.

In the same period (2010-2020), AFOLU saw a 16.2% drop in removals, mainly due to greater use of biomass and natural disasters (e.g., fires, strong winds, insect damage and diseases).

The following sections present the contributions of IPCC sectors to total GHG emissions.

4.3.1 Energy

The energy sector is the main contributor to national GHG emissions. Emissions from the energy sector stood at 50,739.92 Gg CO_2 eq in 2020, accounting for 79.8% of total GHG emissions. The fuel combustion activities category contributed 95.5% to energy sector emissions. GHG emissions in this category increased by 1.0% compared to 2010, mainly due to increased coal consumption in power generation (Table 3.7).

Table 3.7 GHG Emissions, by Source Categories in the Energy Sector, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO_2 eq)

Energy (Gg CO_2eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
1.A – Fuel Combustion Activities	62,191.71	45,330.50	51,352.90	47,588.64	47,090.69	47,986.15	48,121.03	47,038.50	46,968.54	48,468.71
1.A.1 – Energy Industries	42,712.65	34,121.81	33,825.32	31,850.07	34,115.12	33,800.55	34,291.22	32,300.27	32,294.34	33,997.92
1.A.2 – Manufacturing Industries and Construction	7,832.86	5,406.85	7,777.65	5,504.26	4,238.19	4,791.62	4,210.84	5,232.08	4,670.03	4,350.23
1.A.3 – Transport	4,559.93	2,374.22	6,694.31	6,728.36	5,999.11	6,161.82	6,414.71	6,508.03	7,033.75	6,701.22
1.A.4 – Other Sectors	7,086.26	3,168.60	3,055.61	3,505.95	2,738.26	3,232.15	3,204.27	2,998.12	2,970.42	3,419.34
1.A.5 – Non-Specified	0.00	259.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B – Fugitive Emissions from Fuels	4,120.93	2,939.38	3,184.69	2,653.70	2,791.01	2,676.15	2,786.08	2,687.58	2,344.26	2,271.22
1.B.1 – Solid Fuels	1,086.87	1,144.69	1,070.49	1,125.05	1,123.86	1,130.54	1,150.10	1,074.22	1,130.37	1,104.18
1.B.2 – Oil and Natural Gas	3,034.06	1,794.69	2,114.20	1,528.65	1,667.15	1,545.60	1,635.98	1,613.36	1,213.89	1,167.04

Energy (Gg CO_2eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
1.B.3 – Other Emissions from Energy Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C – Carbon Dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	66,312.63	48,269.89	54,537.58	50,242.34	49,881.69	50,662.30	50,907.12	49,726.08	49,312.80	50,739.92

In 2020, 95.5% of all energy sector emissions originated from fuel combustion activities (source category 1.A), of which 70.1% from Energy Industries, 9.0% from Manufacturing Industries and Construction, 13.8% from Transport and 7.1% from Other Sectors (Figure 3.4).

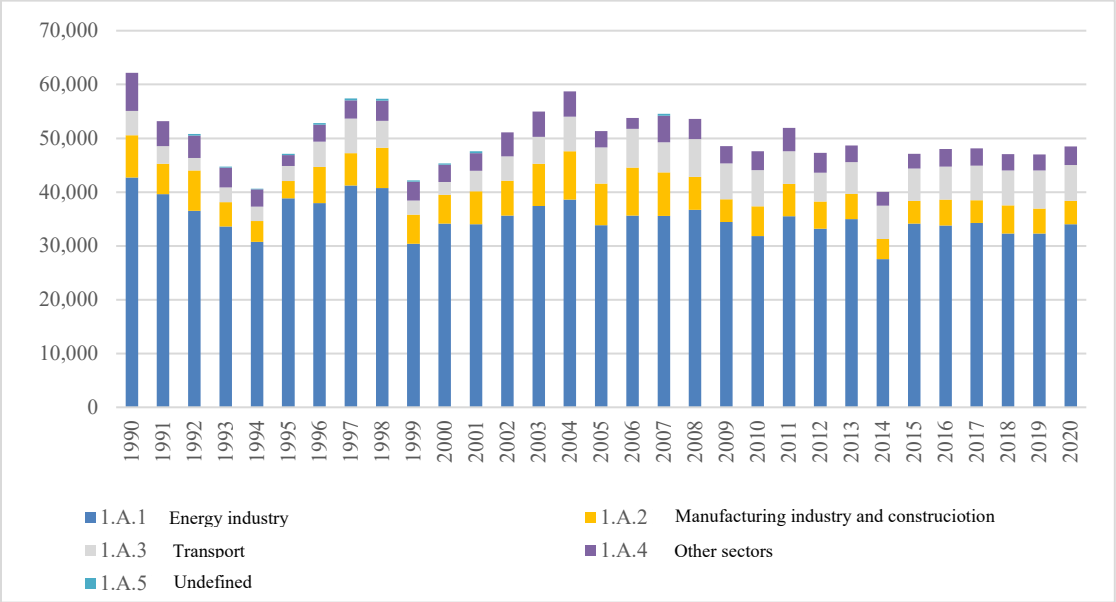

Figure 3.4 Breakdown of Source Categories by Fuel Combustion GHG Emissions, 1990-2020 (Gg CO_2 eq)

Out of 4.5% of fugitive emissions from fuels (source category 1.B) in energy sector GHG emissions, oil and natural gas extraction, transport and distribution accounted for 51.4% and solid fuels (domestic coal extraction) for 48.6% (Figure 3.5).

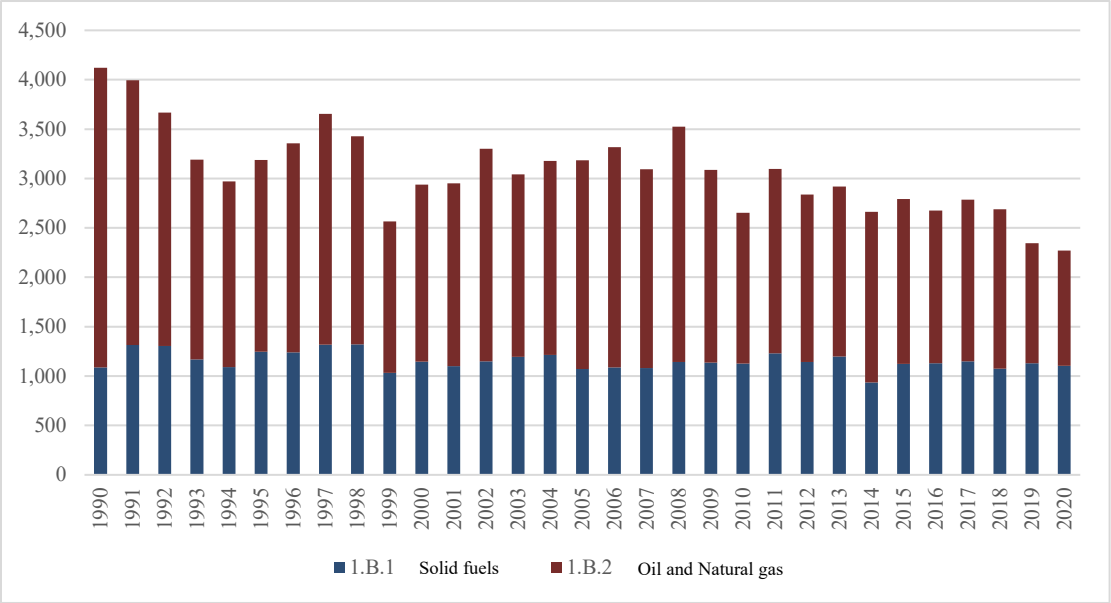

Figure 3.5 GHG Emissions by Source Categories in 1.B Fugitive Emissions from Fuels in the Energy Sector, 1990-2020 (Gg CO_2 eq)

GHG emissions from Fuel Combustion Activities were 1.9% higher in 2020 than in 2010. In this sector, GHG emissions from the Energy Industries source category increased by 6.7%, while GHG emissions fell in Manufacturing Industries and Construction by 21.0%, in Transport by 0.4% and in Other Sectors by 2.5%.

In the 2010-2020 period, GHG emissions were the lowest in 2014, due to floods in coal-mining areas preventing the power sector from using domestic lignite for production. GHG emissions from Energy Industries were 19.0% lower in 2014 than in 2020. In 2015, GHG emissions went back to the 2010-2020 average emissions in this source category.

GHG emissions in Manufacturing Industries and Construction have been steadily decreasing since 2010. In the 2010-2020 period, GHG emissions from Mining and Quarrying, Non-Metallic Minerals and Food Processing, Beverage and Tobacco, Iron, Steel and Non-Iron Metals Production fell, while emissions associated with the Production of Chemicals, Paper, Machinery and Construction increased. The main reason for the decrease in Mining and Quarrying lies in reduced activity in this sector since energy consumption decreased by 43% in the 2010-2020 period. The Food Processing, Beverage and Tobacco Production industries reduced fossil fuel consumption, especially the use of natural gas, as well as the use of liquid and solid fuels, whilst slightly increasing their use of biomass. The decrease in emissions from the production of non-metallic minerals is the combined result of lesser fossil fuel consumption and increased substitution of lignite by natural gas.

Emissions in the paper, pulp and printing industries and in the production of chemicals increased due to a surge in production activities and associated consumption of fossil fuels (especially natural gas).

4.3.2 Industrial Processes and Product Use (IPPU)

In 2020, IPPU GHG emissions stood at 4,623.91 Gg CO2 eq, or 7.3 % of all national GHG emissions (Table 3.8).

Table 3.8 GHG Emissions, by IPPU Categories, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO_2 eq)

IPPU (Gg CO_2eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
2.A - Mineral Industry	2023.81	1485.36	1543.10	1338.99	1036.79	1124.96	1168.09	1262.30	1278.23	1371.58
2.A.1 - Cement Production	1340.26	1045.80	1124.34	1052.22	817.28	889.62	942.40	1033.94	1062.83	1167.81
2.A.2 - Lime Production	499.45	287.23	292.02	188.01	148.64	161.30	162.20	165.40	153.42	139.54
2.A.3 - Glass Production	14.15	6.30	4.79	4.22	4.93	4.42	4.98	4.87	5.52	6.12
2.A.4 - Other Process Uses of Carbonates	169.96	146.03	121.95	94.54	65.94	69.63	58.51	58.09	56.47	58.11
2.A.5 – Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry	1371.29	503.66	1049.55	894.35	611.49	592.79	824.65	575.79	6.27	300.49
2.B.1 - Ammonia Production	334.87	131.44	249.72	214.61	170.52	135.03	412.47	203.03	0.00	0.00
2.B.2 - Nitric Acid Production	563.44	181.26	407.84	300.51	233.73	53.66	90.81	79.32	0.01	0.00
2.B.8 - Petrochemical and Carbon Black Production	444.78	181.89	371.58	357.22	200.33	397.35	314.79	287.02	0.00	294.39
2.B.10 - Other Chemical Industry	28.20	9.07	20.41	22.01	6.91	6.75	6.59	6.42	6.26	6.10
2.C - Metal Industry	1862.80	1008.77	2253.44	2412.62	1924.53	2204.69	2888.42	3764.16	3628.18	2660.19
2.C.1 - Iron and Steel Production	1652.68	989.71	2236.03	2373.36	1813.05	2086.42	2768.11	3646.12	3541.00	2623.34
2.C.4 - Magnesium Production	165.71	0.00	14.97	26.71	111.49	118.27	120.30	118.04	87.18	36.85
2.C.5 - Lead Production	3.13	5.30	2.44	12.54	0.00	0.00	0.00	0.00	0.00	0.00
2.C.6 - Zinc Production	41.28	13.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.7 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	257.74	63.26	83.04	91.20	95.42	116.70	97.75	88.98	93.46	87.48
2.D.1 - Lubricant Use	194.04	9.24	29.57	37.14	42.44	63.08	46.07	37.69	42.77	38.33
2.D.2 - Paraffin Wax Use	0.00	0.00	0.00	2.36	1.77	1.77	1.90	1.68	1.75	0.95
2.D.3 Other Solvent Use	63.70	54.02	53.47	51.71	51.20	51.86	49.78	49.61	48.95	48.20
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	1.97	42.95	231.42	406.37	348.32	299.95	272.11	223.81	199.33
2.F.1 - Refrigeration and Air Conditioning	0.00	1.23	38.55	226.03	398.86	340.27	292.53	264.90	216.66	191.94
2.F.4 – Aerosols	0.00	0.74	4.40	5.40	7.51	8.05	7.41	7.21	7.16	7.39
2.G - Other Product Manufacture and Use	0.00	0.03	1.18	3.15	4.34	4.38	4.38	4.38	4.38	4.83
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	5515.64	3063.06	4973.26	4971.72	4078.93	4391.84	5283.24	5967.72	5234.33	4623.91

Since 2010, GHG emissions in the IPPU sector decreased by 7.0%; they fell by 66.4% in the Chemical Industry and increased by 2.4% in the Mineral Industry and by 10.3% in the Metal Industry. In Product Use (in the absence of substances that damage the ozone layer, refrigeration and air conditioning being the main sources of emissions) emissions were reduced by 13.9%

due to substitution of air conditioning appliances by those with refrigerants with much lower global warming potential.

Iron and Steel Production process emissions reflect the production trends of the integrated iron and steel plant *Železara Smederevo*; the change in its ownership in the 2010-2016 period also affected production level in that period, which was on the rise until 2018. In early 2019, the EU introduced a global quota on imports of steel from third countries, which resulted in the fall of production and GHG emissions in the 2018-2020 period (Figure 3.6).

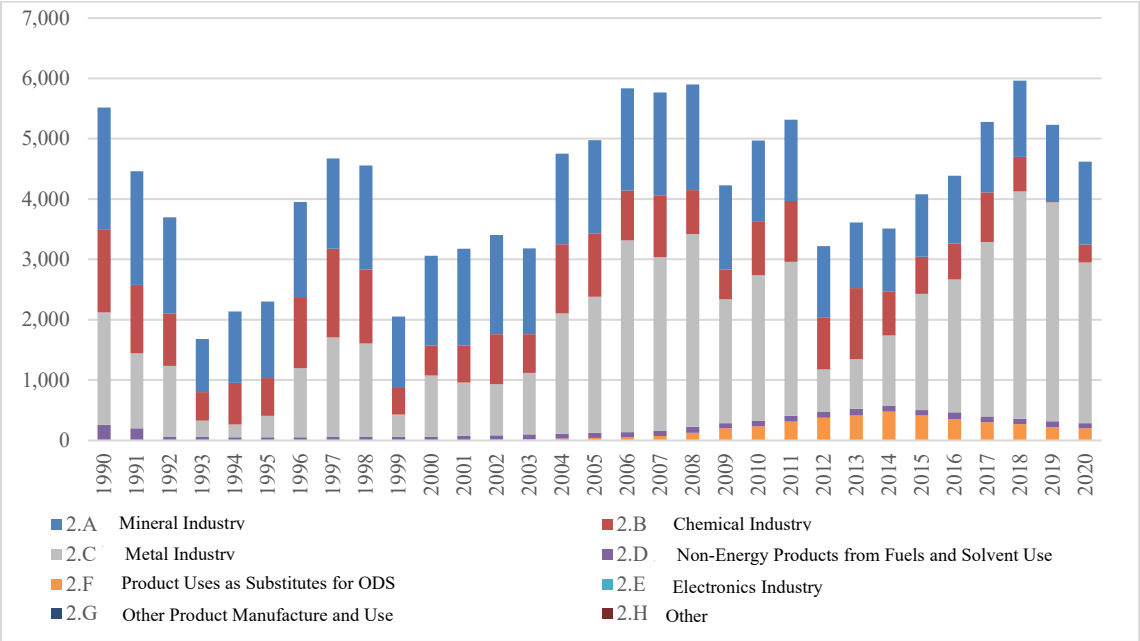

Figure 3.6 IPPU GHG Emissions by Category, 1990-2020 (Gg CO_2 eq)

In 2020, 57.6% of all IPPU GHG emissions originated from the Metal Industry, where 99% of process emissions occurred in Iron and Steel Production. The Mineral Industry accounted for 29.7% of process emissions, with Cement Production being the main contributor with 85%, followed by Lime Production with 12%.

Chemical Industry contributed 6.5% to all process emissions. The production of nitric acid, carbon black and ammonia ended in 2019 when the *HIP Azotara* plant shut down.

Ozone depleting substances account for 4.3% of all process emissions; 96% of them came from Refrigeration and Air Conditioning. Therefore, GHG emissions from this sector peaked in 2014, due to higher consumption of household refrigeration and air conditioning devices. GHG emissions dropped in the 2015-2020 period, and were 15.1% lower than in 2010.

The remaining 1.9% of total process emissions originated from Use of Non-Energy Products and Solvent Use; solvent use accounted for 44%, lubricant use for 51% and paraffin wax use for 1% of this GHG emissions category.

4.3.3 Agriculture, Forestry and Other Land Use (AFOLU)

Total net emissions[14] from Agriculture, Forestry and Other Land Use (AFOLU) stood at 669.56 Gg CO_2 eq in 2020 (Table 3.9).

Table 3.9 AFOLU GHG Emissions by Category, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO_2 eq)

AFOLU (Gg CO_2 eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
3.A - Livestock	**5,563.29**	**4,743.14**	**4,119.05**	**3,578.58**	**3,529.55**	**3,364.53**	**3,368.00**	**3,382.43**	**3,392.86**	**3,366.42**
3.A.1 - Enteric Fermentation	4,090.37	3,391.30	2,990.61	2,593.29	2,565.49	2,480.95	2,495.52	2,456.45	2,467.46	2,465.72
3.A.2 - Manure Management	1,472.92	1,351.84	1,128.43	985.30	964.06	883.58	872.48	925.98	925.40	900.70
3.B - Land	-1361.72	-4017.35	-6081.56	-5780.38	-4888.87	-4626.09	-4720.02	-4472.81	-4718.03	-4657.17
3.B.1 - Forest Land	-2011.68	-5444.17	-6312.94	-6116.38	-5311.00	-5018.15	-5098.61	-4853.65	-5101.13	-5042.51
3.B.2 - Cropland	18.51	11.41	84.37	14.07	56.11	56.19	56.27	56.35	56.43	56.51
3.B.3 - Grassland	354.43	1158.74	-136.77	11.80	35.43	6.71	-5.41	-1.80	1.80	5.40
3.B.4 - Wetlands	178.95	164.30	148.06	91.35	92.80	89.15	85.49	81.84	78.19	74.54
3.B.5 - Settlements	73.12	70.92	128.38	141.39	148.05	148.46	148.87	149.28	149.70	150.11
3.B.6 - Other Land	24.96	21.44	7.34	77.39	89.73	91.54	93.35	95.17	96.98	98.79
3.C - Aggregate Sources and non-CO_2 Emissions Sources on Land	974.87	919.05	2344.51	1973.65	2021.70	2562.40	2257.10	1732.40	1791.69	2250.52
3.C.1 - Emissions from Biomass Burning	106.92	81.20	105.34	108.57	96.09	96.25	94.34	89.72	92.04	94.76
3.C.2 - Liming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea Application	32.18	35.05	132.83	97.48	132.59	252.40	213.82	73.84	171.74	225.85
3.C.4 - Direct N_2O Emissions from Managed Soils	581.79	561.61	1527.24	1283.58	1296.43	1610.09	1408.19	1141.79	1110.52	1404.68
3.C.5 - Indirect N_2O Emissions from Managed Soils	253.97	241.18	579.11	484.01	496.60	603.66	540.75	427.06	417.39	525.23
3.C.6 - Indirect N_2O Emissions from Manure Management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.7 - Rice Cultivation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.8 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other	-50.21	-33.44	-148.46	-278.72	-378.25	-314.41	-339.32	-346.62	-378.91	-290.21
3.D.1 - Harvested Wood Products	-50.21	-33.44	-148.46	-278.72	-378.25	-314.41	-339.32	-346.62	-378.91	-290.21
3.D.2 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**5,126.23**	**1,611.39**	**233.54**	**-506.88**	**284.13**	**986.44**	**565.76**	**295.39**	**87.60**	**669.56**

Total net emissions increased by 1,176.44 Gg CO_2 eq since 2010 (Figure 2.5), primarily due to:

→ a decrease in removals from forest land (due to increased use of biomass and increased natural disasters occurrences), and

[14] Net emissions are the difference between removals by sinks and emissions by sources in the AFOLU sector

→ an increase in agricultural activities (urea application and higher direct N_2O emissions from managed soils).

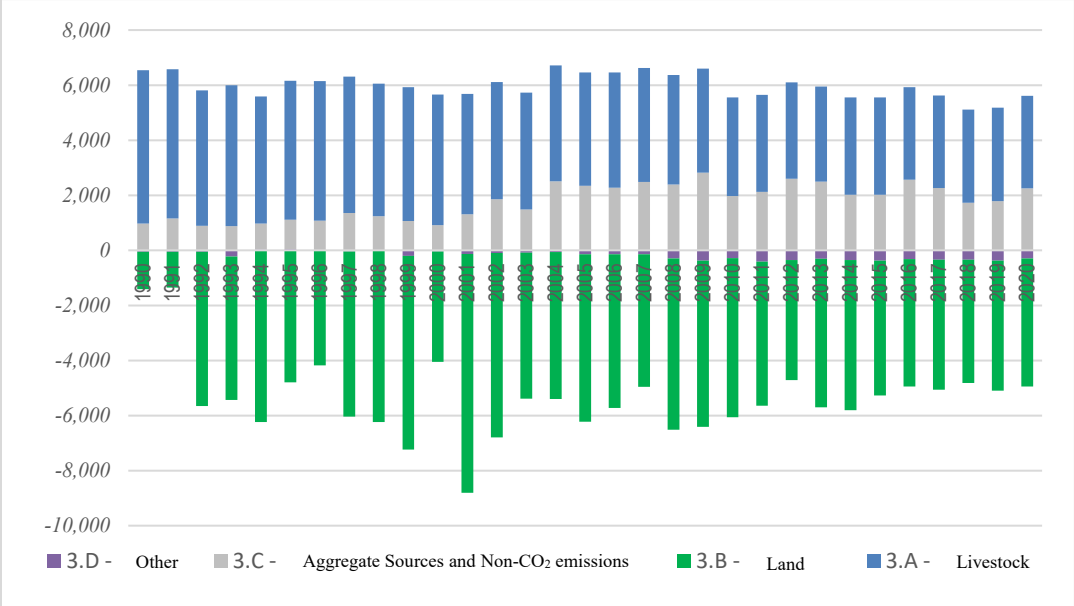

Figure 3.7 AFOLU GHG Emissions by Category, 1990-2020 (Gg CO_2 eq)

In 2020, Agriculture emitted 5,616.94 Gg CO_2 eq of all AFOLU GHG emissions. Of that quantity, 3,366.42 Gg CO_2 eq (59.9%) were from Livestock, including 2,465.72 Gg CO_2 eq from Enteric Fermentation and 900.70 Gg CO_2 eq from Manure Management.

CH_4 emissions from Enteric Fermentation have been mildly declining since 1990, dropping by 39.7% from 1990 to 2020. The main driver for the observed decrease was the reduction of the dairy cattle population, mainly compensated by increased productivity. Emissions from enteric fermentation of dairy cattle fell by 47.5% and from non-dairy cattle by 38.5%. The decrease in emissions from dairy cattle was less intensive (13.5%) in the 2010-2020 period. The trend reversed with respect to non-dairy cattle, where a 2.48% increase in emissions was registered in the same period.

GHG emissions from Aggregate sources and non-CO_2 emissions sources on land stood at 2,250.52 Gg CO_2 eq, 62.4% (1,404.68 Gg CO_2 eq) of which originated from Direct and Indirect N_2O Emissions from managed soil, while the rest came from: Emission from Biomass Burning (stubble burning), Urea Application and Indirect N_2O emissions from manure management.

Forest land (forestry) removals stood at 5,043 Gg CO_2 in 2020, which is 17.6% less than in 2010. Lower sequestration can mainly be attributed to the increased use of wood for industrial purposes and heating. Moreover, losses due to disturbances in 2020 were almost three times higher than in 2010, amounting to almost 494 Gg CO_2 that were not sequestrated. The lowest removals were registered in 1990 due to strong commercial harvesting for fuel wood and industrial technical wood for the pulp and paper industries.

4.3.4 Waste

In 2020, emissions from the Waste Sector stood at 3,130.85 Gg CO_2eq, or 4.8% of national GHG emissions (Table 3.10).

Table 3.10 Waste Sector GHG Emissions by Category, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO2 eq)

Waste (Gg CO_2 eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
4.A - Solid Waste Disposal	3,047.26	2,426.45	2,171.09	2,114.57	2,128.75	2,102.23	2,088.79	2,167.43	2,252.50	2,319.01
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	1,253.14	954.10	940.60	919.13	883.27	917.67	832.13	826.78	817.47	811.84
4.E - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4,300.39	3,380.55	3,111.69	3,033.70	3,012.02	3,019.90	2,920.92	2,994.21	3,069.97	3,130.85

Emissions decreased by 3.2% in the 2010-2020 period (Figure 2.6). In 2020, 74.1% of Waste Sector GHG emissions came from Solid Waste Disposal on land, and 25.9% from Wastewater Treatment. Despite recent improvements in waste and wastewater management practices, the number of waste management facilities and amounts of treated solid waste and wastewaters is still negligible, while the share of GHG emissions from these categories has remained almost constant over the entire 1990-2020 period.

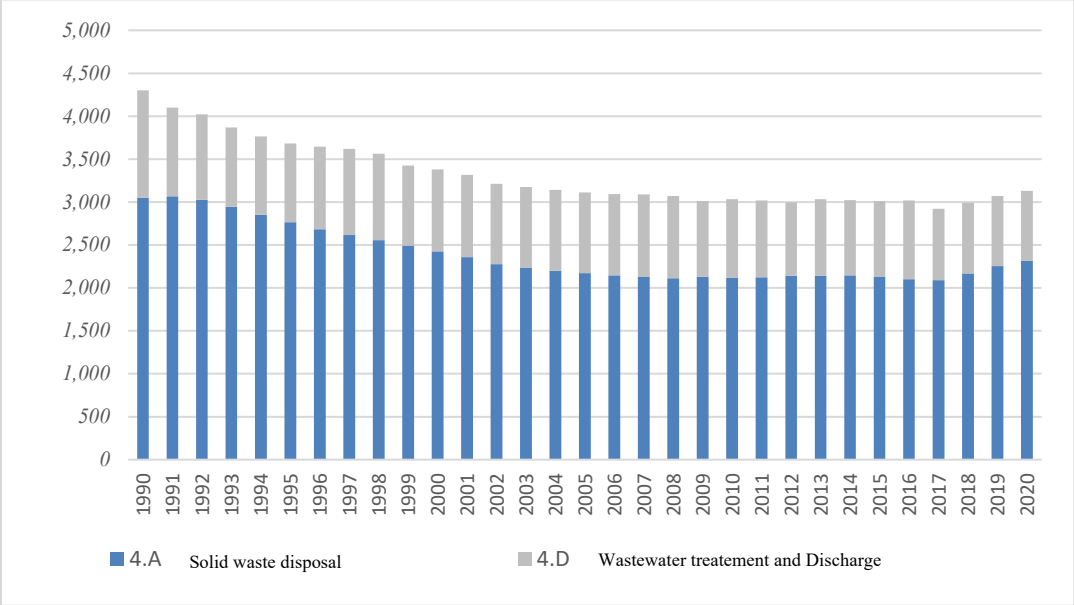

Figure 3.8 GHG Emissions by Category in the Waste Sector, 1990-2020 (Gg CO_2 eq)

4.4 GHG Inventory and Trends by Gas

In 2020, the main GHG was carbon dioxide (CO_2) accounting for 82.1% of all GHG emissions expressed in CO_2 equivalent (CO_2 eq). Next came methane (CH_4) with 13.2% and nitrous oxide (N_2O) with 4.3%. Hydrofluorocarbons (HFCs) and sulfur-hexafluoride (SF_6) together accounted for 0.75 GHG emissions in the country[15] (Table 3.11).

In the 2010-2020 period, the share of CO_2 in total GHG emissions increased by 0.3%, the share of CH_4 remained unchanged, while the share of N_2O decreased by 0.3%.

Table 3.11 GHG Emissions by Gas, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO_2 eq)

Greenhouse Gas	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
Emissions										
CO_2	68,496	49,798	56,932	52,163	50,789	52,198	53,300	52,818	51,896	52,699
CH_4	12,308	10,254	9,082	8,905	9,027	8,798	8,670	8,658	8,774	8,912
N_2O	2,515	1,942	3,414	2,897	2,845	3,077	2,848	2,437	2,315	2,748
HFCs	0	2	43	231	406	348	300	272	224	199
SF_6	136	0	13	25	96	101	103	101	76	35
Removals										
CO_2	-2,199	-5,671	-6,628	-6,480	-5,907	-5,463	-5,544	-5,303	-5,579	-5,428
Total GHG Emissions excluding Removals	**83,454**	**61,995**	**69,484**	**64,221**	**63,164**	**64,523**	**65,221**	**64,286**	**63,284**	**64,593**
Total GHG Emissions including Removals	**81,255**	**56,325**	**62,856**	**57,741**	**57,257**	**59,060**	**59,677**	**58,983**	**57,705**	**59,164**

CO_2 removals by sinks in forestry stood at 4,947.37 Gg CO_2 eq in 2020, i.e., dropped by 18.2% compared to 2010 (Figure 3.9).

[15] Data on imports and consumption of HFCs, PFCs and SF_6 have been available since 2004.

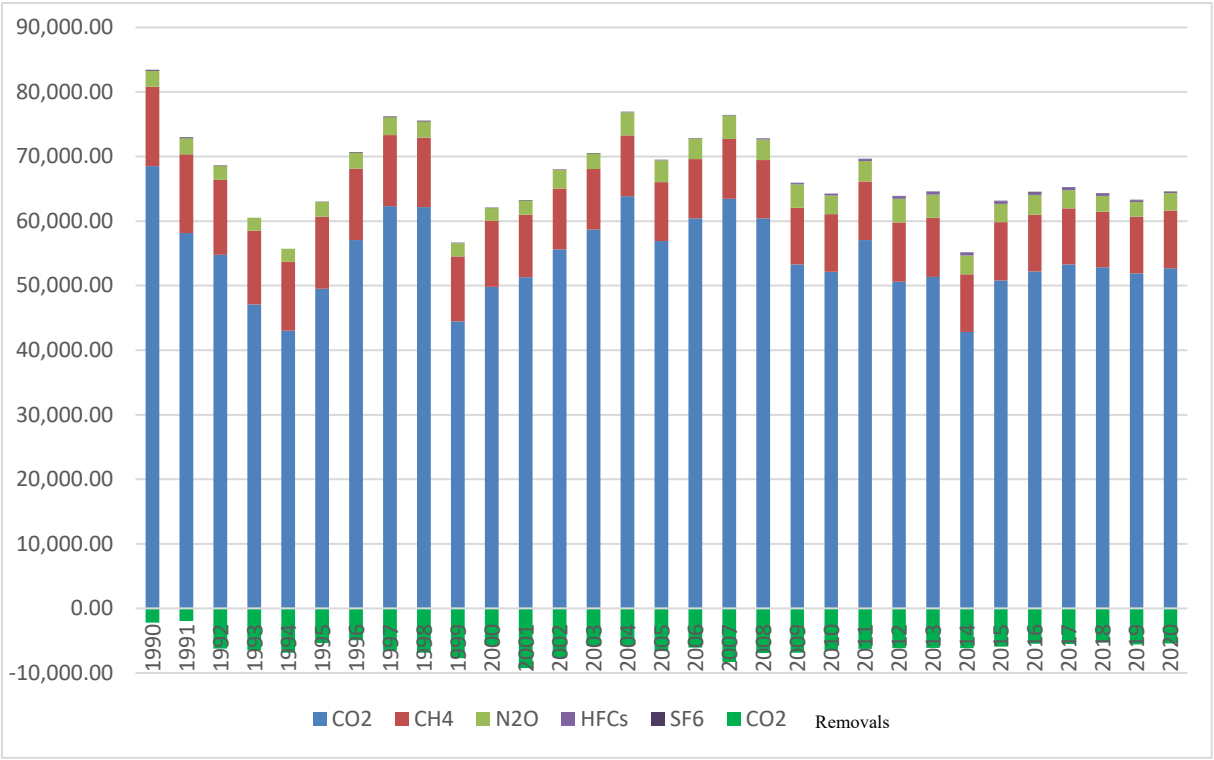

Figure 3.9 GHG Emissions by Gas, 1990-2020 (Gg CO_2 eq)

4.4.1 Carbon Dioxide (CO_2)

CO_2 emissions stood at 52,217.71 Gg in 2020. They mostly originated from the energy sector, specifically, from fuel combustion activities (Table 3.12).

Table 3.12 CO_2 Emissions and Removals, by Category, 1990, 2000, 2005, 2010, 2015-2020 (Gg)

CO_2 (Gg)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
1 - Energy	62,918.69	45,371.02	51,926.38	47,266.99	46,719.31	47,582.31	47,847.53	46,779.97	46,329.10	47,636.57
1.A - Fuel Combustion Activities	61,420.47	44,789.86	50,732.01	46,898.54	46,428.98	47,305.37	47,454.51	46,378.42	46,296.47	47,606.10
1.B - Fugitive Emissions from Fuels	1,498.21	581.16	1,194.37	368.45	290.32	276.95	393.02	401.55	32.62	30.47
1.C - Carbon Dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 - Industrial Processes and Product Use	4,796.57	2,871.88	4,488.80	4,395.09	3,334.51	3,866.90	4,776.04	5,502.88	4,934.58	4,377.05
2.A - Mineral Industry	2,023.81	1,485.36	1,543.10	1,338.99	1,036.79	1,124.96	1,168.09	1,262.30	1,278.23	1,371.58
2.B - Chemical Industry	788.23	314.49	621.50	574.21	369.29	517.63	720.53	484.33	6.26	288.04
2.C - Metal Industry	1,726.78	1,008.77	2,241.15	2,390.69	1,833.02	2,107.61	2,789.67	3,667.27	3,556.62	2,629.94

CO_2 (Gg)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
2.D - Non-Energy Products from Fuels and Solvent Use	257.74	63.26	83.04	91.20	95.42	116.70	97.75	88.98	93.46	87.48
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for ODS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 - Agriculture, Forestry, and Other Land Use	-1,418.68	-4,115.29	-6,110.79	-5,979.22	-5,171.89	-4,713.62	-4,867.55	-4,767.53	-4,947.05	-4,743.28
3.A - Livestock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B - Land	-1,400.65	-4,116.90	-6,095.16	-5,797.97	-4,926.23	-4,651.62	-4,742.05	-4,494.74	-4,739.88	-4,678.92
3.C - Aggregate sources and non-CO2 emissions sources on land	32.18	35.05	132.83	97.48	132.59	252.40	213.82	73.84	171.74	225.85
3.D - Other	-50.21	-33.44	-148.46	-278.72	-378.25	-314.41	-339.32	-346.62	-378.91	-290.21
4 - Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total CO_2 Emissions excluding removals	68,495.73	49,798.17	56,932.05	52,163.05	50,788.83	52,198.43	53,300.20	52,818.32	51,895.86	52,698.73
Total CO_2 Emissions including removals	66,296.57	44,127.61	50,304.39	45,682.87	44,881.93	46,735.59	47,756.02	47,515.32	46,316.63	47,270.34

The shares of CO_2 emissions in total GHG emissions excluding removals stood at 81.8% in 2010 and at 82.1% in 2020. Although their shares increased by 0.3%, CO_2 emissions increased by 3.5% in 2020 compared to 2010 (Figure 3.10).

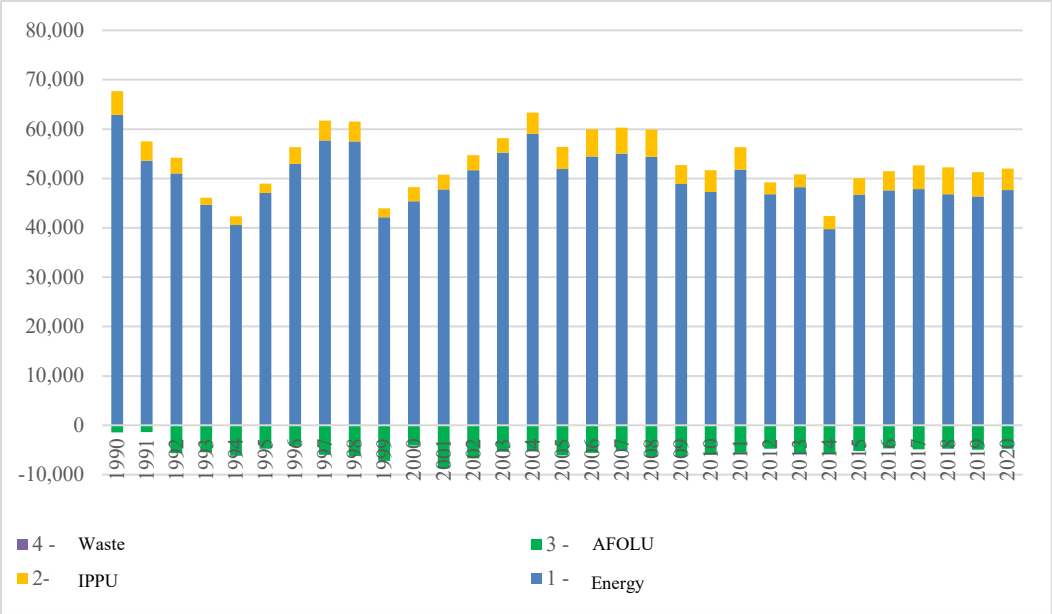

Figure 3.10 CO_2 Emissions and Removals by Sector, 1990-2020 (Gg CO_2)

4.4.2 Methane (CH_4)

CH_4 emissions stood at 318.28 Gg of CH_4 in 2020, originating mostly from: Livestock (33.5%), Solid waste disposal (26%) and Fugitive emissions from fuels (25.1%) (Table 3.13)

Table 3.23 CH_4 Emissions by Category, 1990, 2000, 2005, 2010, 2015-2020 (Gg)

CH_4 (Gg)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
1 - Energy	110.64	95.90	83.63	96.55	102.84	99.34	98.44	94.69	96.07	99.53
1.A - Fuel Combustion Activities	17.19	11.76	12.72	14.98	13.57	13.69	13.03	13.10	13.51	19.50
1.B - Fugitive Emissions from Fuels	93.45	84.14	70.91	81.57	89.27	85.65	85.41	81.59	82.56	80.03
1.C - Carbon Dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 - Industrial Processes and Product Use	0.70	0.28	0.72	0.70	0.30	0.77	0.48	0.43	0.00	0.44
2.A - Mineral Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry	0.70	0.28	0.72	0.70	0.30	0.77	0.48	0.43	0.00	0.44
2.C - Metal Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 - Agriculture, Forestry, and Other Land Use	179.00	152.74	132.18	115.68	114.86	109.39	109.53	110.26	110.73	109.57
3.A - Livestock	175.46	148.67	129.15	112.37	111.56	106.35	106.62	107.48	107.89	106.65
3.B - Land	0.47	1.74	0.01	0.20	0.54	0.28	0.20	0.20	0.20	0.20

CH_4 (Gg)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
3.C - Aggregate sources and non-CO2 emissions sources on land	3.07	2.33	3.02	3.11	2.76	2.76	2.71	2.57	2.64	2.72
3D - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 - Waste	149.23	117.27	107.81	105.09	104.41	104.70	101.18	103.83	106.55	108.75
4.A - Solid Waste Disposal	108.83	86.66	77.54	75.52	76.03	75.08	74.60	77.41	80.45	82.82
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	40.40	30.61	30.27	29.57	28.38	29.63	26.58	26.42	26.10	25.93
4.E - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total CH_4 Emissions	439.56	366.20	324.34	318.02	322.41	314.21	309.64	309.21	313.35	318.28

The share of CH_4 emissions in total GHG emissions remained 13.8% in the 2010-2020 period. In absolute terms, CH_4 emissions increased in 2020 by 0.1% compared to 2010 (Figure 2.9). There are three main sources of CH_4 emissions: Energy (with fugitive emissions from fuels dominating) which accounted for slightly less than one-third of all CH_4 emissions in 2020; Agriculture (with emissions from livestock dominating) contributed with 34.4% that year; and the Waste sector (with emissions from solid waste disposal dominating) accounted for 34.2% of all CH_4 emissions in 2020. The overall trend of CH_4 emissions reflects the combination of trends in the above-mentioned sectors, where reduced livestock population and, consequently, lower CH_4 emissions were the main driver for the decreasing trend.

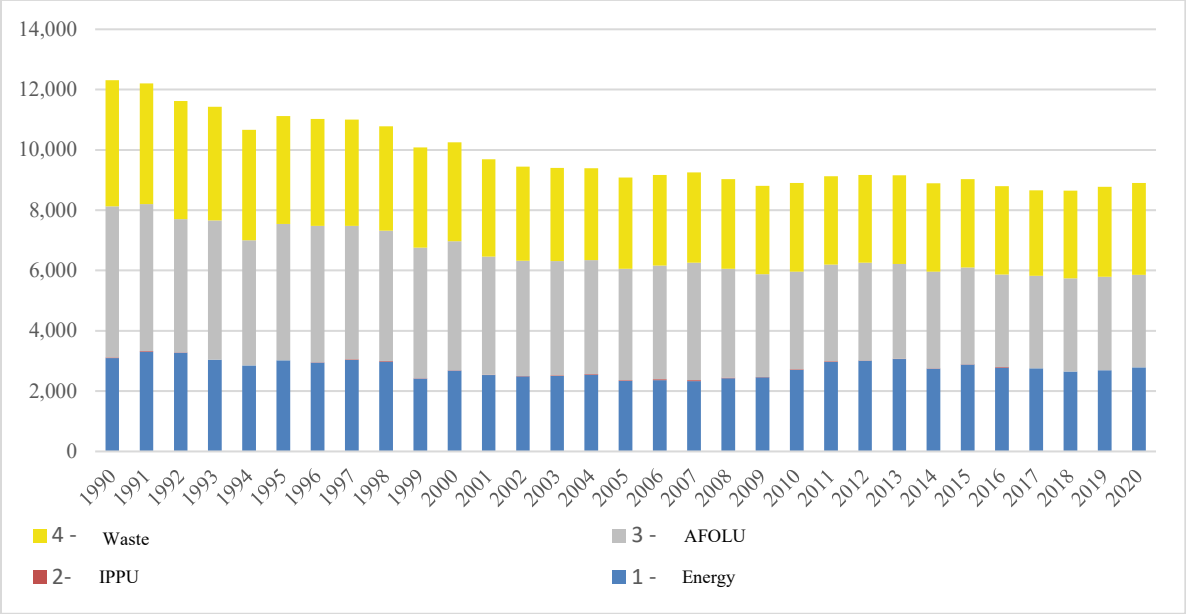

Figure 3.11 CH_4 Emissions by Sector, 1990-2020 (Gg)

4.4.3 Nitrous Oxide (N_2O)

N_2O emissions stood at 10.37 Gg in 2020. Direct and Indirect N_2O emissions from managed soils (use of nitrogen-based fertilizers in agriculture) accounted for 85.3%, while Fuel Combustion Activities accounted for 11.5% of all N_2O emissions (Table 3.14).

The share of N_2O emissions in total national GHG emissions, excluding removals, ranged from 4.6% to 4.3% in the 2010-2020 period.

Table 3.34 N_2O Emissions, by Category, 1990, 2000, 2005, 2010, 2015-2020 (Gg)

N_2O(Gg)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
1 - Energy	1.12	0.81	1.02	1.03	1.07	1.13	1.14	1.11	1.11	1.19
1.A - Fuel Combustion Activities	1.09	0.80	1.00	1.02	1.06	1.12	1.14	1.11	1.11	1.19
1.B - Fugitive Emissions from Fuels	0.02	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.00	0.00
1.C - Carbon Dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 - Industrial Processes and Product Use	2.13	0.68	1.54	1.13	0.88	0.20	0.34	0.30	0.00	0.00
2.A - Mineral Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry	2.13	0.68	1.54	1.13	0.88	0.20	0.34	0.30	0.00	0.00
2.C - Metal Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 - Agriculture, Forestry, and Other Land Use	5.78	5.47	9.97	8.43	8.45	9.95	8.93	7.46	7.30	8.85
3.A - Livestock	2.45	2.19	1.90	1.63	1.53	1.46	1.44	1.41	1.40	1.44
3.B - Land	0.10	0.19	0.05	0.05	0.08	0.07	0.06	0.06	0.06	0.06
3.C - Aggregate sources and non-CO2 emissions sources on land	3.23	3.09	8.03	6.75	6.84	8.43	7.42	5.99	5.83	7.35
3.D - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 - Waste	0.46	0.37	0.35	0.34	0.33	0.33	0.33	0.33	0.33	0.32
4.A - Solid Waste Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	0.46	0.37	0.35	0.34	0.33	0.33	0.33	0.33	0.33	0.32
4.E - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total N_2O Emissions	9.49	7.33	12.88	10.93	10.74	11.61	10.75	9.20	8.73	10.37

In absolute terms, N_2O emissions decreased by 5.2% from 2010 to 2020. Agriculture was by far the dominant source of N_2O emissions; it accounted for 85.3% of all N_2O emissions in 2020. Next came the energy sector with 11.5% and wastewater treatment and discharge with 3.1%.

The predominant N_2O emission category in Agriculture was 3.C Aggregate sources and non-CO_2 emissions sources on land, which includes the following categories: 3.C.4 Direct N_2O Emissions from managed soils and 3.C.5 Indirect N_2O emissions from managed soils.

The main drivers in these categories determining the overall N_2O emission trend included use of inorganic fertilizers, organic fertilizers, atmospheric deposition and nitrogen leaching and run-off.

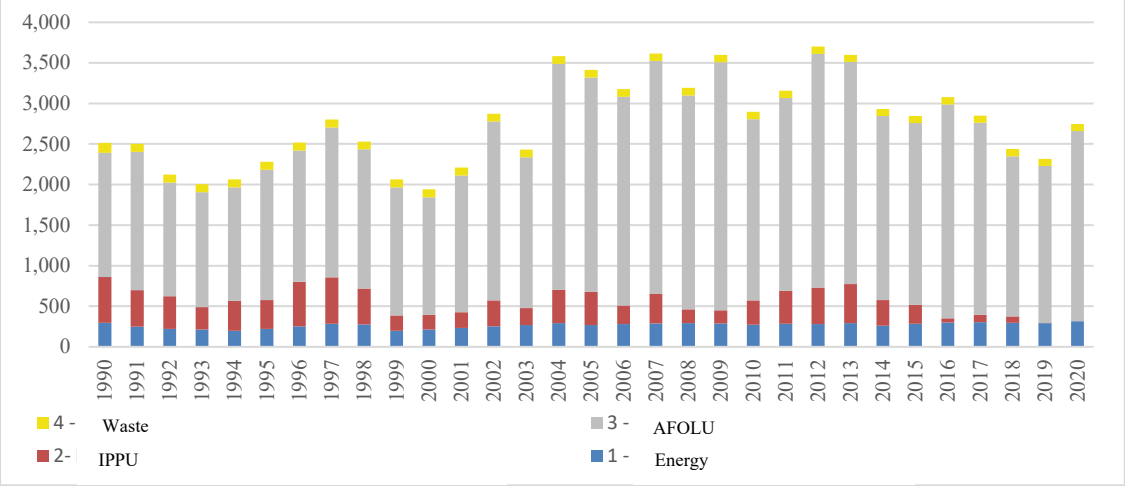

Figure 3.12 N_2O Emissions by Sector, 1990-2020 (Gg CO_2eq)

4.4.4 Hydrofluorocarbons (HFCs)

In 2020, HFC emissions stood at 199.33 GgCO_2 eq in total, accounting for less than 0.3% of national GHG emissions (Table 3.15).

Table 3.45 HFC Emissions by Category, 1990, 2000, 2005, 2010, 2015/2020 (Gg CO_2 eq)

HFCs (Gg CO_2 eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
2 - Industrial Processes and Product Use	0.00	1.97	42.95	231.42	406.37	348.32	299.95	272.11	223.81	199.33
2.A - Mineral Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	1.97	42.95	231.42	406.37	348.32	299.95	272.11	223.81	199.33
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total HFCs Emissions	0.00	1.97	42.95	231.42	406.37	348.32	299.95	272.11	223.81	199.33

In 2010, HFC emissions accounted for 0.4% of all national GHG emissions (Figure 3.13). Use of HFCs increased significantly as of 2010, mainly due to substitution of ozone depleting substances in air conditioning systems.

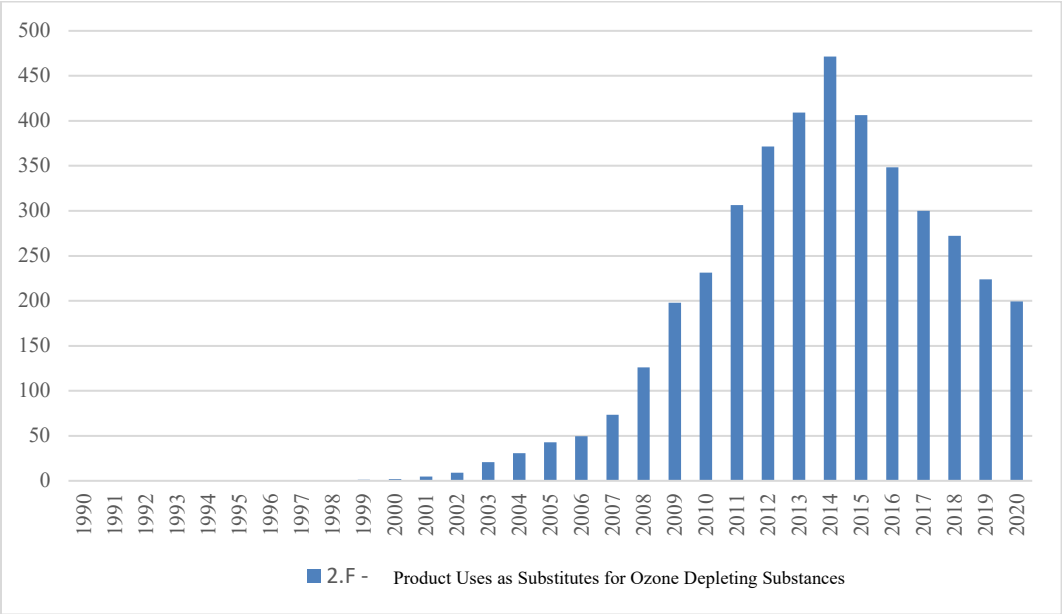

Figure 3.23 HFC Emissions, 1990-2020 (Gg CO_2eq)

First HFC emissions in Serbia, dating back to 1997, grew exponentially until 2014. After 2014, decreases in HFC-134a and HFC-143a emissions were observed in Refrigeration and Stationary Air Conditioning. It shall be noted that there are plans to improve that methodology for estimating GHG emissions from this sector.

4.4.5 Sulphur Hexafluoride (SF_6)

SF_6 emissions stood at 35.1 Gg of CO_2 eq in 2020. In the Metal Industry, SF_6 is used for magnesium production and casting since magnesium requires a protection system to prevent burning (Table 3.16 and Figure 3.14).

Table 3.56 SF_6 Emissions by Category, 1990, 2000, 2005, 2010, 2015-2020 (Gg CO_2 eq)

SF_6 (Gg CO_2 eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
2 - Industrial Processes and Product Use	136.02	0.03	13.47	25.07	95.85	101.46	103.12	101.27	75.93	35.08
2.A - Mineral Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	136.02	0.00	12.29	21.93	91.51	97.08	98.75	96.89	71.56	30.25
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SF_6 (Gg CO_2 eq)	1990	2000	2005	2010	2015	2016	2017	2018	2019	2020
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Other Product Manufacture and Use	0.00	0.03	1.18	3.15	4.34	4.38	4.38	4.38	4.38	4.83
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total HFCs Emissions	136.02	0.03	13.47	25.07	95.85	101.46	103.12	101.27	75.93	35.08

The share of SF_6 emissions in total GHG emissions ranged from 0.03% to 0.1% in the 2000-2020 period.

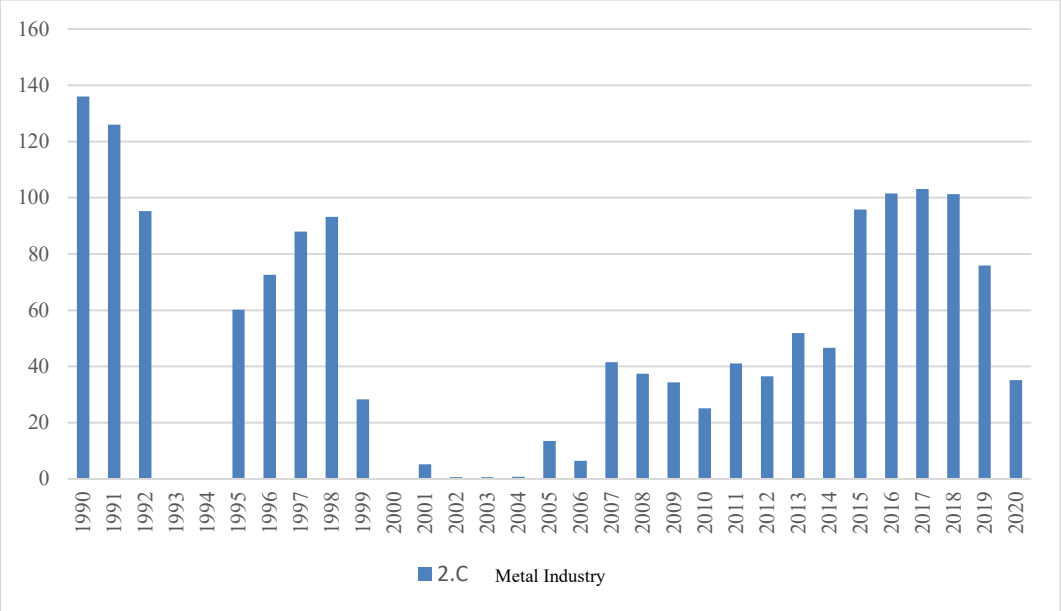

Figure 3.34 SF_6 Emissions, 1990-2020 **(**Gg CO_2eq)

SF_6 emissions from electrical equipment, such as gas insulated switchgears (GIS and circuit breakers), were not estimated since emissions from this category are not significant or a key source category.

4.5 Uncertainty Analysis

Uncertainties related to annual GHG emissions, as well as time trends, were assessed in accordance with the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and Good Practice Guidance for Land Use, Land-Use Change and Forestry, and by use of Approach 1.

The estimated uncertainties of the 2020 GHG Inventory stood at 9.5%, while the uncertainty trend stood at 1.9%.

The following key sectors contributed the most to the variance:

→ CH_4 emissions from 5.A - Solid Waste Disposal: 54.7%
→ N_2O emissions from 3.D.1 - Direct N_2O emissions from managed soils: 14.7%; and
→ CO_2 emissions from 1.A.1 - Energy Industries: 10. 6%.

4.6 Needs for the Further Improvement of the GHG Inventory

The following priority capacity-building needs in line with the MRV framework have been identified in order to further improve Serbia's GHG Inventory:

- Enhancement of institutional capacities and cooperation in order to:
  - implement obligations in accordance with the Law on Climate Change,
  - strengthen the capacities of SEPA and data providers,
  - improve data exchange between and joint efforts by data providers and SEPA to improve the quality of activity data,
  - implement QA/QC activities, and
  - implement the GHG Inventory improvement plan;
- Development of a reliable and timely system for collecting activity data;
- Development of supporting tools for the preparation of the GHG Inventory by using higher Tier methodologies, as an integral part of the IT MRV system;
- Further development and improvement of country-specific emission factors and other parameters, including supporting methodologies;
- Further improvement of time-series consistency and accuracy;
- Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement;

As per quality assurance and quality control (QA/QC), it is necessary to, *inter alia*, start with the systematic documentation and archiving of:

- Assumptions and criteria for selection of activity data and emission factors;
- Rationale for selected methods;
- Methods used, including those used to estimate uncertainties;
- Changes in data inputs or methods from the previous years;
- Identification of individuals providing expert assessments of uncertainty estimates and their qualifications to do so;
- Details of electronic databases or software used in the development of the Inventory, including versions, operating manuals, hardware requirements and any other information required for their use;
- Worksheets and interim calculations for source category estimates and aggregated estimates and any recalculations of previous estimates;
- Final inventory reports and any analyses of trends from the previous years;
- Outcomes of QA/QC procedures;
- Inclusion of indirect emissions in GHG inventories.

In addition, it is very important to use the results of the key category analysis when deciding which Tier levels to apply as required by IPCC Good Practice Guidance and when prioritizing actions to be included in the national GHG inventory improvement plan.

The development of country-specific emission factors, emission calculation/conversion parameters, including supporting methodologies, as well as the development of electronic

exchange of and mandatory templates for activity data and improvement of data quality in general, are among the most important capacity building needs.

It shall be noted that those improvements are related to the need to further build SEPA's capacity for the preparation of quality GHG inventories. The critical need at this moment is to strengthen the capacity of the GHG Inventory Team within the SEPA.

5. GHG Mitigation Potential

5.1 Introduction

With a goal to identifying potentials for low-carbon economic development and enhancing its NDC ambitions, the Ministry of Environmental Protection implemented the IPA project "Climate Change Strategy with Action Plan" in the 2016-2019 period, in collaboration with other institutions and organizations. Within this project, the Government of the Republic of Serbia developed the Low Carbon Development Strategy of the Republic of Serbia the 2023-2030 Period with Projections until 2050 as well as the Second Biennial Report (SBUR) which relies on the results set out in the Strategy and shows the GHG projections up to 2025 and 2030.

The SBUR shows the GHG projections up to 2025 and 2030, while the FBUR provided projections until 2015 and 2020.

The year 2015 was the starting point for projections in the SBUR, while 2010 was the starting point for projections in the FBUR.

The LEAP (Long-range Energy Alternatives Planning System) model was used for developing projections in the FBUR. Three different models were used for GHG emissions projections in the SBUR:

- The PRIMES – GEM-E3 suite comprising the PRIMES energy system model and the GEM-E3 model for macroeconomic projections;
- CAPRI - Common Agricultural Policy Regional Impacts, the model for agriculture and land use, land use change and forestry (LULUCF); and,
- The IPCC 2006 Waste model, for the waste sector (excluding wastewater, which was estimated using a distinct, simplified approach).

In general, Serbia's status of EU candidate country and its associated obligations to align its law with the EU *acquis*, were some of the main assumptions used for modelling.

The SBUR sets out activities, policies and measures needed to achieve the 2030 GHG emissions reduction potential, the responsible institutions, timelines and the funds needed to implement the measures. SBUR focuses on measures with the greatest impact on GHG emissions or removals and measures affecting key categories in the national GHG Inventory.

5.2 GHG Emissions Scenarios

Scenarios of GHG emissions cover a broad range of the main driving forces of future GHG emissions in Serbia, from policy, social, economic to environmental ones. Modelling was conducted from 2015 onwards, whilethe following three scenarios were important from the perspective of the SBUR:

- **Scenario without Measures** (WOM)[16], the so-called Baseline (Business as Usual, BaU) scenario - excludes all policies and measures implemented, adopted and planned after 2015, and does not include new policies defined and adopted in 2020 and subsequently;
- **Scenario with Existing Measures** (WEM)[17] – considers policies and measures envisaged in the Low Carbon Development Strategy of the Republic of Serbia for the 2023-2030 Period ;
- **Scenario with Additional Measures** (WAM)[18] – considers ways of achieving the 2030 targets defined at the EU level

During the assessment of mitigation potential until 2030,all sectors recognized by the IPCC methodology (Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use and Waste) were taken into account.

5.3 Scenario without Measures (WOM)

The Scenario without Measures (WOM) or the BaU scenario excludes all PAMs implemented, adopted and planned from 2015, as the starting year for projections, to 2020. Therefore, the WOM scenario assumes that the current situation will not change until 2030.

Under the WOM/BaU scenario, national GHG emissions trends will increase in 2030 (Table 5.1)

Table 5.1 National WOM GHG Emissions Trend in 2030

GHG Trend in 2030			
without LULUCF	**Compared to**	**with LULUCF**	**Compared to**
3.2%	2010	4.5%	2010
-5.1%	2005	- 2.3%	2005
20.7%	1990	-25.6%	1990

[16]

[17] Mitigation Scenario 2 in the LCDS

[18] Mitigation Scenario 3 in the LCDS

Sectoral and total GHG emissions in 2030, as projected within the WOM, as well as their trends compared to 2010, 2005 and 1990, are presented in Table 5.2 below.

Table 5.2 WOM GHG emissions (kt CO_2 eq)

WOM	1990	2005	2010	2015	2020	2025	2030	2030/ 2010	2030/ 2005	2030/ 1990
Energy	66,017	54,325	49,956	49,381	50,579	51,206	51,856	3.8%	-4.5%	-21.5%
Energy Industries	44,146	35,557	33,050	34,700	34,451	34,188	34,590	4.7%	-2.7%	-21.6%
Manufacturing Industries and Construction	6,418	6,064	4,278	3,452	3,898	4,062	4,014	-6.2%	-33.8%	-37.5%
Transport	4,564	6,702	6,742	5,995	7,197	7,822	8,354	23.9%	24.6%	83.0%
Other Sectors	7,048	3,030	3,477	2,711	2,627	2,660	2,677	-23.0%	-11.6%	-62.0%
Fugitive Emissions	3,841	2,973	2,409	2,523	2,406	2,474	2,221	-7.8%	-25.3%	-42.2%
IPPU	5,455	4,729	4,660	3,883	4,736	5,384	5,671	21.7%	19.9%	4.0%
Agriculture	6,186	6,238	5,305	5,259	5,133	5,046	4,752	-10.4%	-23.8%	-23.2%
Waste	3,868	2,800	2,730	2,709	2,755	2,582	2,371	-13.1%	-15.3%	-38.7%
Total BaU (without LULUCF)	81,526	68,093	62,650	61,233	63,204	64,218	64,650	3.2%	-5.1%	-20.7%
LULUCF	-1,432	-7,090	-5,627	-4,533	-6,532	-5,451	-5,050	-10.3%	-28.8%	252.7%
Total with LULUCF	80,094	61,002	57,023	56,700	56,672	58,767	59,600	4.5%	-2.3%	-25.6%

Therefore, after 2010 and up to 2030, GHG emissions will increase in Energy Industries, Transport and IPPU. GHG emissions will decrease in Manufacturing Industries and Construction, Other Sectors (residential and commercial), Fugitive Emissions, Agriculture and Waste (Figure 5.1)

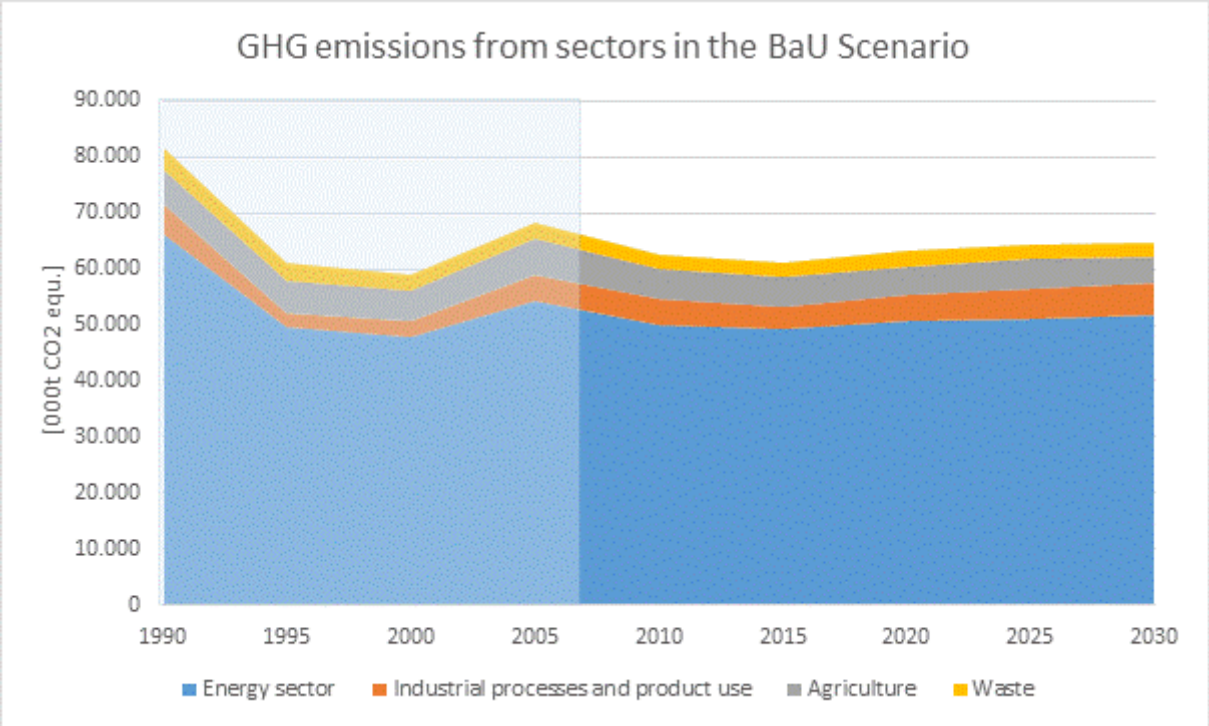

Figure 5.1 GHG Emissions from Sectors under the WOM Scenario (kt CO_2 eq)

In 2030, according to the WOM, the Energy Industries sub-category will continue contributing the most to national GHG emissions, while emissions in the Transport sub-category of the same category (Energy) will register the highest increase.

Herewith an overview of GHG emissions by sector:

Energy

GHG emissions from the Energy Industries sub-category will increase by 4.7% in 2030 compared to 2010, and decrease by 2.7% compared to 2005 and by 21.6% compared to 1990. However, this sub-category will retain the biggest share in the Energy sector and national GHG emissions. GHG emissions in the Transport sub-category will grow the most in 2030 – by 23.9%, 24.6% and 83% compared to 2010, 2005 and 1990 respectively.

Thus, the Fuel Combustion category will continue to contribute the most to national GHG emissions in 2030 (Figure 5.2).

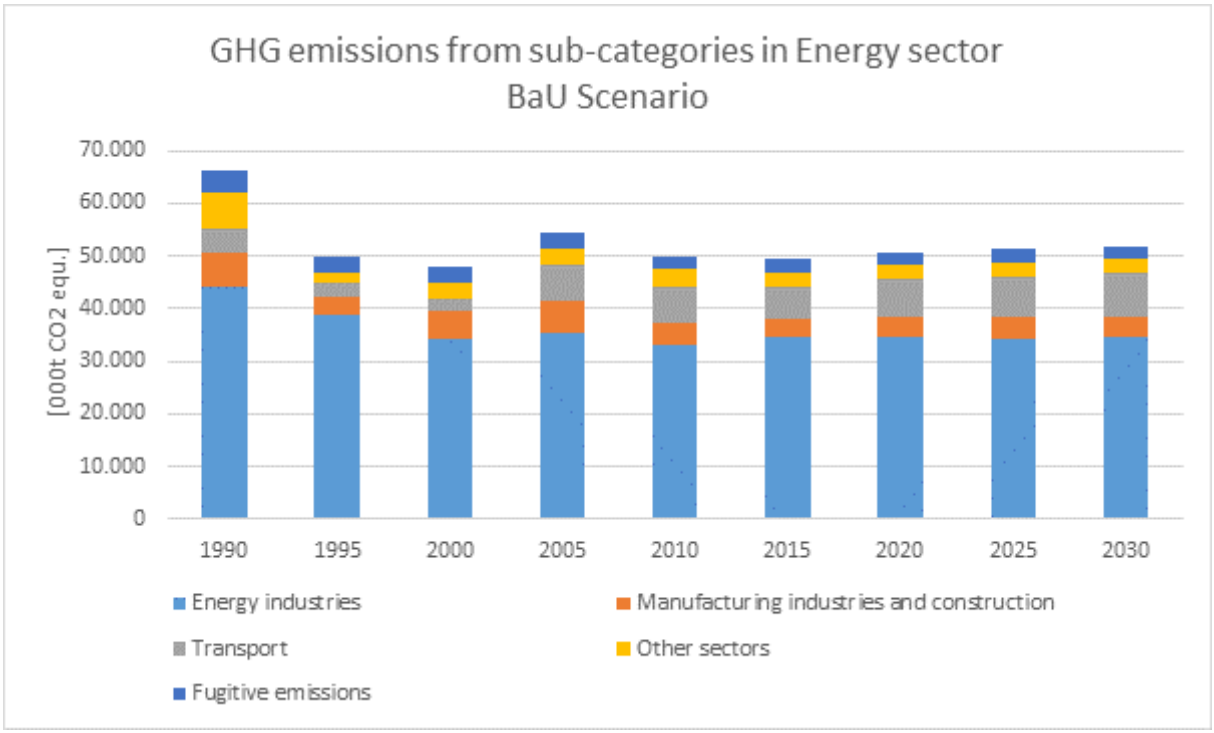

Figure 5.2 GHG Emissions from Energy Sector Sub-Categories (in kt CO_2 eq)

IPPU

GHG emissions from the IPPU sector will increase in 2030 by 21.7% compared to 2010, by 19.9% compared to 2005 and by 4% compared to 1990. The increase in GHG emissions in the Metal Industry sub-category (iron and steel) will contribute the most to the rise in IPPU GHG emissions.

In the 2015-2030 period, Metal Production will continue to account for between 51% and 54%, the Mineral Industry for around 34% and the Chemical Industry for around 10% of IPPU GHG

emissions. The Metal Industry and the Mineral Industry are responsible for over 85% of all industrial process (IP) GHG emissions.

The shares of Non-Energy Products and Solvent Use in IPPU GHG emissions will remain at 3% (Figure 5.3).

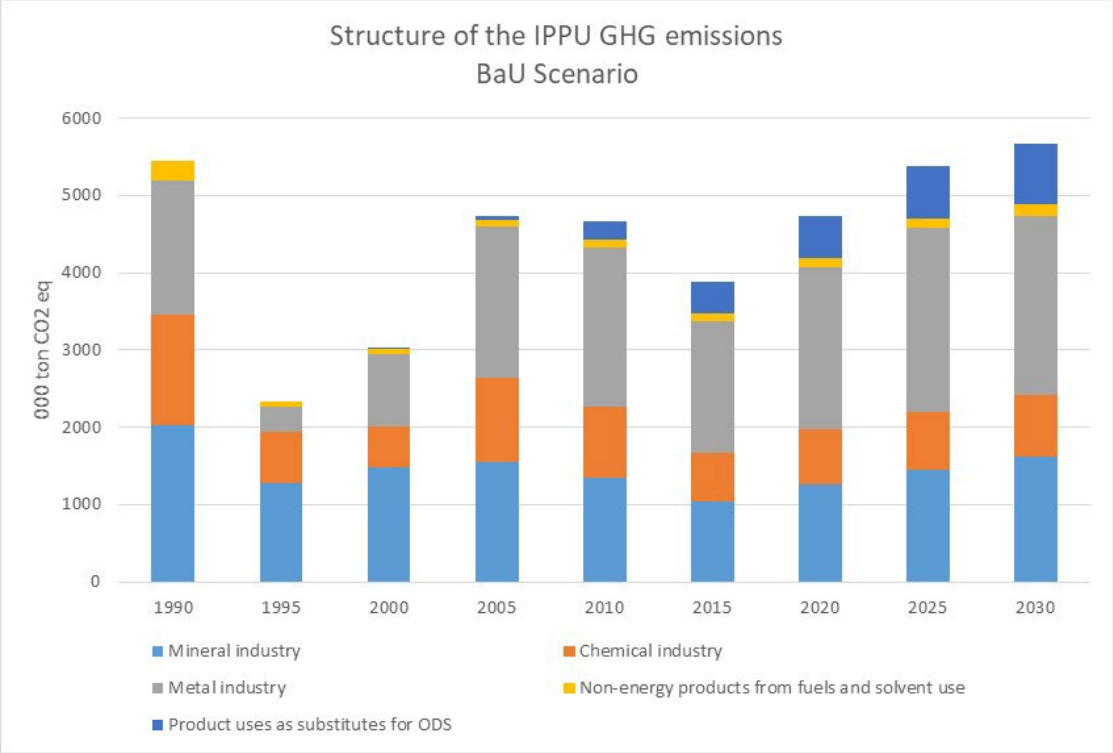

Figure 5.3 Structure of IPPU GHG emissions (kt CO_2 eq)

Agriculture

GHG emissions will decrease by 10.4% in 2030 compared to 2010, i.e., by 23.8% compared to 2005 and by 23.2% compared to 1990. The shares of Agriculture sub-categories are shown in Figure 5.4.

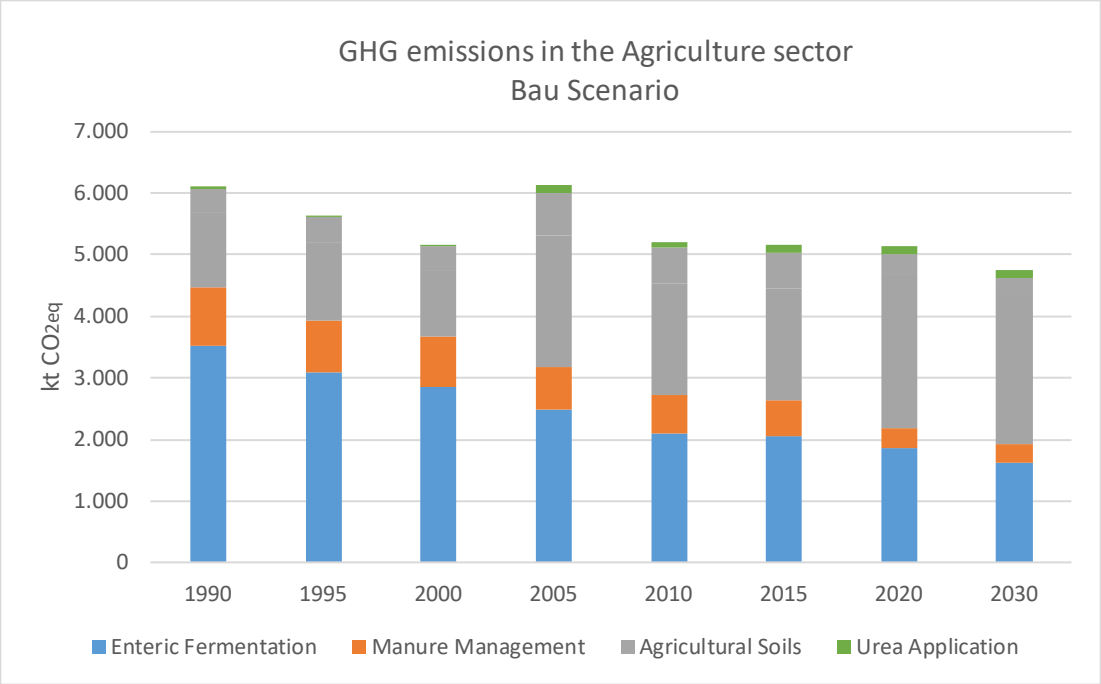

Figure 5.4 GHG Emissions in the Agriculture Sector (kt CO_2 eq)

In 2030, N_2O emissions from microbial processes in soils will account for almost 60% of GHG emissions, replacing the previously dominant CH_4 emissions from enteric fermentation. Such a trend has been registered since 2005.

Emissions from agricultural soils will continue rising, mainly due to emissions from inorganic N-fertilizers. The drop in emissions from enteric fermentation and manure management is mainly caused by declining livestock production.

LULUCF

Land use, land use change and forestry (LULUCF) encompasses GHG effects caused by changes in biomass and litter (CO_2), soil organic carbon (CO_2, N_2O), agricultural use of histosol areas (CO_2) and burning activities (CO_2, CH_4, and N_2O).

LULUCF GHG emissions will decrease by 10.3% in 2030 compared to 2010 (Table 3.2). The shares of LULUCF sub-categories presented in Figure 3.5 show the evident contribution of forest management.

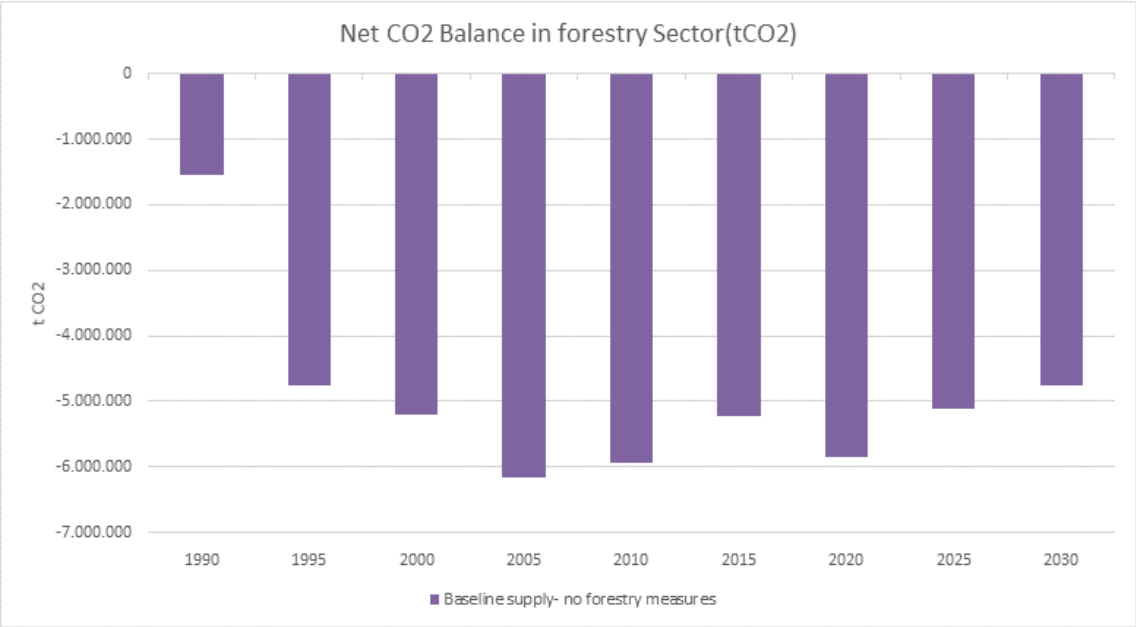

Figure 5.5 LULUCF GHG Emissions (kt CO_2 eq)

Waste

In 2030, GHG emissions will fall in the Waste Management sector (solid waste disposal and wastewater treatment) by 13.1%, 15.3% and 38.7% compared to 2010, 2005 and 1990 respectively.

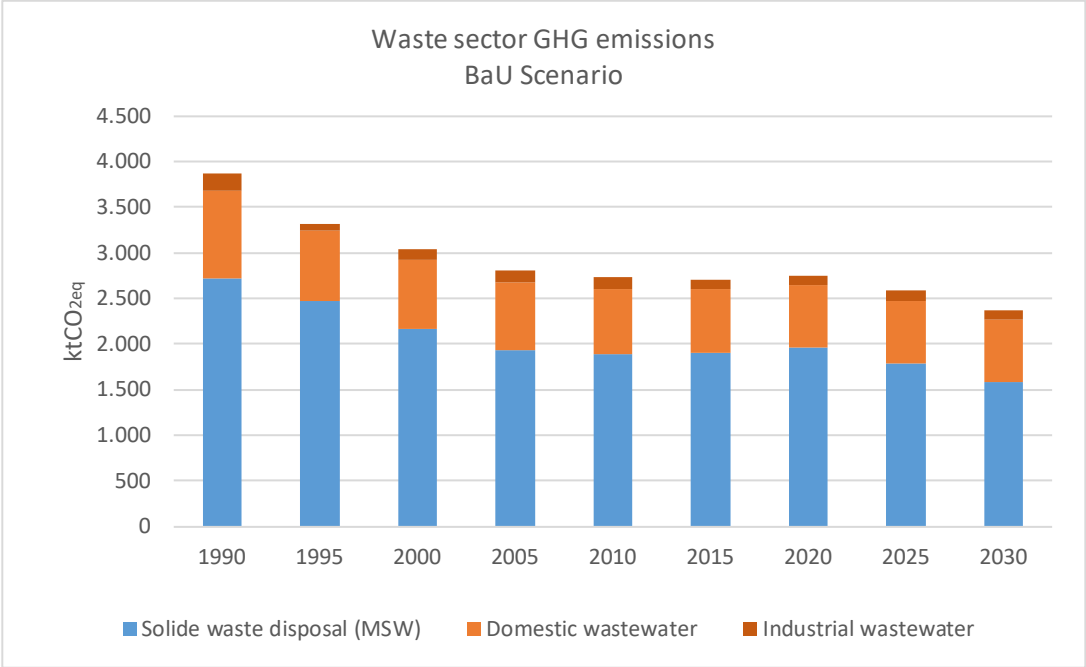

Figure 5.6 Waste Sector GHG Emissions (kt CO_2 eq)

GHG emissions from solid waste disposal are expected to average 1,750 kt CO_2 eq per year during the 2015 – 2030 period (Figure 3.6). Emissions of CO_2 eq from the Solid Waste Disposal

sub-category are expected to drop by 21.7% in the 2010-2030 period, i.e., approximately 0.96% per annum.

Emissions from wastewater treatment (with domestic wastewater accounting for 86% and industrial wastewater for 14%) are expected to fall by 6.6% in the 2010-2030 period. Emissions from domestic wastewater treatment will be 4.7% lower in 2030 than in 2010, which corresponds to an annual reduction of approximately 0.20%. Moreover, this corresponds to a 32.1% reduction compared to 2005 and a 49% reduction compared to 1990.

5.4 Scenario with Existing Measures (WEM)

The Scenario with Existing Measures (WEM) considers PAMs envisaged in the national LCDS.

According to the WEM, Serbia will reduce its GHG emissions (without LULUCF) by 13.2% in 2030 compared to 2010, i.e., by 33.3% compared to 1990 (and by 20.1% compared to 2005).

With LULUCF, these GHG emission reductions will stand at 16.1%, 21.6% and 40.3% compared to 2010, 2005 and 1990.

WEM GHG emissions by sector and category/sub-category and their trends are presented in Table 5.3.

Table 5.3 WEM Level of GHG Emissions (kt CO_2 eq) and Changes (%) by Sector and Category/Sub-Category

WEM	1990	2005	2010	2015	2020	2025	2030	2030/ 2010	2030/ 2005	2030/ 1990
Energy – estimate, final emissions will be determined in the INECP	66,017	54,325	49,956	49,382	50,308	47,217	42,537	-14.8%	-21.7%	-35.6%
Energy Industries - estimate, final emissions will be determined in the INECP	44,146	35,557	33,050	34,700	34,548	31,164	27,426	-17.0%	-22.9%	-37.9%
Manufacturing Industries and Construction	6,418	6,064	4,278	3,452	3,842	4,101	3,651	-14.7%	-39.8%	-43.1%
Transport	4,564	6,702	6,742	5,995	7,096	7,406	7,433	10.2%	10.9%	62.9%
Other Sectors	7,048	3,030	3,477	2,711	2,393	2,267	2,089	-39.9%	-31.0%	-70.4%
Fugitive Emissions	3,841	2,973	2,409	2,523	2,429	2,279	1,938	-19.6%	-34.8%	-49.5%
IPPU	5,455	4,729	4,660	3,883	4,736	5,178	4,994	7.2%	5.6%	-8.4%
Agriculture	6,186	6,238	5,305	5,259	5,132	4,813	4,493	-15.3%	-28.0%	-27.4%
Waste	3,868	2,800	2,730	2,709	2,755	2,582	2,371	-13.1%	-15.3%	-38.7%
Total (without LULUCF)	81,526	68,093	62,650	61,233	62,931	59,790	54,396	-13.2%	-20.1%	-33.3%
LULUCF	-1,432	-7,090	-5,627	-4,533	-6,766	-6,323	-6,576	16.9%	-7.3%	359.2%
Total with LULUCF	80,094	61,002	57,023	56,700	56,165	53,467	47,820	-16.1%	-21.6%	-40.3%

Herewith a breakdown of GHG emissions by sector:

Energy

GHG emissions in the Energy Industries sub-category will decrease by 17% even in 2030 compared to 2010, by 22.9% compared to 2005 and by 37.9% compared to 1990. They will remain the main contributor to Energy sector's and national GHG emissions.

GHG emissions from the Transport sub-category will increase significantly: by 10.2% compared to 2010, by 10.9% compared to 2005 and by 62.9% compared to 1990. However, the deviation from the BaU sub-category curve is important.

As opposed to the WOM scenario, the WEM scenario assumes the implementation of measures for alignment with the EU Emissions Trading System (EU ETS) and/or introduction of other carbon pricing instruments as of 2026 and introduction of the CO_2 tax in non-EU ETS sectors as of 2026.

Compared to the WOM scenario, GHG mitigation impact in 2030 is estimated at 9,312 kt.

IPPU

In the IPPU sector, process emissions occur due to chemical reactions releasing CO_2, wherefore mitigation measures are extremely limited and are usually not based on technology, but market or regulatory driven. In the free market, this requires a global common harmonized approach (e.g., phasing out concrete and its replacement with other low carbon materials). In practice, limited mitigation options can only level out increased market demand. In 2030, GHG emissions from the IPPU sector are projected at 4,994 kt CO_2 eq, which is an increase of 7.2% compared to 2010 and a decrease of 8.4% compared to 1990.

Agriculture

GHG emissions from Agriculture are expected to stand at 4,493 kt CO_2 in 2030, i.e., be lower by 15.3% compared to 2010 and by 27.4% compared to 1990.

Such a reduction of GHG emissions will be the result of the following measures:

A. Additional potential planting of winter cover crops on 1,919 kha by 2030, which will contribute to the reduction of GHG emissions by 579.05kt CO_2 compared to WOM.
B. Additional potential planting of legumes on 33 kha of temporary grassland, which will increase bio-fixation and thus reduce fertilizer needs. Assumptions are that the share of legumes on temporary grassland can be increased by a maximum of 20%, which is equivalent to a nitrogen fixation rate of 15%. The biological nitrogen fixation processes lead to lesser fertilizer use and a reduction of GHG emissions by 14.60 kt CO_2 compared to the WOM scenario.

LULUCF

GHG removals in the LULUCF sector are projected at 6,576 kt CO_2 eq in 2030. This entails a 16.9% increase in sequestration compared to 2010 and 1990.

The measures in the LULUCF sector are the same in the WEM and the WAM scenarios, with different sizes of areas. These measures in the WEM scenario include:

A. Application forest management practices that are close to nature, i.e. cultivation forest measures, which imply filling of stands as a form of auxiliary measures in forest restoration, on 300 ha per year until 2050, whereby the use of different deciduous and coniferous species will result in additional sink of 0.54 kt CO_2 eq per annum.
B. The planned conversion of coppice forests to high forests on 7,000 ha every year will result in additional GHG emission removal of 38.20 kt CO_2 eq per annum, i.e., 458.4 kt CO_2 up to 2030.
C. Short rotation plantations on an area of 1,500 hectares a year (planting of poplars and willows), taking into account an annual increment of 10 m^3/ha up to age 10 and an annual increment of 18 m^3/ha after age 10, will result in additional sink of 27.29 kt CO_2 eq per annum until tree-age 10 and 49.12 kt CO_2 eq per annum after tree-age 10. This will lead to additional sequestration of 654.84 kt CO_2 eq compared to the WOM in 2030.
D. Regeneration of overmature stands (beech) – the goal is to complete the production process in mature and overmature stands with low productivity (and even negative effects in terms of CO_2) and establish naturally or artificially new forest stands with high productivity (group-mixed stands where possible). This is extremely important for forestry and climate change effects, because the annual increment of old stands is less than 3 m^3/ha, while their CO_2 absorption capacity is negligible compared with the increment of young stands of 8 m^3/ha. Sufficient planting material of site adapted tree species have to be produced for the afforestation of areas where natural regeneration is not successful. Increased harvesting will increase the demand for skilled forest workers and machinery.

Waste

GHG emissions from the waste sector will stand at 2,371 kt CO_2 eq in 2030, i.e., will be 13.1% lower than in 2010 and 38.7% lower than in 1990 (according to values in Table 3.3 for the WEM scenario). Such a reduction in GHG emissions will be the result of measures described in the following table.

Table 5.4 Measures and Timetables in the WOM /WEM scenarios

Name of Region	Construction of Sanitary Landfills		Introduction of Source Separation & Construction of Material Recovery Facilities		Construction of Biological Treatment Facilities (Composting Plants)		Construction of Thermal Treatment (Incineration) Plants	
	2025	2030	2025	2030	2025	2030	2025	2030
Sremska Mitrovica								
Pančevo								
Inđija								
Užice								
Pirot								
Kikinda								
Lapovo								
Jagodina								

Name of Region	Construction of Sanitary Landfills		Introduction of Source Separation & Construction of Material Recovery Facilities		Construction of Biological Treatment Facilities (Composting Plants)		Construction of Thermal Treatment (Incineration) Plants	
	2025	2030	2025	2030	2025	2030	2025	2030
Leskovac								
Subotica								
Valjevo								
Zrenjanin								
Nova Varoš								
Vranje								
Belgrade								
Novi Sad								
Niš								
Sombor								
Vršac								
Zaječar								
Smederevo								
Kragujevac								
Kraljevo								
Kruševac								
Požarevac								
Loznica								

5.5 Scenario with Additional Measures (WAM)

By definition, the Scenario with Additional Measures (WAM) includes implemented, adopted and planned policies and measures. For Serbia, this scenario is a way to achieve the 2030 targets defined at the EU level, on the assumption that Serbia will accede to the EU in 2025.

It is assumed that national GHG emissions (excluding LULUCF) will be reduced by 45.2% in 2030 compared to 1990, i.e., by 28.7% compared to 2010.

In 2030, national GHG emissions (including LULUCF) will be reduced by 34.4% compared to 2010, i.e., by 53.3% compared to 1990 (Table 3.5). Compared to the WEM scenario, the WAM scenario generally requires major additional efforts in the energy, agriculture and waste sectors.

Table 5.5 GHG Emissions (kt CO_2 eq) and Changes (%) by Sector and Category/Sub-Category

WAM	1990	2005	2010	2015	2020	2025	2030	2030/ 2010	2030/ 2005	2030/ 1990
Energy - estimate, final emissions will be determined in the INECP	66,017	54,325	49,956	49,382	49,893	42,533	34,313	-31.3%	-36.8%	-48.0%

WAM	1990	2005	2010	2015	2020	2025	2030	2030/ 2010	2030/ 2005	2030/ 1990
Energy Industries - estimate, final emissions will be determined in the INECP	44,146	35,557	33,050	34,700	34,287	27,051	20,843	-36.9%	-41.4%	-52.8%
Manufacturing Industries and Construction	6,418	6,064	4,278	3,452	3,856	4,175	3,109	-27.3%	-48.7%	-51.6%
Transport	4,564	6,702	6,742	5,995	6,924	7,011	6,613	-1.9%	-1.3%	44.9%
Other Sectors	7,048	3,030	3,477	2,711	2,409	2,130	2,081	-40.1%	-31.3%	-70.5%
Fugitive Emissions	3,841	2,973	2,409	2,523	2,417	2,166	1,667	-30.8%	-43.9%	-56.6%
IPPU	5,455	4,729	4,660	3,883	4,731	5,167	4,641	-0.4%	-1.9%	-14.9%
Agriculture	6,186	6,238	5,305	5,259	5,132	4,691	4,249	-19.9%	-31.9%	-31.3%
Waste	3,868	2,800	2,730	2,709	2,601	2,134	1,488	-45.5%	-46.8%	-61.5%
Total (without LULUCF)	81,526	68,093	62,650	61,233	62,357	54,525	44,692	-28.7%	-34.4%	-45.2%
LULUCF	-1,432	-7,090	-5,627	-4,533	-6,725	-6,672	-7,274	29.3%	2.6%	408.0%
Total with LULUCF	80,094	61,002	57,023	56,700	55,632	47,853	37,418	-34.4%	-38.7%	-53.3%

Herewith a breakdown of GHG emissions by sector:

Energy

The highest contribution to national GHG emissions in 2030 will come from the Energy Sector (Other Sectors will contribute with -40.1%, and Energy Industries with -36.9% compared to 2010). However, the reduction of GHG emissions in the Energy Sector is projected at 31.3% compared to 2010. The reduction of GHG emissions in the Transport sub-category is projected in WAM (1.9%) but not in WEM.

In general, the same types of actions are envisaged in the WAM and WEM scenarios. The WAM scenario assumes a major increase in use of solar energy, and an additional (*vis-à-vis* the WOM) reduction of GHG emissions of 5,805 kt CO_2 eq.

An additional reduction of energy consumption by household heating and cooling, compared to the WEM, requires the installation of upgraded heating and cooling equipment. That would result in a 389 kt CO_2 eq reduction compared to the WOM in 2030, while increased energy efficiency will result in a 287 kt CO_2 eq reduction in the industrial sector.

A major change in GHG emissions in the Transport sub-category (from a 10.2% increase under the WEM to a 1.9% decrease under the WAM) will be the result of measures focusing on the improvement of efficiency and promotion of modern technologies and alternative fuels. This will discourage the purchase of old second-hand vehicles after 2025. The measures will result in the evolution of the fleet of the new passenger cars and freight vehicles and falls in GHG emissions by 1,950 kt CO_{2e} (passenger cars) and by 711 kt CO_2 (freight vehicles) compared to the WOM.

Agriculture

The 2030 GHG emissions from the agriculture sector are projected at 4,249 kt CO_2 eq. This represents a decrease of 19.9% compared to 2010 and of 31.3% compared to 1990.

The WAM assumes the undertaking of the following additional efforts:

A. Planting of winter cover crops on 1,926 kha that will lead to an additional 581.07 kt CO_2 eq reduction by 2030 compared to the WOM.
B. Potential planting of legumes on 35 kha of temporary grassland resulting in an additional reduction of 15.4 kt CO_2 eq by 2030 compared to the WOM.

The WAM includes some new measures, such as:

A. Lipid supplementation of animal diets increases the energy content of the diets and enhances energy utilization, resulting in higher feed efficiency and a decrease of CH_4 emissions from cattle. Linseed is one of the most efficient dietary lipids. Thus, the scenario envisages lipid supplementation of diets of 13,000 heads of dairy cows (the largest livestock group) by 2030.
B. Precision farming (PF), including Variable Rate Technology (VRT), Remote Sensing Technologies, Global Positioning Systems (GPS) and Geographic Information Systems (GIS) to support the more precise application of inputs and machinery, on 146 kha by 2030. This will contribute to a 20.44 kt CO_2 eq reduction compared to the WOM scenario.
C. It is assumed that farms with more than 200 livestock units shall use anaerobic digestion as a technological option to mitigate livestock manure emissions, covering 42,000 sows and 28,000 pigs in 2030. This shall reduce emissions by an additional 9.15 kt CO_2 eq compared to the WOM in 2030.

- **LULUCF**

According to the WAM scenario, LULUCF shall remove 7,274 kt CO_2 eq in 2030, increasing carbon sequestration by 29.3% compared to 2010 (and to 1990).

The measures and areas in the WAM scenario are almost the same as those in the WEM scenario.

- **Waste**

The waste sector shall achieve a substantial reduction in GHG emissions: 45.5% compared to 2010, 46.8% compared to 2005 and 61.5% compared to 1990. However, this sector's share in national GHG emissions will remain almost unchanged.

The WAM scenario envisages the same measures and timeframes as the WOM and WEM scenarios, but the waste treatment targets are intensified in order to achieve higher emission reductions. This shall be achieved by increasing investments in capacities and treatment technologies and the efficiency of the collection system (i.e., efficiency of source separation schemes), as well as by conducting more intensive public awareness campaigns/initiatives in line with the defined targets.

5.6 Comparison of Mitigation Scenarios

Tables 5.6 and 5.7 and Figures 5.7 and 5.8 below present GHG emission levels (kt CO_2 eq) and their trends based on projections of GHG emissions in the WOM, WEM, and WAM scenarios.

Table 5.6. GHG Emissions for All Scenarios (kt CO_2 eq)

	1990	2010	2020	2025	2030
WOM	81,526	62,650	63,204	64,218	64,650
WEM	81,526	62,650	62,931	59,790	54,396
WAM	81,526	62,650	63,357	54,525	44,692

Table 5.7 GHG Emission Trends for Different Periods

	2020/2010	2025/2010	2030/2010	2030/1990
WOM	1.3%	2.9%	3.2%	-20.7%
WEM	0.7%	-4.9%	-13.2%	-33.3%
WAM	-0.8%	-14.3%	-28.7%	-45.2%

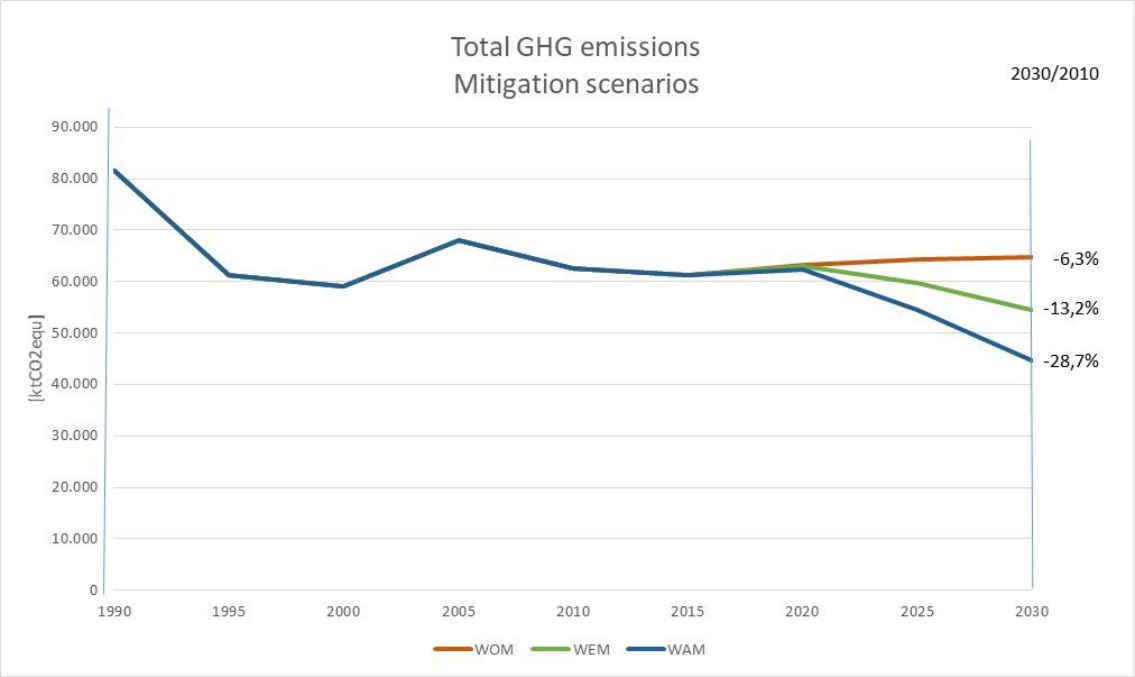

Figure 5.7 GHG Mitigation Trajectories for the 1990 – 2030 Period

The highest GHG emission reductions by 2030 can be expected in the Energy Sector, notably, in the Energy Industries category (dominated by production of electricity and heat) within this sector. Compared to 2010, the reduction of GHG emissions in Energy Industries ranges from -17% in the WEM scenario to -36.9% in the WAM scenario.

Such a reduction of GHG emissions in the energy system will mostly be a consequence of a major increase in use of renewables and energy efficiency. Fugitive emissions accounted for 4.2% of overall emissions in 2010; their share is expected to drop to between 3.36 and 3.73% in 2030. Future trends in fugitive emissions closely correlate with Mining and post-mining activities, Oil and natural gas exploration, production, transport, refining/storage and distribution of gas and oil products, and Venting and flaring of gas, oil or combined. Fugitive emissions from solid fuels will closely follow the projected production of lignite and sub-bituminous coal in Serbia.

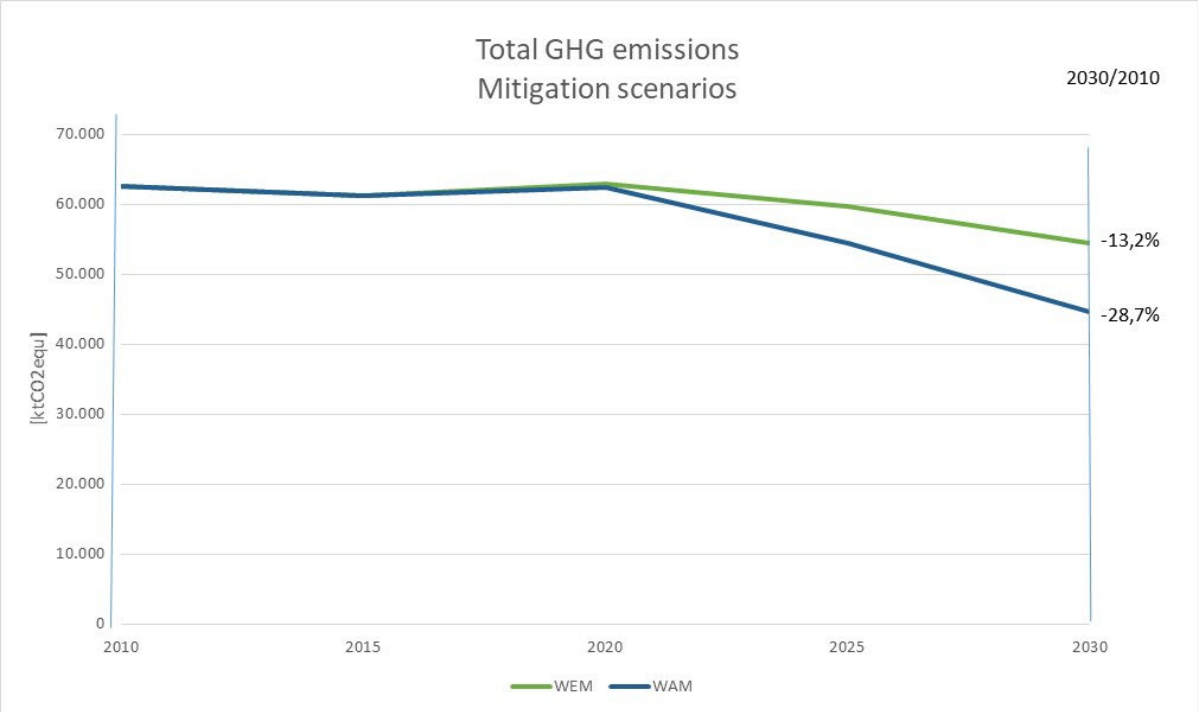

Figure 5.8 GHG Mitigation Trajectories in the 2010-2030 Period

According to the WAM scenario, the total reduction of 28.7% in 2030 will almost entirely come from the power sector (Other sectors will contribute with -40.1%, and Energy Industries with -36.9% compared to 2010).

GHG emissions in Manufacturing Industries and Construction are expected to decrease by 14.7% under the WEM and by 27.3% under the WAM scenario by 2030 compared to 2010.

According to the WEM scenario, GHG emissions in the Transport sub-category will increase by 10.2% in 2030 compared to 2010 level. Under the WAM scenario, this sub-category will also contribute to the reduction of GHG emissions, by 1.9%.

GHG emissions from the Waste sector are expected to decrease between 2010 and 2030 by 13.1% under the WEM and by 45.5% under the WAM due to the implementation of measures to reduce the amounts of biodegradable waste and methane released into the atmosphere.

In the field of wastewater management, cumulative emissions of CO_2 eq in the 2010-2030 period can be expected to average 600 kt a year. Reductions of CO_2 eq emissions from city sewage systems for the 2010-2030 period will stand at 28%.

When it comes to reducing GHG emissions, two sectors have been identified as challenging: IPPU and Agriculture.

GHG emissions in the IPPU sector are expected to increase by 7.2% in 2030 compared to 2010, under the WEM scenario. The share of process emissions in total GHG emissions in Serbia, which stood at a mere 7.6% in 2010, is expected to increase in the future. Under the WEM and WAM scenarios, the share of IPPU emissions is expected to range between 9.18% and 10.38%.

GHG emissions from Agriculture are expected to grow until 2030, but all scenarios show a decreasing trend of total agriculture emissions from 2010 until 2030, with a slight increase between 2015 and 2020. Nevertheless, there is room for reducing emissions, especially in the livestock (dairy and non-dairy cattle) segment. Emissions will decrease by 15.3% under the WEM scenario and by 19.9% under WAM scenario in 2030 over 2010. Such a decrease will require the implementation of a broad range of GHG mitigation measures.

Agricultural soil emissions contribute the most to total agricultural emissions in the ex-ante years and to emission reductions in mitigation scenarios. GHG emissions will be reduced by 1.0% in the WOM, by 10.2% in the WEM, and by 16.8% in the WAM in 2030 compared to 2010.

Enteric fermentation contributes about 6 to 8 times more to agricultural emissions than manure management. Potential for reduction appears moderate.

The LULUCF sector's contribution to GHG emissions ranges from a 16.9% increase in the WEM to a 29.3% increase in the WAM scenario.

According to the WEM, total national GHG emissions, including LULUCF, will decrease by 16.1% in 2030 compared to 2010, while the WAM expects a 34.4% decrease.

Estimates of emissions per gas in the baseline and mitigation scenarios show that the WEM scenario registers the greatest change in the composition of GHG gases.

5.7 Implementation Costs

Serbia's costliest scenario in the long term (until 2050) would be to ignore climate related costs, continuing along the emissions trajectory assumed in the WOM scenario.

Slightly higher investments in the shorter term (until 2030) would simultaneously lead to substantially lower total costs, and definitely to a significant reduction of losses and damages. Additional costs in the field of energy, including energy efficiency, as sources of funds for investments, specified in this chapter, determined on assumptions adopted for the Strategy, will be further analyzed within the Integrated National Energy and Climate Plan, wherefore the total investment costs will be defined by that plan, once it is implemented.

Table 3.8 presents the costs of implementation associated with scenarios and sectors/measures included in each scenario in the key sectors compared to the costs of implementation of the WOM scenario.

Table 5.8 Costs of Implementation of Each Scenario per Sector (in million €) (Compared to WOM)

	2020-2025		2026-2030		2020-2030	
	WEM	**WAM**	**WEM**	**WAM**	**WEM**	**WAM**
TOTAL	1,893	6,650	4,618	12,589	6,511	19,239
Energy assessment, final emissions will be determined in the INECP	1,825	6,531	4,510	12,388	6,335	18,919
IPPU	2	3	2	3	4	6
Agriculture	20	31	60	93	80	121
Waste	0	39	0	59	0	98
Forestry	46	46	46	46	92	92

The high WEM implementation costs will require significant support of the Green Climate Fund (GCF) and other donors, while the EU support shall be even more important. Furthermore, WAM costs of implementation for the 2020-2030 period are €19,239 million higher than the WOM scenario costs. Thus, its implementation will be possible only with the support of bilateral donors and the international community/GCF.

This especially holds true in view of the other impacts of implementing GHG emission reduction activities, as shown in Table 3.9.

Table 5.9 Key Socio-Economic Impact Indicators (compared to the WOM)

Indicator	**WEM**	**WAM**
Impacts on employment	-1.4%	-2.0%
Impacts on share of energy costs in household expenditure	1.1%	2.3%
Impacts on the Energy Poverty 2M Indicator[19]	5%	5%
Impacts on GDP (default) Impacts on household consumption	-1.4% -2.4%	-2.7% -1.5%

A technology needs assessment (TNA) at project/action or sector level will be undertaken to achieve the most effective results and assess the type of support needed. Such an analysis will result in the identification of not only specific technologies for mitigation measures, but also of

[19]This group of indicators includes: twice the median of energy expenditures; twice the mean of energy expenditures; twice the median of the share of energy expenditures; twice the mean share of energy expenditures. When comparing the mean and the median, the metrics based on the median are more appropriate statically since the mean is more sensitive to atypical values and change in habits. Household is energy poor if its share of income spent on energy services is larger than twice the national median (2M) (European Commission, DG Energy, Selecting Indicators to Measure Energy Poverty, ENER/A4/516-2014)

capacity building needs, barriers hindering deployment and dissemination of priority technologies and of other needs, which is prerequisite for the implementation of the measures.

Moreover, effectiveness of the implementation of the mitigation measures depends on the understanding and knowledge of climate change. Therefore, it is important to develop a national climate change education plan, trainings in new skills and awareness raising. The costs of preparing and implementing the above plan, including trainings in new skills, are estimated at €5 million.

In addition, Serbia submitted Nationally Appropriate Mitigation Actions (NAMAs) to the NAMAs Registry. Some of the below projects are still in need of support:

- NS-31 – Expansion of the existing hot water network in Valjevo;
- NS-33 - Use of solar energy for domestic hot water production in the Belgrade "Cerak" heating plant;
- NS-35 - Introduction of 1,000 MW small biomass boilers in the Republic of Serbia;
- NS-36 – Rehabilitation of arterial roads in the Republic of Serbia.

Support extended by the international community, particularly the Green Climate Fund, for all climate change mitigation projects and actions, is considered especially important.

6. Mitigation Actions and Their Effects

Since the WOM scenario includes already initiated or planned mitigation actions addressing sectoral priorities or required for alignment with the EU *acquis* for which funding has been secured, this chapter presents PAMs included in the WEM scenario that will require substantial financial, technical and capacity building support (Table 6.1). Therefore, the expected and achieved GHG emission reductions, as well as costs shown in Table 4.1, are additional to those in the WOM.

The objectives are expressed as targeted GHG emissions reduction in 2030 compared to 2010. Resources for their achievement will be planned in accordance with the decision of the Ministry of Finance and provided by the responsible ministries. A share of state costs will be covered through loans, wherefore the implementation of mitigation actions will require financial support of the international community, in accordance with the Paris Agreement and Serbia's status under the UNFCCC.

Table 6.1 Mitigation Actions until 2030

Mitigation Action 1	Alignment with the EU Emissions Trading System and/or introduction of other carbon pricing instruments
Description:	Alignment with the EU Emissions Trading System and/or implementation of equivalent measures until EU accession in line with the polluter pays principle, for activities requiring GHG emission licenses under Article 25 of the Law on Climate Change.

Goal:	Reduce GHG emissions by 15.0%
Type of instrument:	Financial, regulatory
Status:	Planned
Sector(s) affected:	Energy, IPPU
Gases affected:	CO_2, N_2O
Start year of implementation:	2026
Implementing entity(ies)	Ministry of Environmental Protection Ministry of Finance
Costs:	Preparatory (start-off)[20]: €1.6 million Additional investment costs[21] for investors[22]: €279.3 million
Non-GHG mitigation co-benefits:	Improve air quality Improve resource efficiency Reduce negative impacts on health
Information on interactions with other mitigation actions:	Support to the implementation of **Mitigation Action 3**
GHG emission reductions (in 2030 (single year) compared to WOM	6,942 kt CO_2 (combined mitigation impact with **Mitigation Action 3**)
Target year or period:	2030
Other year:	Progress in achievement will be monitored annually and corrective measures will be made in 2028, if necessary

Mitigation Action 2	Introduction of a CO_2 and fuel excise duties
Description:	Introduction of a CO_2 tax and of appropriate levels of excise duties as a policy instrument enables the implementation of the polluter pays principle in the non-ETS sector and/or the introduction of other carbon pricing instruments. The purpose is to render 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 taxation is an important driver for consumers to redirect investment to low or zero carbon technologies and energy efficiency. Funds collected from CO_2 tax should be

[20] All the relevant preparatory costs for institutional enforcement and administrative preparation and management of the measures.
[21] Costs additional to those for the WOM.
[22] For cost estimation purposes, costs are allocated to the ones making the investments, irrespective of their capacity to move the investment costs through the value chain to consumers and irrespective of any public subsidies or incentives they received. Investors denote public or private companies and farmers, consumers denote households, and the state denotes state investments from the state budget.

	used to support the implementation of measures reducing GHG emissions by final consumers such as households, commercial and institutional sectors and industry (small and medium enterprises).
Goal:	Reduce GHG emissions by 15.0%
Type of Instrument:	Financial, regulatory
Status:	Planned
Sector(s) affected:	Industry (SMEs), households, commercial and institutional sectors
Gases affected:	CO_2 , N_2O, CH_4
Start year of implementation:	2026
Implementing entity(ies)	Ministry of Finance
Costs:	Preparatory (*start-off*)[23]: €1 million
Non-GHG co-benefits:	Improve air quality Improve resource efficiency Reduce negative impacts on health
Information on interactions with other mitigation actions:	Support to the implementation of Mitigation Actions 5-9
GHG emission reductions (in 2030 (single year) compared to WOM	161 kt CO_2
Target year or period:	2030
Other year:	Progress in achievement will be monitored annually and corrective measures will be made in 2028, if necessary

Mitigation Action 3	**Increase in the Use of RES in Energy Production**
Description:	Measures supporting the production of electricity from RES laid down in the Law on Use of Renewable Energy Sources need to be implemented in practice in order to increase the share of RES in the energy system, which is mostly based on coal. This law provides for two types of incentives: feed-in tariff system for small plants and the system of market premiums. The final measures and activities will be defined in the Integrated National Energy and Climate Plan of the Republic of Serbia until 2030, with projections until 2050.

[23] All the relevant preparatory costs of institutional enforcement and administrative preparation and management of the actions along with use of European mechanisms supporting the implementation of the green tax reform.

Type of instrument:	Incentive, Financial, Regulatory
Status:	Ongoing (plans are to intensify the implementation of this action)
Sector(s) affected:	Energy
Gases affected:	CO_2, CH_4, N_2O
Start year of implementation:	2009
Implementing entity or entities:	Ministry of Mining and Energy
Costs:	Preparatory (start-off): €2 million Additional investment costs for investors: €635 million
Non-GHG mitigation co-benefits:	Improve air quality Reduce adverse impacts on health Increase number of green jobs
Information on interactions with other mitigation actions:	Support to the implementation of Mitigation Action 1
GHG emission reductions (in 2030 (single year) compared to WOM	4,397 kt CO_2 eq (combined mitigation impact with Mitigation Action 1)
Target year or period:	2030
Other year:	Progress in achievement will be monitored annually and corrective measures will be made in 2025, if necessary

Mitigation Action 4	**Improvement of Energy Efficiency and Increased Use of CHPs and RES in District Heating Systems**
Description:	The Law on Energy Efficiency and Rational Energy Use provides for financial incentives – feed-in tariffs and market premiums for high-efficiency combined heat and power (CHP) plants with a capacity under 10 MW. Under this law, non-financial incentives will be provided through the issuance of guarantees of origin by the transmission system operators to all high-efficiency CHP plants not covered by financial incentives. This law also provides for priority dispatching of electricity generated in CHP plants. Under this law, new and reconstructed CHP plants of at least 5 MW applying for an energy/construction license will have to submit an energy efficiency report including an economic analysis of the possibility of using CHP.
Type of instrument:	Incentive, Financial, Regulatory

Status:	Ongoing (plans are to intensify the implementation of this action)
Sector(s) affected:	Energy
Gases affected:	CO_2
Start year of implementation:	2021
Implementing entity or entities:	Ministry of Mining and Energy
Costs:	Preparatory costs (start-off): €1.5 million Additional investment costs for investors: €115.2 million
Non-GHG mitigation co-benefits:	Improve air quality Health benefits
Information on interactions with other mitigation actions:	Implementation of Mitigation Action 1 will support the achievement of the goal of this Action
GHG emission reductions in 2030 (single year) compared to WOM	Integral part of Mitigation Action 1
Target year or period:	2030
Other year:	Progress in achievement will be monitored annually and corrective measures will be made in 2025, if necessary

Mitigation Action 5	**Increased Use of RES and Energy Efficiency in Industry**
Description:	Use of RES in industry should increase substantially by 2030. Adequately high carbon tax will be an important driver for switching from fossil fuels to RES for industry covered by the ETS or equivalent carbon pricing measures. For non-ETS industries, this role will be played by the introduction of the CO_2 tax. However, additional measures in the form of subsidies for new wood boilers or use of waste heat via heat pumps need to be undertaken.
Type of instrument:	Regulatory, Incentive, Financial
Status:	Planned
Sector(s) affected:	Manufacturing industry
Gases affected:	CO_2, CH_4, N_2O
Start year of implementation:	2026

Implementing entity or entities:	Ministry of Mining and Energy, Ministry of Economy, Ministry of Finance
Costs:	Preparatory costs (start-off): €2.5 million Additional investment costs for investors: €694.2 million
Non-GHG mitigation co-benefits:	Improve air quality Attract use of cleaner technologies Improve working conditions Reduce utility bills
Information on interactions with other mitigation actions:	This action is part of other regulatory measures, such as penetration of the best available technology (BAT) to maintain a competitive advantage and indirectly benefit from carbon taxation introduced within Mitigation Action 1
GHG emission reductions (in 2030 (single year) compared to WOM	715 kt CO_2
Target year or period:	2030
Other year:	Progress in achievement will be monitored annually and corrective measures will be made in 2028, if necessary

Mitigation Action 6	**Improvement of the Thermal Integrity of Households**
Description:	Estimates are that 85% of the buildings do not fulfil minimum energy efficiency requirements. Renovation of buildings is extremely costly, wherefore financial suppor to households for these measures is crucial. However, an independen network of experts who will be providing - free of charge - advice or energy efficiency and use of RES in households needs to be establishe to support the most appropriate decisions on investments in households This network of advisors should be funded by the Government. Plans ar to set up an Information Portal familiarizing the public with all energy efficiency measures; the Portal is to be developed within a World Ban project funding energy-related improvements of residential facilities. The final measures and activities will be defined in the INECP until 2030 with projection until 2050.
Type of instrument:	Regulatory, Incentive, Financial, Informational-Educational; Organizational-Administrative-Institutional
Status:	Planned
Sector(s) affected:	Residential sector

Gases affected:	CO_2, N_2O, CH_4
Start year of implementation:	2021
Implementing entity or entities:	Ministry of Mining and Energy
Costs:	Preparatory (start-off): €3 million, of which €2 million for establishing an independent advisory network for the citizens. Additional investment costs for consumers: €1,730.1 million
Non-GHG mitigation co-benefits:	Improve air quality Reduce utility bills
Information on interactions with other mitigation actions:	The implementation of this action is incremental for the reduction of costs associated with Mitigation Action 7
GHG emission reductions (in 2030 (single year) compared to WOM	220 kt CO_2
Target year or period:	2030
Other year:	-

Mitigation Action 7	**Energy Efficiency, Improvement of Heating and Cooling Infrastructure and Promotion of Use of RES in Households**
Description:	A large number of single-family houses predominantly use old inefficient coal and wood biomass boilers. Their combustion causes high specific CO_2 emissions. Coal and biomass use in inefficient boilers emits PM 2.5, which has adverse effects on health. More efficient boilers reduce fuel use, while decreasing emissions. This measure is implemented in zones and agglomerations in accordance with the scope set out in the national 2022-2030 Air Quality Program and Action Plan.
Type of instrument:	Regulatory, Incentive, Financial, Informational-Educational
Status:	Planned and partially adopted
Sector(s) affected:	Residential sector
Gases affected:	CO_2, N_2O, CH_4
Start year of implementation:	2024

Implementing entity or entities:	Ministry of Mining and Energy, Ministry of Environmental Protection, Energy Efficiency Directorate
Costs:	Preparatory (start-off): €2 million Additional investment costs for consumers: €81.4 million.
Non-GHG mitigation co-benefits:	Improve living conditions Reduce health pressures Reduce utility bills
Information on interactions with other mitigation actions:	Interaction with Improvement of the Thermal Integrity of Households will lead to substantial and reasonable investments and actions geared at reducing GHG emissions - Mitigation Action 6.
GHG emission reductions (in 2030 (single year) compared to WOM	Included in Mitigation Action 6
Target year or period:	2030
Other year:	-

Mitigation Action 8	**Improvement of Energy Efficiency and Use of RES in the Tertiary Sector**
Description:	This action aims to further reduce energy consumption in Government, official and business buildings. Its goal is to improve the way in which the tertiary sector satisfies its heating and cooling needs, including the improvement of electrical appliances used in the services sector. The action aims to reduce the consumption of energy (including electricity) and effect the switch to low- or zero-emission fuels for heating. It will contribute to the reduction of energy consumption (including electricity) and substitution of fuels by zero- or low-emission fuels for heating purposes. The detailed estimate of the savings will be defined in the INECP.
Type of instrument:	Regulatory, Incentive, Financial
Status:	Planned
Sector(s) affected:	Tertiary sector (the tertiary sector includes buildings in the public and private service sector (1.A.4a) and in the agriculture sector (1.A.4c.i))
Gases affected:	CO_2, N_2O, CH_4
Start year of implementation:	2024

Implementing entity or entities:	Service for Common Affairs of the Republican Authorities, Ministry of Mining and Energy, Ministry of Construction, Transport and Infrastructure, Ministry of Finance, local self-governments and other public administration and private entities
Costs:	Preparatory costs (start-off): €2 million Additional investment costs (mainly for the state): €94.4 million
Non-GHG mitigation co-benefits:	Improve air quality Improve quality of services Reduce utility bills "Greening" of the local economy Improve working conditions
Information on interactions with other mitigation actions:	Strong interaction with Improvement of Thermal Integrity in the Tertiary Sector (Mitigation Action 9) in order to achieve a substantial reduction of GHG emissions and attract sustainable investments.
GHG emission reductions (in 2030 (single year) compared to WOM	365 kt CO_2
Target year or period:	2030
Other year:	-

Mitigation Action 9	**Improvement of Thermal Integrity in the Tertiary Sector**
Description:	Further improvement of the thermal integrity (insolation) of tertiary sector buildings will reduce their heating and cooling needs, contributing substantially to energy efficiency gains. Consequently, costs of energy and of investments in heating and cooling infrastructure will be reduced. Buildings with heating infrastructure (boilers) need to invest in them parallelly or after completing investments in insolation. The development of the energy services market is envisaged by the National Energy Efficiency Action Plans and Serbia has already included the ESCO[24] approach in its primary and secondary legislation. The situation needs to be improved by support programs combining ESCO funding with budget grants for public buildings.

[24] An Energy Saving Company (ESCO) is a company or another legal person or sole proprietor registered to provide energy services increasing the energy efficiency of the facilities, technological processes and services and which accepts the financial risk for the rendered energy services to an extent, by charging its services, either in full or in part, based on savings resulting from the implemented measures and the fulfilment of other contracted performance criteria.

Type of instrument:	Regulatory, Incentive, Financial
Status:	Planned
Sector(s) affected:	Other sectors – Tertiary Sector
Gases affected:	CO_2, N_2O, CH_4
Start year of implementation:	2024
Implementing entity or entities:	Service for Common Affairs of the Republican Authorities, Ministry of Mining and Energy, Ministry of Construction, Transport and Infrastructure, Ministry of Finance, local self-governments and other public administration and private entities.
Costs:	Preparatory (start-off): €1 million Additional investment costs (mainly for the state): €168.7 million
Non-GHG mitigation co-benefits:	Improve quality of life Reduce utility bills "Greening" of the local economy
Information on interactions with other mitigation actions:	Interaction with Improvement of Energy Efficiency and Use of RES in the Tertiary Sector (Mitigation Action 8)
GHG emission reductions (in 2030 (single year) compared to WOM	Included in Improvement of Energy Efficiency and Use of RES in the Tertiary Sector (Mitigation Action 8)
Target year or period:	2030
Other year:	-

Mitigation Action 10	**Renewal of the Passenger Fleet and Promotion of Sustainable Passenger Transport**
Description:	This action covers three areas: efficiency improvement of vehicle stock and usage of vehicles, promotion of public transport and non-motorized transport, and promotion of usage of alternative fuels and biofuels with the aim of fostering the penetration of low-CO_2 passenger cars through relevant adjustments of the legal framework and increased incentives, in order to increase the use of public transportation. This will contribute to limiting the growth of GHG emissions by 2030 and the preparation of a legal framework to allow and support the penetration of the 2nd generation of biofuels in the Serbian transport fuel market.

Type of instrument:	Regulatory, Informational-Educational, Organizational-Governance-Institutional, Incentive
Status:	Planned
Sector(s) affected:	Road Transport
Gases affected:	CO_2, N_2O, CH_4
Start year of implementation:	2025
Implementing entity or entities:	Ministry of Construction, Transport and Infrastructure
Costs:	Additional investment costs for consumers: €2,262.9 million.
Non-GHG mitigation co-benefits:	Improve air quality Reduce impacts on health Additional reduction of released $PM_{2.5}$
Information on interactions with other mitigation actions:	The Action will be implemented in combination with Mitigation Action 10
GHG emission reductions (in 2030 (single year) compared to WOM	752 kt CO_2
Target year or period:	2030
Other year:	-

Mitigation Action 11	**Renewal of the Freight Fleet and Promotion of Sustainable Freight Transport**
Description:	Freight transport is necessary for economic growth and usually testifies to higher GDP growth rates. In a context in which both Serbia's GDP and freight transport will continue growing, it is important to find modalities to limit emissions from this source, without necessarily limiting the growth of freight transport. Therefore, in order to support the promotion of sustainable freight transport, it is important to conduct a modulation of yearly infrastructure charges for HDVs according to CO_2 emission performance standards and implement road charging for freight vehicles based on the EURO emissions standard. The goal is to have railways and waterways handle 45% of all freight transport. Fees will have to be ensured for this.
Type of instrument:	Regulatory, Organizational-Administrative-Institutional
Status:	Planned

Sector(s) affected:	Road Transport
Gases affected:	CO_2, N_2O, CH_4
Start year of implementation:	2025
Implementing entity or entities:	Ministry of Construction, Transport and Infrastructure
Costs:	Additional investment costs for investors: €388 million
Non-GHG mitigation co-benefits:	Improve air quality Reduce impacts on health
Information on interactions with other mitigation actions:	This Action will be implemented in combination with Mitigation Action 9.
GHG emission reductions (in 2030 (single year) compared to WOM:	156 kt CO_2
Target year or period:	2030
Other year:	-

Mitigation Action 12	**Raising Awareness of Benefits of Winter Cover Crops**
Description:	Awareness raising activities through the Serbian Agricultural Advisory and Professional Services. The action is expected to result in the planting of winter cover crops on 1,919 kha.
Type of instrument:	Informational-Educational
Status:	Planned
Sector(s) affected:	Agriculture
Gases affected:	N_2O, CO_2
Start year of implementation:	2025
Implementing entity or entities:	Ministry of Agriculture, Forestry and Water Management, Rural Development Sector, Agricultural Advisory and Professional Services, farmers
Costs:	Additional investment costs for investors: €76.2 million
Non-GHG mitigation co-benefits:	Reduce soil erosion Increase soil fertility

	Increase soil and water quality Reduce pressure on biodiversity.
Information on interactions with other mitigation actions:	-
GHG emission reductions (in 2030 (single year) compared to WOM	579.05 kt CO_2 eq of which 410.70 kt CO_2 are related to sequestration.
Target year or period:	2030
Other year:	-

Mitigation Action 13	**Potential Increase in Legume Shares in Fodder Areas**
Description:	Financial incentives for increasing legume shares by 33,000 ha compared to 2017, combined with awareness raising through the national Agricultural Advisory and Professional Services. Additional legumes will be produced by increasing temporary grassland.
Type of instrument:	Incentive, Informational-Educational Amendments to legislation on agriculture
Status:	Planned
Sector(s) affected:	Agriculture
Gases affected:	N_2O, CO_2
Start year of implementation:	2025
Implementing entity or entities:	Ministry of Agriculture, Forestry and Water Management, Agricultural Advisory and Professional Services, Agrarian Payments Directorate, Agricultural Land Directorate, Chamber of Commerce, farmers
Costs:	Additional investment costs: €3.55 million
Non-GHG mitigation benefits (co-benefits):	Increase biofixation Reduce costs for farmers Reduce water pollution
Information on interactions with other mitigation actions:	-
GHG emission reductions (in 2030 (single year) compared to WOM	14.6 kt CO_2 eq

Target year or period:	2030
Other year:	-

Mitigation Action 14	**Afforestation**
Description:	This action provides for the afforestation of 3,770 ha a year until 2026 and continued afforestation until 2030 (to be continued until 2050) in accordance with the forestry strategic documents and the Spatial Plan of the Republic of Serbia.
Type of instrument:	Regulatory, Incentive
Status:	Planned
Sector(s) affected:	LULUCF
Gases affected:	CO_2
Start year of implementation:	2023
Implementing entity or entities:	Ministry of Agriculture, Forestry and Water Management, research institutions, Agrarian Payments Directorate, forest management organizations, private forest owners
Costs:	Additional investment costs: €35 million
Non-GHG mitigation co-benefits:	Reduce soil erosion Increase biodiversity Conserve rainwater Increase employment
Information on interactions with other mitigation actions:	This Action is combined with Mitigation Action 14.
GHG emission reductions (in 2030 (single year) compared to WOM	259.1 kt CO_2
Target year or period:	2030
Other year:	-

Mitigation Action 15	**Conversion of Coppice to High Forests**
Description:	This Action envisages the annual conversion of 7,000 ha of coppice to high forests, in particular oak and beech coppice forests. The

	Government is currently financing the amelioration of forests, which also includes the direct conversion of coppice forests. Direct conversion involves site clearance and afforestation. Both state-owned and private forests can benefit from this Action.
Type of instrument:	Regulatory, Incentive
Status:	Planned
Sector(s) affected:	LULUCF
Gases affected:	CO_2
Start year of implementation:	2024
Implementing entity or entities:	Ministry of Agriculture, Forestry and Water Management, research institutions, Agrarian Payments Directorate, forest management organizations, private forest owners
Costs:	Additional investment costs: €33.5 million
Non-GHG mitigation co-benefits:	Increase biodiversity Conserve rainwater Increase employment
Information on interactions with other mitigation actions:	This Action is combined with Mitigation Action 13
GHG emission reductions (in 2030 (single year) compared to WOM	458.4 kt CO_2
Target year or period:	2030
Other year:	-

7. Monitoring, Reporting and Verification

The Republic of Serbia has been improving its Monitoring, Reporting and Verification system (MRV), an essential tool for tracking progress in the implementation of the NDCs and the fulfilment of the country's obligations under the UNFCCC.

As an EU candidate country, Serbia also needs to transpose Regulation (EU) 2018/1999. In order to fulfil the main requirements arising from the Regulation, Serbia needs to put in place a legal, procedural and institutional framework facilitating the following five preconditions:

A. Adoption of and reporting on low-carbon development strategies;
B. Adoption of and reporting on policies, measures and projections of GHG emissions;

C. Establishment of a national inventory system for estimating anthropogenic emissions by sources and removals by sinks of GHG not controlled by the Montreal Protocol, and for reporting and archiving inventory information;
D. Provision of reliable data on GHG emissions not covered by the ETS Directive;
E. Reporting to the UNFCCC (and the European Commission).

The Law on Climate Change transposed the responsibilities for preparation of the GHG Inventory in line with the Law on Air Quality. The following by-laws envisaged by the Law on Climate Change have been adopted: Regulation on Types of Data, Bodies and Organizations and Other Natural and Legal Persons that Submit Data for the Preparation of the National Inventory of Greenhouse Gases in May 2023 and the Rulebook on the Content of the GHG National Inventory and of the National Report on the GHG National Inventory was adopted in June 2023. In order to establish a comprehensive MRV system, the Republic of Serbia must identify all institutions responsible for individual MRV elements (strategies, PAMs, projections, NDCs, etc.) and prescribe their competences and preparation, monitoring and reporting procedures.

The Law on Climate Change lays the grounds for the MRV system, which needs to be improved on reporting on financial aspects, capacity building needs, and requisite technologies, as well as on its provisions on NDCs. This law entrusts the MoEP with the establishment and maintenance of the MRV system, in cooperation with other government institutions.

The MoEP is also entrusted with the preparation of emission projections in cooperation with other Government institutions and reporting to the UNFCCC.

The MoEP is the competent authority for and coordinator of environmental and climate change mitigation policies in Serbia. However, it has established cooperation with the other relevant ministries since policies affecting greenhouse gases mainly come from other sectors, especially the energy and transport sectors.

The Law on Climate Change lays the grounds for the establishment of a complete and functional MRV system trough capacity building and employment in the relevant institutions that will be involved in the MRV system.

The UNDP-GEF project "Establishing a Transparency Framework for the Republic of Serbia" (a CBIT project) played an important role in the establishment of a comprehensive MRV system. The project assisted the Government of Serbia in strengthening methodologies and tools requisite for enhancing transparency pursuant to Article 13 of the Paris Agreement.

8. Support Received and Needs

Support received from multilateral and bilateral sources has substantially contributed to addressing the country's climate change mitigation and adaptation needs. It supports the country's progress towards low-emission and climate resilient development.

The SBUR has been prepared with the financial support of the GEF. Complete information on this issue, as well as on flows relevant to the establishment of the system for reporting to the UNFCCC, is provided in Table 8.1.

Table 8.1 Overview of Support Received from Multilateral and Bilateral Sources

Title	Program/ Project description	Channel	Recipient Entity	Implementing Entity	Amount Received		Time Frame	Financial Instrument	Status	Type of support	Sector and subsector/ Focal Area	Whether the activity has contributed to technology development and transfer and/or capacity-building	Status of activity	Use, impact and estimated results
					EUR	USD								
Establishing a Transparency Framework for the Republic of Serbia	To establish a national transparency framework in the Republic of Serbia to enhance implementation and comply with the Paris Agreement transparency provisions	GEF - Capacity-building Initiative for Transparency	Ministry of Environmental Protection	UNDP		1,100,000	2019-2022	grant	received	cross-cutting	Climate Change	capacity-building	Completed	
Second Biennial Report and Third National Communication under the UNFCCC	Support the Government of the Republic of Serbia to prepare its Second Biennial Report and Third National Communication under the UNFCCC	GEF Trust Fund- Enabling Activity	Ministry of Environmental Protection	UNDP		852,000	2018-2021	grant	received	cross-cutting	Climate Change	capacity-building	Completed	
Climate Smart Urban Development Challenge	Promote innovation and community engagement for climate smart urban development (CSUD)	GEF Trust Fund- Medium-size Project	Ministry of Environmental Protection	UNDP		1,950,000	2017-2021	grant	received	mitigation	Climate Change	capacity-building and technology development	Completed	
Capacity Development for Improved Implementation of Multilateral Environmental Agreements (MEAs)	Improve implementation of MEAs in Serbia by strengthening consultative processes and integrating MEA provisions into high-priority policies and programs at national and local levels	GEF Trust Fund- Medium-size Project	Ministry of Environmental Protection	UNDP		950,000	2017-2022	grant	received	cross-cutting	Climate Change, Biodiversity	capacity-building	Completed	
Contribution of Sustainable Forest Management to a Low Emission and Resilient Development	Contribute to the conservation of biodiversity and climate change mitigation through promotion of multifunctional sustainable forest management in productive forest landscapes	GEF Trust Fund- Full-size Project	Ministry of Agriculture, Forestry and Water Management	FAO		3,274,658	2018-2021	grant	received	cross-cutting	Climate Change, Biodiversity	capacity-building	Completed	

Title	Program/ Project description	Channel	Recipient Entity	Implementing Entity	Amount Received		Time Frame	Financial Instrument	Status	Type of support	Sector and subsector/ Focal Area	Whether the activity has contributed to technology development and transfer and/or capacity-building	Status of activity	Use, impact and estimated results
					EUR	USD								
Removing Barriers to Promote and Support Energy Management Information Systems in Municipalities (EMIS) throughout Serbia	Promote greater investment in energy efficiency in public buildings and services in the municipal sector in Serbia	GEF Trust Fund- Full-size Project	Ministry of Energy, Development, and Environmental Protection	UNDP		2,300,000	2015-2020	grant	received	mitigation	Climate Change	capacity-building and technology development	Completed	
Creation of a monitoring, reporting and verification system for the successful implementation of EU Emissions Trading System (ETS)	Accelerate harmonization with and implementation of the EU climate *acquis* through the establishment of a monitoring, reporting and verification system for the EU Emissions Trading System (EU ETS)	EU - IPA 2012	Ministry of Environmental Protection		1,000,000		2013-2015	grant	received	mitigation	Climate Change	capacity-building	Completed	Draft Law on the GHG Emissions Reduction System with by-laws
Establishment of a Mechanism for the Implementation of the Monitoring Mechanism Regulation (MMR)	Accelerate the transposition and efficient implementation of the EU climate change *acquis* and UNFCCC requirements through the implementation of EU Regulation 525/2013 on a mechanism for monitoring and reporting GHG emissions (MMR)	EU - IPA 2013	Ministry of Environmental Protection		1,000.000		2015-2017	grant	received	cross-cutting	Climate Change	capacity-building	Completed	Law on Climate Change with by-laws
Climate Strategy and Action Plan	Draft the Climate Strategy and Action Plan thus establishing both a strategic and a policy framework for climate action in Serbia in compliance with international obligations and pledges on GHG gas mitigation (Paris Agreement and EU accession).	EU - IPA 2014 Project ID: EuropeAid/136596/DH/SER/RS	Ministry of Environmental Protection		1,301,892		2016-2019	grant	received	cross-cutting	Climate Change	capacity-building	Completed	The Law on Climate Change provides for the adoption of the LCDS and its Action Plan within two years from the day it enters into force

However, in addition to the needs specified in the previous chapter, experience gained in these projects and other activities indicates that there is still a need to:

A. Further strengthen the technical capacity of institutions and experts at the national level for the preparation of BRs/NCs;
B. Establish a system for collecting information on financial and technical support for climate change mitigation (and adaptation) activities;
C. Operationalize the MRV system;
D. Create domestic sustainable financial mechanisms for climate change mitigation (and adaptation).

Monitor progress in achieving the goals specified in Serbia's NDCs, which will be a key part of the future ETFs and BTRs, wherefore further support is needed for the development of national communications and BTRs, and the MRV system in general, since the country still lacks capacity to fulfil these obligations.

Moreover, Serbia will need support for implementing trainings in new skills and awareness raising.

ANNEX I Key Category Analysis

Key Category Analysis for the latest reported year (2020) based on the level of emissions (excluding LULUCF)

CRF	CRF Name	Fuel/Fuel Group	Gas	Emissions 2020 [Gg CO_{2eq}]	$L_{x,2020}$	Cumulative	Rank
1.A.1	Energy Industry	Solid fuels	CO_2	31044.30	0.488	48.8%	1
1.A.3.b	Road Transport		CO_2	6532.26	0.103	59.1%	2
2.C.1	Iron and Steel Production a		CO_2	2623.34	0.041	63.2%	3
3.A	Enteric Fermentation		CH_4	2465.72	0.039	67.1%	4
5.A	Managed Waste Disposal Sites		CH_4	2319.01	0.036	70.8%	5
1.A.1	Energy Industry	Gaseous fuels	CO_2	2270.14	0.036	74.3%	6
1.A.2	Manufacturing Industry	Gaseous fuels	CO_2	1996.41	0.031	77.5%	7
3.D.1	Direct N_2O Emissions from Managed Soils		N_2O	1404.68	0.022	79.7%	8
1.A.2	Manufacturing Industry	Solid fuels	CO_2	1323.49	0.021	81.8%	9
1.A.4	Other Sectors	Solid fuels	CO_2	1265.28	0.020	83.7%	10
2.A.1	Mineral Industry/Cement		CO_2	1167.81	0.018	85.6%	11
1.B.1	Fugitive emissions/Solid Fuels	Solid fuels	CH_4	1104.18	0.017	87.3%	12
1.A.4	Other Sectors	Gaseous fuels	CO_2	1055.00	0.017	89.0%	13
1.A.2	Manufacturing Industry	Liquid fuels	CO_2	993.94	0.016	90.5%	14
1.B.2	Fugitive Emissions from Fuels / Oil & Natural Gas	Liquid fuels	CH_4	808.70	0.013	91.8%	15
5.D	Wastewater Treatment and Discharge		CH_4	725.91	0.011	93.0%	16
1.A.1	Energy Industry	Liquid fuels	CO_2	557.43	0.009	93.8%	17
3.D.2	Indirect N_2O Emissions from Managed Soils		N_2O	525.23	0.008	94.7%	18
1.A.4	Other Sectors	Liquid fuels	CO_2	512.92	0.008	95.5%	19

Key Category Analysis for the latest reported year (2020) based on the level of emissions (including LULUCF)

CRF	CRF Name	Fuel/Fuel Group	Gas	Emissions 2020 [Gg CO_{2eq}]	$L_{x,2020}$	Cumulative	Rank
1.A.1	Energy Industry	Solid fuels	CO_2	31044.30	0.447	44.7%	1
1.A.3.b	Road Transport		CO_2	6532.26	0.094	54.1%	2
4.A.1	Forest Land Remaining Forest Land		CO_2	4916.22	0.071	61.2%	3
2.C.1	Iron and Steel Production		CO_2	2623.34	0.038	64.9%	4
3.A	Enteric Fermentation		CH_4	2465.72	0.035	68.5%	5
5.A	Managed Waste Disposal Sites		CH_4	2319.01	0.033	71.8%	6
1.A.1	Energy Industry	Gaseous fuels	CO_2	2270.14	0.033	75.1%	7
1.A.2	Manufacturing Industry	Gaseous fuels	CO_2	1996.41	0.029	78.0%	8
3.D.1	Direct N_2O Emissions from Managed Soils		N_2O	1404.68	0.020	80.0%	9
1.A.2	Manufacturing Industry	Solid fuels	CO_2	1323.49	0.019	81.9%	10
1.A.4	Other Sectors	Solid fuels	CO_2	1265.28	0.018	83.7%	11
2.A.1	Mineral Industry/Cement		CO_2	1167.81	0.017	85.4%	12
1.B.1	Fugitive emissions / Solid fuels	Solid fuels	CH_4	1104.18	0.016	87.0%	13
1.A.4	Other Sectors	Gaseous fuels	CO_2	1055.00	0.015	88.5%	14
1.A.2	Manufacturing Industry	Liquid fuels	CO_2	993.94	0.014	89.9%	15
1.B.2	Fugitive Emissions from Fuels/Oil	Liquid fuels	CH_4	808.70	0.012	91.1%	16
5.D	Wastewater Treatment and Discharge		CH_4	725.91	0.010	92.1%	17
1.A.1	Energy Industry	Liquid fuels	CO_2	557.43	0.008	92.9%	18
3.D.2	Indirect N_2O Emissions from Managed Soils		N_2O	525.23	0.008	93.7%	19
1.A.4	Other Sectors	Liquid fuels	CO_2	512.92	0.007	94.4%	20
1.A.4	Other Sectors	Biomass	CH_4	484.27	0.007	95.1%	21

Analysis of Key GHG Emissions Trends from base year 1990 to the latest reported year 2020 (excluding LULUCF)

CRF	CRF Name	Fuel/Fuel Group	Gas	Emissions 1990 [GgCO_2eq]	Emissions 2020 [Gg CO_2eq]	Lx, 2020	Contribution to the Trend	Cumulative
1.A.3.b	Road Transport		CO_2	4469.75	6532.26	0.037	0.174	0.174
1.A.2	Manufacturing Industry	Liquid fuels	CO_2	4001.71	993.94	0.026	0.120	0.294
2.C.1	Iron and Steel Production		CO_2	1652.68	2623.34	0.016	0.076	0.370
1.A.1	Energy Industry	Gaseous fuels	CO_2	1303.63	2270.14	0.015	0.072	0.442
1.B.2	Fugitive Emissions from Fuel/Oil	Liquid fuels	CO_2	1453.16	1.93	0.014	0.064	0.506
3.D.1	Direct N_2O Emissions from Managed Soils		N_2O	581.79	1404.68	0.012	0.054	0.560
1.A.1	Energy Industry	Liquid fuels	CO_2	1901.60	557.43	0.011	0.052	0.613
1.A.4	Other Sectors	Solid fuels	CO_2	2796.70	1265.28	0.011	0.052	0.664
1.A.4	Other Sectors	Gaseous fuels	CO_2	2328.70	1055.00	0.009	0.043	0.707
3.A	Enteric Fermentation		CH_4	4090.37	2465.72	0.009	0.040	0.748
1.A.4	Other Sectors	Liquid fuels	CO_2	1463.40	512.92	0.008	0.035	0.783
1.A.1	Energy Industry	Solid fuels	CO_2	39344.12	31044.30	0.006	0.027	0.810
2.B.2	Chemical Industry/Nitric Acid		N_2O	563.44	0.00	0.005	0.025	0.835
3.D.2	Indirect N_2O Emissions from Managed Soils		N_2O	253.97	525.23	0.004	0.019	0.854
2.B.1	Chemical Industry/Ammonia		CO_2	363.07	6.10	0.003	0.016	0.870
1.B.1	Fugitive Emissions / Solid Fuels	Solid fuels	CH_4	1086.87	1104.18	0.003	0.015	0.884
2.A.2	Mineral Industry/Lime		CO_2	499.45	139.54	0.003	0.014	0.898
1.A.2	Manufacturing Industry	Gaseous fuels	CO_2	2284.38	1996.41	0.003	0.013	0.911
3.X	Urea Application		CO_2	32.18	225.85	0.002	0.011	0.922
1.A.4	Other Sectors	Biomass	CH_4	411.13	484.27	0.002	0.009	0.932

5.D	Wastewater Treatment and Discharge		CH_4	1131.12	725.91	0.002	0.009	0.941
1.A.2	Manufacturing Industry	Solid fuels	CO_2	1525.24	1323.49	0.002	0.008	0.948
2.A.1	Mineral Industry/Cement		CO_2	1340.26	1167.81	0.002	0.007	0.956

Analysis of Key GHG Emissions Trends from base year 1990 to the latest reported year 2020 (including LULUCF)

CRF	CRF Name	Fuel/Fuel Group	Gas	Emissions 1990 [GgCO_2eq]	Emissions 2020 [Gg CO_2eq]	Lx, 2020	Contribution to the Trend	Cumulative
1.A.3.b	Road Transport		CO_2	4469.75	6532.26	0.038	0.143	0.143
4.A.1	Forest Land Remaining Forest Land		CO_2	-1719.37	-4916.22	0.033	0.122	0.265
1.A.2	Manufacturing Industry	Liquid fuels	CO_2	4001.71	993.94	0.023	0.088	0.353
1.A.1	Energy Industry	Solid fuels	CO_2	39344.12	31044.30	0.021	0.081	0.434
2.C.1	Iron and Steel Production		CO_2	1652.68	2623.34	0.016	0.062	0.496
1.A.1	Energy Industry	Gaseous fuels	CO_2	1303.63	2270.14	0.015	0.058	0.554
1.B.2	Fugitive Emissions from Fuel/Oil	Liquid fuels	CO_2	1453.16	1.93	0.013	0.048	0.602
3.D.1	Direct N_2O Emissions from Managed Soils		N_2O	581.79	1404.68	0.011	0.043	0.645
1.A.1	Energy Industry	Liquid fuels	CO_2	1901.60	557.43	0.010	0.038	0.683
1.A.4	Other Sectors	Solid fuels	CO_2	2796.70	1265.28	0.010	0.036	0.719
1.A.4	Other Sectors	Gaseous fuels	CO_2	2328.70	1055.00	0.008	0.030	0.749
1.A.4	Other Sectors	Liquid fuels	CO_2	1463.40	512.92	0.007	0.026	0.775
3.A	Enteric Fermentation		CH_4	4090.37	2465.72	0.007	0.025	0.800
2.B.2	Chemical Industry/Nitric Acid		N_2O	563.44	0.00	0.005	0.019	0.819
3.D.2	Indirect N_2O Emissions from Managed Soils		CO_2	253.97	525.23	0.004	0.015	0.834
4.A.2	Land converted to Forest Land		CO_2	-393.18	-186.94	0.004	0.014	0.848

1.A.2	Manufacturing Industry	Gaseous fuels	CO_2	2284.38	1996.41	0.004	0.013	0.861
1.B.1	Fugitive Emissions / Solid Fuels	Solid fuels	CH_4	1086.87	1104.18	0.004	0.013	0.874
2.B.1	Chemical Industry/Ammonia		CO_2	363.07	6.10	0.003	0.012	0.886
2.A.2	Mineral Industry/Lime		CO_2	499.45	139.54	0.003	0.010	0.896
4.G	Harvested wood Products		CO_2	-50.21	-290.21	0.003	0.010	0.906
3.X	Urea Application		CO_2	32.18	225.85	0.002	0.009	0.915
1.A.2	Manufacturing Industry	Solid fuels	CO_2	1525.24	1323.49	0.002	0.008	0.924
1.A.4	Other Sectors	Biomass	CH_4	411.13	484.27	0.002	0.008	0.932
2.A.1	Mineral Industry/Cement		CO_2	1340.26	1167.81	0.002	0.008	0.939
4.C.2	Land coverted to Grassland		CO_2	195.44	-26.91	0.002	0.008	0.947
5.D	Wastewater Treatment and Discharge		CH_4	1131.12	725.91	0.001	0.005	0.952