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MINISTRY OF CLIMATE



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**ESTONIA'S FIRST BIENNIAL TRANSPARENCY
REPORT**

under the Paris Agreement

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Estonian Environmental Research Centre has the responsibility for the preparation and finalization of Biennial Transparency Report and its submission to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat on behalf of the Ministry of Climate.

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Executive summary

National Inventory Report

Estonia has submitted the National Inventory Report (NIR) for the years 1990-2022 to the UNFCCC in December 2024 as a stand-alone report. The NIR consists of the National Inventory Document (NID) with relevant Annexes and the Common Reporting Tables (CRT).

In 2022, the total emissions of GHGs (with indirect CO₂ and with LULUCF), measured as CO₂ eq., were 14,290.84 kt, and without LULUCF 13,951.55 kt. From 1990 to 2022 emissions with LULUCF decreased by 59.21%.

In 2022, the most important GHG in Estonia was carbon dioxide (CO₂), contributing 82.3% to total national GHG emissions expressed in CO₂ eq. (with LULUCF, including indirect CO₂), followed by methane (CH₄), 8.4%, and nitrous oxide (N₂O), 8.0%. Fluorocarbons (so-called ‘F-gases’) account for about 1.4% of total emissions. The Energy sector accounted for 84.4% of total GHG emissions (without LULUCF), followed by Agriculture (11.4%), Waste (2.3%) and Industrial processes and product use (2.0%) (including indirect CO₂).

Information necessary to track progress

Under their updated NDC the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. As a European Union Member State, Estonia also contributes to the achievement of EU’s GHG emission reduction target of at least 55% in 2030 compared to 1990 levels and to reach climate neutrality by 2050, by designing and implementing its policies in the framework of EU directives, regulations, decisions and recommendations.

Policies and measures

Estonia’s long-term **General Principles of Climate Policy until 2050 (GPCP 2050)** is a vision document setting the long term GHG emissions reduction target and policy guidelines for adapting to the impact of climate change or ensuring the preparedness and resilience to react to the impact of climate change. In February 2023, the Parliament adopted an amendment to the long-term target in accordance with the 2050 climate neutrality goal set in Estonia’s development strategy Estonia 2035. Estonia's long-term goal according to the GPCP 2050 is to balance GHG emissions and sequestration by 2050 at the latest, i.e. reduce net greenhouse gas emissions to zero by then.

In September 2023, the process of development of the Estonian **Climate Resilient Economy Act** was launched, which from 2025 onwards will provide a framework for all Estonian law-making and help turn a smaller environmental footprint and climate-friendly economy into Estonia’s competitive advantage in the future.

Policies and measures with a substantial impact on multiple climate sectors are described in the section on cross-sectoral policies and measures. In the sectoral chapters, focus is on those sectoral

policies and measures that have the most significant impact on GHG emissions or removals and those impacting key categories in the national GHG inventory.

Projections

Estonia's greenhouse gas emissions are expected to decrease by around 34.9% in the WEM scenario with LULUCF and GHG emissions without LULUCF are expected to decrease by around 49.8% by 2040 compared to the base year of 2022.

While the Energy sector's subcategory Energy industries dominated total emissions in 1990, its emissions decreased sharply in the beginning of the time series and fluctuate but are projected to continue on a decreasing pathway, reaching a reduction of 89.5% by 2040 compared to 1990. Emissions are also projected to decrease in transport, agriculture, IPPU and waste sectors (see relevant chapters). According to the projections, the LULUCF sector is expected to remain a source of GHGs in the WEM scenario from – 5,235.3 kt CO₂ eq. total sequestration in 1990 to 2,304.60 kt CO₂ eq. in 2040 according to the WEM scenario.

Between 1990 and 2040, emissions of all gases are projected to decrease except for SF₆. Emissions of SF₆ reported under the CRT subcategory Other product manufacture and use are projected to rise steadily until 2037 because additional switchgears are needed.

Climate change impacts and adaptation

The National Adaption Strategy (NAS) called the Climate Change Adaptation Development Plan until 2030 and the accompanying implementation plan (NAP) for the period of 2017–2020 were adopted by the Government of the Republic of Estonia on March 2, 2017. The overall goal of the NAS is to decrease the vulnerability of Estonia to climate change and achieve the preparedness and capability to cope with the impacts of climate change at the local, regional, and national level with the help of a framework of activities.

The NAS describes the most important problems in the area of adaptation to climate change and analysed vulnerability, the impacts of climate change until 2100, and the potential adaptation measures, based on the future climate change scenarios in Estonia in eight priority areas:

1. health and rescue capability;
2. land use and planning;
3. natural environment;
4. bioeconomy;
5. economy;
6. society, awareness, and cooperation;
7. infrastructure and buildings;
8. energy and security of supply.

Support provided and mobilized

Estonia is not among the countries listed in Annex II of the United Nations Framework Convention on Climate Change (UNFCCC) and is therefore not obliged to fulfill the commitments arising from Articles 4.3, 4.4, and 4.5 of the Convention. Nevertheless, Estonia has voluntarily contributed to climate finance. The Estonian government is committed to combating global climate change, placing particular importance on assisting countries that are most vulnerable to its impacts, including least developed countries and small island developing states.

Estonia recognizes that the financial needs for achieving climate policy objectives are among the many critical factors requiring continuous attention. Investments in programs and policies aimed at reducing greenhouse gas emissions and enhancing resilience to climate change must be supported through both public and private sector funding.

Estonia has decided to focus its climate action financing on the needs of developing countries and aims to continue with this approach in the future. Estonia's goal is to support all activities related to mitigation and adaptation to climate impacts in developing countries, such as fostering the development of renewable energy sources, implementing energy and resource efficiency projects in the transport and industrial sectors, enhancing administrative capacity for climate action, and supporting solutions for climate adaptation.

1. Overview

Estonia is pleased to submit its First Biennial Transparency Report (BTR1) under the Paris Agreement. The report is prepared in accordance with decision 18/CMA.1 and follows the outline provided in decision 5/CMA.1 Annex IV.

Tabular information as defined in the common tabular format (CTF) for the information reported pursuant to decision 18/CMA.1, annex chapter III, V and VI (decision 5/CMA.3) are available as separate submissions on the UNFCCC website. The CTF submission has been made to the UNFCCC using the electronic reporting application, according to decisions 5/CMA.1.

2. National Inventory Report

This chapter provides key information about the Estonia's greenhouse gas (GHG) inventory for more detailed information please see Estonia's National Inventory Document (NID) **Greenhouse Gas emissions in Estonia 1990–2022** that is available as separate stand-alone submissions on the UNFCCC website. The GHG inventory data presented in this chapter of the Biennial Transparency Report (BTR) is consistent with the GHG inventory Estonia submitted in its 2024 National Inventory Report.

Total emissions of the greenhouse gases in Estonia (without LULUCF) decreased steadily from 40,273.58 kt CO₂ eq. in 1990 to 13,951.55 kt CO₂ eq. in 2022 (Figure 2.1). From 1990 to 2022 emissions without LULUCF decreased by 65.36%. Total emissions including LULUCF decreased 59.21% from 35,038.31 kt CO₂ eq. in 1990 to 14,290.84 kt CO₂ eq. in 2022.

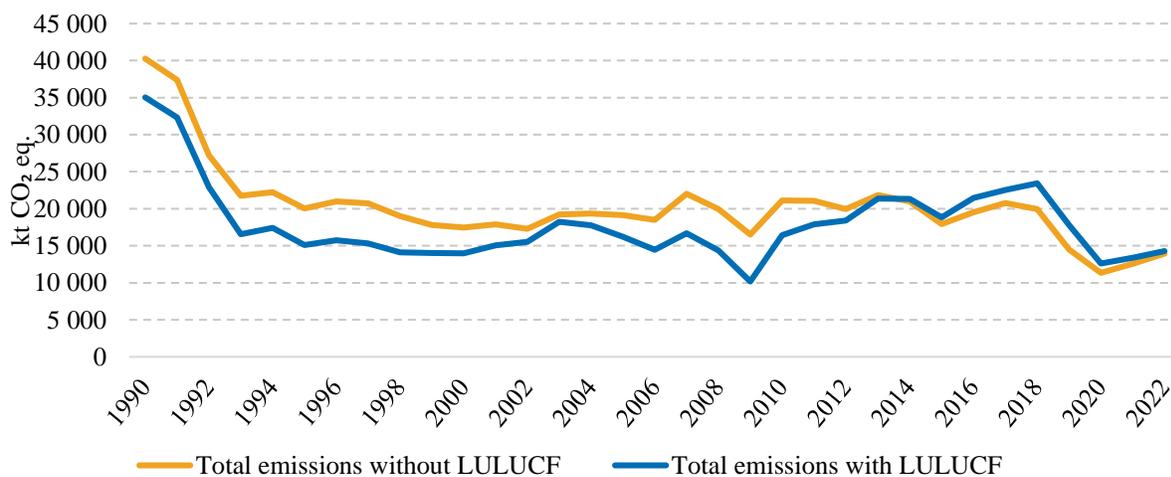


Figure 2.1 Estonia's greenhouse gas emissions in 1990–2022 (with indirect CO₂), without LULUCF and with LULUCF, kt CO₂ eq.

This decrease was predominantly caused by the transition from a planned economy to a market economy in the early 1990s and due to recent efforts made to transition to renewable energy sources and due to a high European Union Emission Trading System (EU ETS) allowance price. Estonia has made significant progress in improving its environmental performance by decoupling economic growth from the primary environmental pressures (Figure 2.2). Also, the share of energy from renewable sources in Estonia has been increasing continuously since 2006. In 2006, the share was 16.1%, in 2010, it was 24.6%, and in 2022, it was as high as 38.5%¹. The GHG emission increase in 2022 compared to the previous two years was mainly in the energy industries. The increase was mainly in the energy industries because of energy crises caused by Russian invasion of Ukraine, which led to significantly higher electricity prices in Europe and therefore allowed additional electricity generation from oil shale to enter the electricity market.

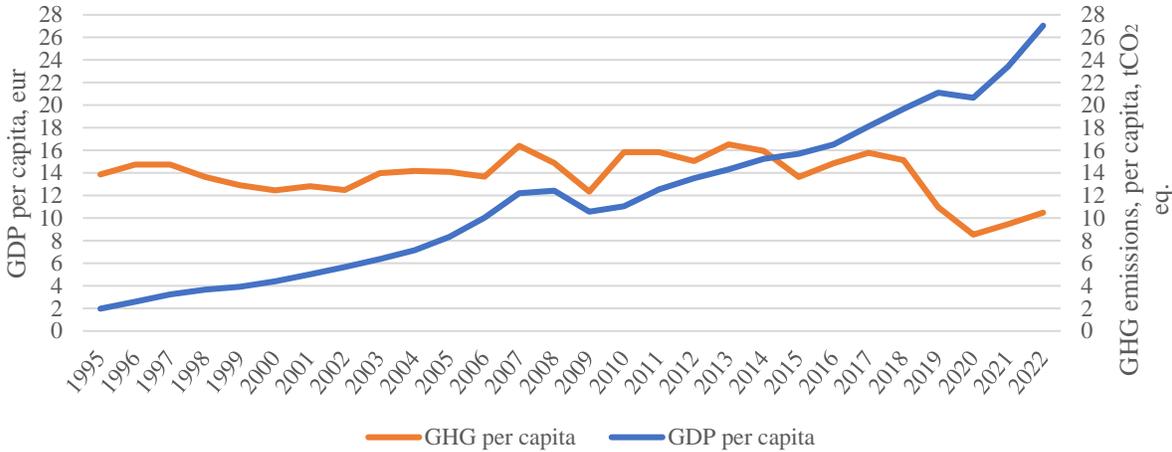


Figure 2.2 Estonia’s GHG emissions per GDP from 1995 to 2022

The Energy sector (including transport sector) is by far the largest producer of GHG emissions in Estonia. In 2022, the sector accounted for 84.4% of Estonia’s total GHG emissions (Figure 2.3).

¹ Share of energy from renewable sources in EU. [www] https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ren/default/table?lang=en (06.12.2024)

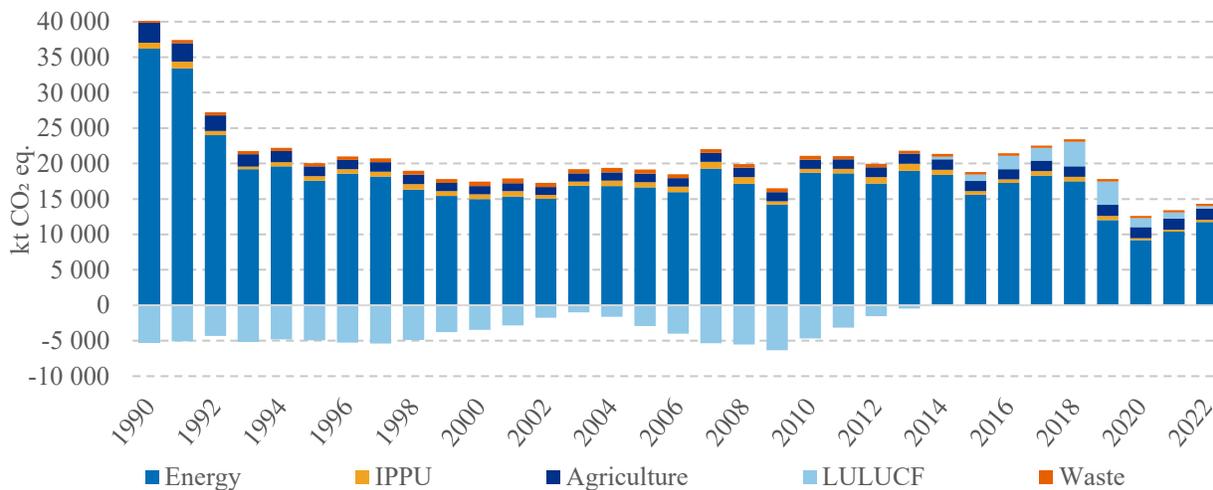


Figure 2.3. Greenhouse gas emission trends, by sectors, kt CO₂ eq.

The second largest sector that contributes to the GHG emissions is Agriculture, which accounted for 11.4% of total emissions in 2022. Emissions from the Industrial processes and product use (IPPU) as well as the Waste sectors accounted for 2.0% and 2.3% of total emissions, respectively.

The LULUCF sector, acting as the only possible sink of GHG emissions in Estonia, plays an important role in the national carbon cycle. In 2022, net emissions from the LULUCF sector equaled 339.29 kt CO₂ eq., which is 58.2% lower compared to the previous year (2021). In the base year (1990), the LULUCF sector acted as C sink with net emissions of -5,235.27 kt CO₂ eq. The LULUCF sector sink is mainly affected by the age structure of managed forests, management practices in forestry and agriculture, usage of peat soils and horticultural peat, and C sequestration in harvested wood products (HWP).

In 2022, as in previous years, the main GHG in Estonia was CO₂ (Figure 2.4), accounting for 84.27% of the total GHG emissions (with indirect CO₂ and without LULUCF) expressed in CO₂ eq., followed by CH₄ with 8.05% and N₂O with 6.24%. Fluorinated gases (the so-called F-gases) collectively accounted for about 1.44% of overall GHG emissions.

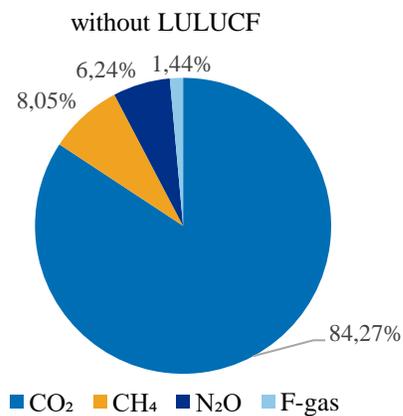


Figure 2.4. GHG emissions by gas in 2022 with indirect CO₂ and without LULUCF, %

Emissions of CO₂ (with indirect CO₂) decreased by 68.16% from 36,916.96 kt in 1990 to 11,757.18 kt in 2022, especially CO₂ emissions from the Energy subsector Public electricity and heat production, which is the major source of CO₂ in Estonia. After 1990 the use of fossil fuels decreased and the use of biomass increased during the period in this subsector. The use of biomass increased significantly in 2016/2017 since many new biomass-based capacities were added to the production of electricity and heat.

Methane is the second most significant contributor to greenhouse gas emissions in Estonia after CO₂. Emissions of CH₄ decreased by 47.83% from 2,152.38 CO₂ eq. in 1990 to 1,122.98 kt CO₂ eq. in 2022. The downturn was especially noticeable in the Agriculture subsector Enteric fermentation, which is a leading source of CH₄ emissions in Estonia. The main reason for that is the collapse of Soviet Union in 1991 and the disappearance of collective farms, after which the population of livestock started to decrease.

Emissions of N₂O have decreased by 27.66% from 1,204.23 kt CO₂ eq. in 1990 to 871.16 kt CO₂ eq. in 2022, especially N₂O emissions from the Agriculture subsector Agricultural soils, which is the main contributor of N₂O emissions in Estonia. This is mainly due to the decrease in the number of the livestock population (i.e., amount of animal manure applied on agricultural soils and emissions from grazing animals) and due to the decline in the quantity of fertilizers applied on agricultural land.

Emissions of the total F-gases (HFCs, PFCs and SF₆) increased from 0 kt CO₂ eq. in 1990 to 200.24 kt CO₂ eq. in 2022, especially HFC emissions from Refrigeration and air conditioning, which is the major source of halocarbons in Estonia. Until 2016, emissions from Refrigeration and air conditioning subsector grew rapidly because of substitution of ozone depleting substances with HFCs. In 2017–2022, emission curbing effects of EU Regulation No 517/2014 on this subsector can be seen. The second largest source is Foam blowing agents, which showed a relatively steady increase of emissions until 2007. In 2001, one of two big Estonian producers of one component foam replaced HFC-134a with HFC-152a, followed by another producer starting from 2007. Due to the much lower GWP of HFC-152a the emissions decreased suddenly in the corresponding years. See [Table 2.1](#) for an overview of contributions of the various GHGs.

NF₃ emissions do not occur in Estonia.

For detailed information about the GHGs from all sectors, please see Estonia's National Inventory Document (NID) **Greenhouse Gas emissions in Estonia 1990-2022** that is available as a separate stand-alone submission on the UNFCCC website.

Table 2.1 Greenhouse gas emissions in Estonia – contributions of the various greenhouse gases

GHG EMISSIONS kt CO ₂ eq.		CO ₂ emissions excluding net CO ₂ from LULUCF	CH ₄ emissions excluding CH ₄ from LULUCF	N ₂ O emissions excluding N ₂ O from LULUCF	HFCs	SF ₆	Total (excluding LULUCF)
1990	kt	36,916.96	2,152.38	1,204.23	NO	NO	40,273.58
	%	91.67%	5.34%	2.99%			100%
2005	kt	17,089.78	1,311.89	601.96	128.15	1.11	19,132.89
	%	89.32%	6.86%	3.15%	0.67%	0.01%	100%
2019	kt	12,288.10	1,161.37	836.05	219.67	2.93	14,508.11
	%	84.70%	8.00%	5.76%	1.51%	0.02%	100%
2020	kt	9,198.25	1,128.89	836.05	179.92	3.03	11,346.13
	%	81.07%	9.95%	7.37%	1.59%	0.03%	100%
2021	kt	10,390.75	1,139.30	833.29	190.21	3.07	12,556.62
	%	82.75%	9.07%	6.64%	1.51%	0.02%	100%
2022	kt	11,757.18	1,122.98	855.66	197.10	3.13	13,936.05
	%	84.37%	8.06%	6.14%	1.41%	0.02%	100%

3. Information necessary to track progress

3.1. National circumstances and institutional arrangements

3.1.1 National circumstances

3.1.1.1 Government structure

Estonia is a democratic parliamentary republic, the institutional structure of which was laid down by the Constitution adopted in 1992. Pursuant to the Constitution, the supreme power of the state is vested in the people, who exercise their power through the legislative representative body, the Riigikogu (the Parliament of the Republic of Estonia), the head of the state is the President of the Republic of Estonia, and the executive is vested in the Government of the Republic. The Riigikogu is the unicameral parliament of Estonia, the main duties of which include developing legislative acts, appointing high officials, incl. the Prime Minister and the Chief Justice of the Supreme Court, exercising parliamentary supervision, and developing foreign communication.^{2,3}

² Government of the Republic. [www] <https://valitsus.ee/en> (05.12.2024)

³ Government of the Republic Act (1996) [www] <https://www.riigiteatja.ee/en/eli/ee/521012014008/consolide/current> [05.12.2024]

The head of state of Estonia is the President of the Republic, who is elected by the Riigikogu. If none of the candidates receive two thirds of the votes of the members of the Riigikogu, the President is elected by an electoral body comprised of the members of the Riigikogu and representatives of the municipal councils. Presidential elections are held in Estonia once in five years. The President declares the laws adopted by the Riigikogu and signs instruments of ratification or denunciation of international treaties. The President represents Estonia in international relations, appoints the diplomatic agents of Estonia, and receives the credentials of the diplomatic agents accredited to Estonia. Their scope of competence also includes appointing the Prime Minister, other ministers, the President of the Bank of Estonia, and several other high state officials. Several advisory bodies, such as the Academic Council, operate within the institution of the President.⁴

The Government of the Republic consists of the Prime Minister and ministers. The Government currently includes fourteen members, including the Prime Minister and 13 ministers. The Prime Minister determines the competence of the ministers in leading the ministries and the fields of responsibility of the ministries. Based on proposals of the Prime Minister, ministers who are not in charge of a specific ministry may also be appointed. The Government holds executive power. The definition of executive state power also includes legislative drafting to a limited extent. For the implementation of laws, they often require further specification. This is done with the regulations of the Government of the Republic and the ministers.^{4,3}

Based on the **Constitution of the republic of Estonia**, all issues concerning local life are organised by the local governments, which operate independently based on legislation. The territory of Estonia is divided into counties, and the counties into rural municipalities and cities. The rural municipalities and cities are local governments. There are 15 counties and 79 local governments in Estonia – 15 cities and 64 rural municipalities. Pursuant to the law, all local governments share the same functions and are mainly responsible for education, national construction works, housing, local road maintenance, waste management, and healthcare at the primary level. The local governments are financially largely dependent on the central government.^{4,5}

In 2023 the **Government of the Republic Act**³ was amended and with that number of ministers were restructured as well as new **Ministry of Climate (MoC)** was established. The area of government of the Ministry of Climate includes comprehensive implementation of green reform, planning climate policy (including preparation, implementation and monitoring the implementation of plans related to climate policy), directing of entrepreneurship towards cleaner technologies; increasing the international competitiveness of the maritime economy, developing of the sectors of the maritime economy and the state-owned fleet of vessels (except for the watercraft in the register of watercraft of the Defence Forces and the Defence League); accelerating the development of renewable energy and coordinating implementation of renewable energy

⁴ Constitution of the Republic of Estonia (1992) [www] <https://www.riigiteataja.ee/en/eli/ee/530122020003/consolide/current> (03.06.2024)

⁵ Estonian municipal system. [www] <https://www.eesti.ee/eraisik/en/artikkel/eesti-vabariik/kohalikud-omavalitsused> (05.12.2024)

projects; organizing the circular economy and waste management policy; management of the environment and nature conservation, organization of the use, protection, reproduction and accounting of natural resources, organization of environmental inspections, weather observations, nature and marine researches and water protection and use, development of the policy on the protection and use of the marine environment and policy on ambient air protection and radiation and nuclear safety, and organization of environmental monitoring; energy, organization of the exploitation of subsurface resources, geological mapping and provision of national geological competence, housing and construction, transportation (including transport, international public transport, transit, logistics and transport infrastructure), traffic management (including rail, road and street, waterborne and air routes traffic), planning of transport systems, mobility and mobility services (including investments and procurement of public transport infrastructure, and procurement of transport infrastructure and state-owned watercraft, except for watercraft in the register of watercraft of the Defence Forces and the Defence League, and implementation of plans, increasing road safety and drafting respective legislation.

Former Ministry of Rural Affairs was restructured to the **Ministry of Regional Affairs and Agriculture (MoRAA)**. MoRAA is responsible for planning and implementation of rural policy, land use policy, agricultural policy, fisheries policy, regional policy and development, local government policy, local government financial management policy and national public transport policy, organization of security of food supply and ensuring food safety and compliance, coordination of activities in the areas of animal health and protection and plant health and protection, organization of post, agricultural research and development and agricultural education, coordination of ensuring the implementation of the principles of accessibility, organization of spatial planning, performance of tasks in the land and spatial sphere, as well as drafting respective legislation.³

The Government Office is also involved in the coordination and is tasked with supporting the Government of the Republic and the Prime Minister in drawing up and implementing the policy. Two of the structural units of the Government Office are involved in the field of climate policy. The Strategy Unit supports planning the work of the Government and coordinates the drawing up and carrying out of the Government's action plan, as well as strategic development plans for increasing the country's competitiveness and for sustainable development. The other unit, the European Union (EU) Secretariat, coordinates the development of Estonia's positions on issues relating to the European Union and the transposition of European Union legislation, as well as to advise and support Prime Minister in issues relating to European Union and in the preparation of European Council summits.⁶

Pursuant to §143 of the **Atmospheric Air Protection Act** activities to reduce climate change shall be arranged by the MoC on the basis of the requirements for limitation of greenhouse gas emissions arising from the Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement, and the European Union legislation. The MoC implements the national climate policy

⁶ Government Office. [www] <https://riigikantselei.ee/en/organisation-news-and-contacts/government-office/about-government-office> (05.12.2024)

and draws up development plans in the energy, transport, waste sectors and in the land use, land use change, and forestry (LULUCF) sector, as well as in the fields of industrial processes and the use of products (incl. F-gases). The MoC also supervises the drawing up of the annual greenhouse gas inventory, the National Communications, the Biennial Transparency Reports to the UNFCCC, and the integrated reporting on energy and climate policies, measures and projections to the European Commission; the ministry also reports on the implementation of the European Union Emissions Trading System (EU ETS) and on the sectors included under the Effort Sharing Regulation, the sectors not included in the EU ETS, and the fulfilling of the obligation to reduce GHG emissions.⁷

In addition to the aforementioned ministries, the **Ministry of the Interior**, the **Ministry of Finance**, the **Ministry of Education and Research**, the **Ministry of Social Affairs**, and the **Ministry of Foreign Affairs** also deal with different aspects of climate issues at the national level. The Ministry of the Interior oversees crisis management and organising rescue operations. The Ministry of the Interior is also responsible for drawing up emergency situation risk analyses (incl. for storms, floods, and extreme weather conditions) and the respective response plans.⁸ If one of the ministries has a leading role in the strategy or development plan related to a certain climate aspect, the remaining ministries involved take part in the working groups assembled for the development of those strategies.

Local governments have also started to integrate aspects related to climate change more actively into spatial planning and transport management. Several of the local governments at risk of floods have developed detailed adaptation and action plans for coping in the case of a flood. In the last few years, local governments have become more active in setting climate goals for themselves, adding climate- and energy-related issues to the development documents, and drawing up **local municipalities' climate and energy plans**.⁹

The national system for organising environmental monitoring has been restructured with the aim of accumulating high-quality source information required for organising the entire environmental sector at the domestic and international level. In 2013, the Estonian Meteorological and Hydrological Institute and the Environment Information Centre merged to create the **Estonian Environment Agency (ESTE)**, which took over the duties, rights, and obligations of the merged authorities. The weather service of the Estonian Environment Agency is most important from the perspective of the climate, conducting meteorological and hydrological observations, distributing weather forecasts, drawing up Estonian climatological studies, etc.¹⁰

⁷ Atmospheric Air Protection Act (2017). [www] <https://www.riigiteataja.ee/en/eli/510062024001/consolide> (05.12.2024)

⁸ Ministry of the Interior. [www] <https://www.siseministeerium.ee/en/ministry-and-contacts/ministry-and-minister/about-ministry> (05.12.2024)

⁹ Local municipalities climate change mitigation and adaptation plans. [www] <https://kik.ee/et/toetatavad-tegevused/kohalike-omavalitsuste-kliima-ja-energiakavad> (05.12.2024)

¹⁰ Statutes of the Environmental Agency [www] <https://www.riigiteataja.ee/akt/102072015001?eiaKehtiv> (05.12.2024)

3.1.1.2 Population profile

As of 2024, the population of Estonia is 1,374,687. In total, 61% of the Estonian population lives in an urban environment, including more than 33% in Tallinn (Harju county), capital of Estonia (Figure 3.1).¹¹

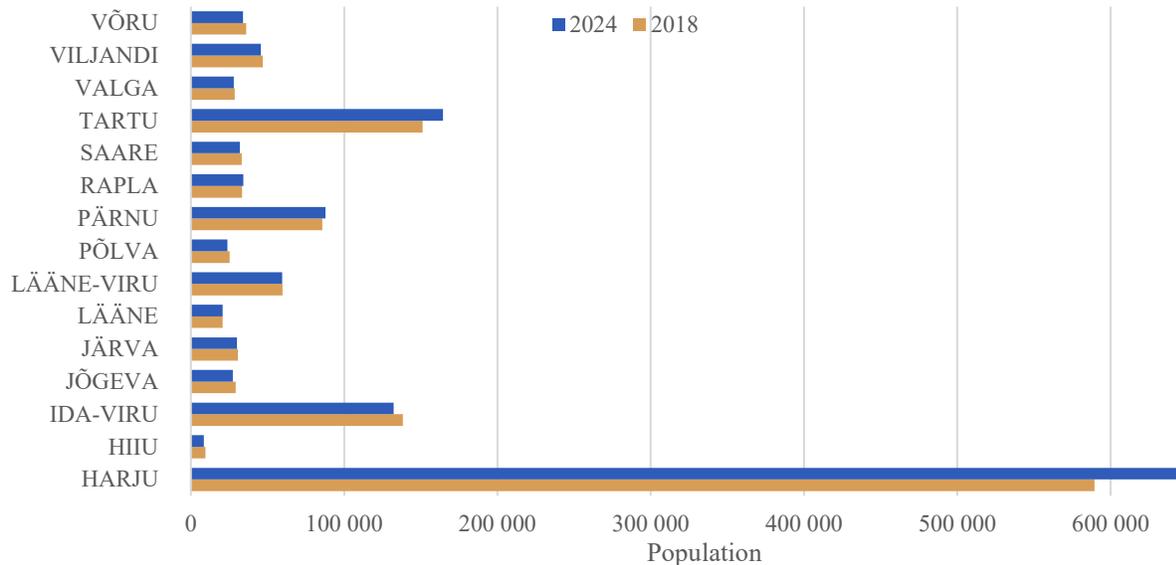


Figure 3.1 Population profile of Estonia by county¹¹

The Estonian population has been constantly decreasing since the 1990s. Since the beginning of the twenty-first century, the shrinking of the population has been slowing down thanks to the modest increase in the birth rate and decrease in the mortality rate. According to the baseline population scenario there will be 1,207,877 people living in Estonia by 2085.¹²

From the perspective of the development of birth rates, Estonia is characterised by leaving first pregnancies to an older age. The timing of the first birth has shifted by more than three years within the past five years. While the average age of mothers at the birth of their first child was 27.2 in 2015, it had risen to 28,7 by 2023. The fertility rate or the average number of children per woman was 1.31 in 2023.¹³

The main long-term factor influencing the development of the Estonian population has been the geopolitical position of the country, hence Estonia has experienced a number of societal transformations, such as occupations before and after World War II, the collapse of the Soviet Union, and regaining independence in 1991. From the perspective of the development of the

¹¹ Statistics Estonia. RV0291U: Population number, area and density, 1 January. [www] https://andmed.stat.ee/en/stat/rahvastik_rahvastikunaitajad-ja-koosseis_rahvaarv-ja-rahvastiku-koosseis/RV0291U

¹² Statistics Estonia. RV083: Population projection until 2085 (based on the population figures as at 1 January 2024) by Sex, Age, Scenario and Year. [www] https://andmed.stat.ee/en/stat/rahvastik_rahvastikunaitajad-ja-koosseis_rahvaarv-ja-rahvastiku-koosseis/RV083

¹³ Statistics Estonia. Births 2023. [www] <https://www.stat.ee/en/en/find-statistics/statistics-theme/population/births> (20.12.2024)

population, the composition and structure of the Estonian population was changed by immigration after the war. According to the population and housing census of 2021, there are 962,643 natives living in Estonia, comprising 72.5% of the total population.¹⁴ Open borders and the ability to choose where to live have made people more mobile. Emigration grew almost 30% in 2023 compared to 2022 and has grown more than 600% compared to year 2000.¹⁵

The post-war development has also had an impact on the long-term standstill in the mortality rate until the middle of the 1990s, which was followed by a rapid increase in the average life expectancy. The life expectancy of Estonians is slightly lower compared to the average of the European Union. In 2022, the life expectancy of men in Estonia was 73.6 years (EU average 80.6) and the life expectancy of women, 82.3 years (EU average 83.3).¹⁶

3.1.1.3 Geographical profile

The Republic of Estonia on the eastern coast of the Baltic Sea is the northernmost of the Baltic States and the smallest by surface area (45,339 km²)¹⁷. Along with the Western Estonian archipelago and the numerous individual islands in the coastal sea, Estonia lies between Finland and the Gulf of Riga as an extensive peninsula, the borders of which are hard to define. The natural geographical factors which influence the climate characterising Estonia include the long coastline, the high number of small islands (approx. 2,222)¹⁸, the multitude of lakes and rivers, and a very level relief. The highest peak is the Suur Munamägi, which reaches 317.4 m above sea level.¹⁹ There are bedrock outcrops – limestone cliffs – stretching all over the mainland part of the northern coast and the coastline of the larger islands.

The neighboring countries of Estonia are Russia in the east, Latvia in the south, Sweden in the west (across the Baltic Sea), and Finland in the north (across the Gulf of Finland). Estonia is located between the latitudes of 57°30' N and 59°49' N and longitudes of 21°46' E and 28°13' E, i.e. the northern part of the temperate zone, on the northern border of boreal broad-leaved forests, and in the transition zone between the oceanic and continental climates.²⁰ Estonian climate is strongly impacted by the Baltic Sea.

Approximately half of the dry land of Estonia is covered with forests (approx. 51.5%).²¹ There are approximately 2200 natural and artificial lakes (with an area of over 1 ha) in Estonia in total²², and the percentage of bogs is 5%, stretching over 225,100 hectares.²¹ Estonia boasts one of the richest biodiversities among territories of a similar size north from the 57th latitude. This is thanks to the

¹⁴ Statistics Estonia. Immigration. [www] <https://rahvaloendus.ee/en/results/native-origin> (06.12.2024)

¹⁵ Statistics Estonia. RVR03: Migration by sex, age group and type of migration. [www] <https://www.stat.ee/en/find-statistics/statistics-theme/population/migration> (06.12.2024)

¹⁶ EUROSTAT. Mortality and life expectancy statistics. [www] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Mortality_and_life_expectancy_statistics#Source_data_for_tables_and_graphs (06.12.2024)

¹⁷ Information about Estonia. [www] <https://www.eesti.ee/eraisik/et/artikkel/eesti-vabariik/eesti-vabariik/ueldandmed> (06.12.2024)

¹⁸ Association of Estonian Islands. [www] <https://www.saared.ee/liikmed/> (06.12.2024)

¹⁹ Estonia Land Board. [www] <https://maaamet.ee/uudised/eesti-linnade-ja-valdade-korgemaid-tipud-said-kaardile> (06.12.2024)

²⁰ Estonian Land Board. Geoportal [www] <https://geoportaal.maaamet.ee/eng/web-maps-p35.html> (11.12.2024)

²¹ Keskkonnaportaali. National Forest Inventory 2023. [www]

<https://tableau.envir.ee/views/SMI/1Maakategooriad?%3Aembed=y&%3Aiid=1&%3AisGuestRedirectFromVizportal=y> (06.12.2024)

²² Keskkonnaportaali. Pinnavesi. [www] <https://keskkonnaportaali.ee/et/teemad/vesi/pinnavesi> (06.12.2024)

varying climate conditions, the presence of island and mainland areas, the length of the coastline and the multitude of inland water bodies, and the variations in the bedrock and soil conditions which have all created a good basis for the formation and development of a diverse ecosystem. According to **eBiodiversity**, a portal for the taxa found in Estonia, there is already data on 39 358 species found in Estonia.²³

Even though Estonia is a small country in terms of the surface area, the share of untouched protected nature in the country is quite high. This is mainly thanks to the low population density – 31.6 residents per 1 km² – which is also highly polarised, as almost two thirds of the population live in cities and just one third in rural areas.¹¹ There are 568 species under national protection in Estonia and protected areas cover more than 19% of the dry land.²⁴

The most significant climate change-based phenomena in Estonia include the rise in temperature, which is above the global average, the decreased snow and ice cover, the higher frequency of winter storms, the changes in the habitats of species, and increased precipitation. This will result in more flooding and erosion in the coastal areas. An increased frequency of the aforementioned phenomena will probably increase the extent of catastrophes, resulting in remarkable economic damage, health issues, and deaths.²⁵

3.1.1.4 Economic profile

Estonia is a Member State of the European Union located on the coast of the Baltic Sea. In 2024 Estonia is celebrating its 20th anniversary of being part of the EU. The Estonian economy is small, but open and flexible to external changes. The internal market of the country of 1.3 million residents is too small for many companies, which is why they have set their sights abroad.

The Estonian economy is tightly connected to EU Member States. Estonia's main trading partners in 2023 were other EU Member States, accounting for 74% of exports and 86% of imports.²⁶

With the help of the European Union, Estonia has been able to invest in the structure of the country and its infrastructure over the course of 20 years – in agriculture, the development of a digital country, transport and transportation, entrepreneurship, the green revolution etc. and in many areas necessary for the functioning of the country for further development.

The Estonian economy was hit heavily by Russia's war of aggression against Ukraine and the resulting energy price shock, leading to a recession. The recession in 2023 was deeper than expected, largely as a consequence of the fall in exports. The impact of the recession is being increasingly felt in the labour market.²⁷

²³ eBiodiversity. [www] <https://elurikkus.ee/en> (06.12.2024)

²⁴ Looduskaitse arvudes 2023. [www] <https://storymaps.arcgis.com/stories/0e6bbe46bcf34c09893ddb99cb96fba0> (06.12.2024)

²⁵ Climate Change Adaptation Development Plan until 2030. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2021-06/Climate%20Change%20Adaption%20Development%20Plan%20until%202030%20%28in%20English%29.pdf> (06.12.2024)

²⁶ Estonian Statistics. Foreign trade decreased significantly in 2023. [www] <https://www.stat.ee/en/news/foreign-trade-decreased-significantly-2023> (09.12.2024)

²⁷ Eesti Pank (2023). The Estonian Economy and Monetary Policy 2023/4. [www] https://haldus.cestipank.ee/sites/default/files/2023-12/rpm2023_4_eng.pdf (06.12.2024)

According to the latest economic forecast from the Bank of Estonia (2024), growth in the economy is expected in the coming years (1.6% in 2025, and around 3% in 2026 and 2027), the performance of the Estonian economy depends largely on the performance of the European economy.²⁸

3.1.1.5 Climate profile

The main factor impacting the climate in Estonia is its geographical position. Estonia is in the mixed-forest subregion of the continental Atlantic region of the moderate zone and in the transition zone between the oceanic and continental climates.²⁹ Based on the Köppen climate classification, the majority of Estonia is of the Dfb climate type (warm-summer humid continental climate) and only the outermost western parts of Saaremaa and Hiiumaa are of the Cfb climate type (temperate oceanic climate). The summers in Estonia are moderately warm (the average temperature in July is 17-18 °C) and the winters moderately cold (the average temperature in February ranges from – 2 to –5 °C). The highest temperature ever measured is +35,6 °C (1992, Võru); the lowest, however, –43,5 °C (1940, Jõgeva).³⁰ The Estonian climate is characterised well by the timeline of the average annual temperatures of the Tartu-Tõravere station (Figure 3.2). The timeline shows a rapid increase in the temperature at the end of the 20th century and a certain stabilisation which has occurred in the last few decades. It should be highlighted that the current situation of a relatively high average temperature also occurred at the end of the 1930s as a shorter period.

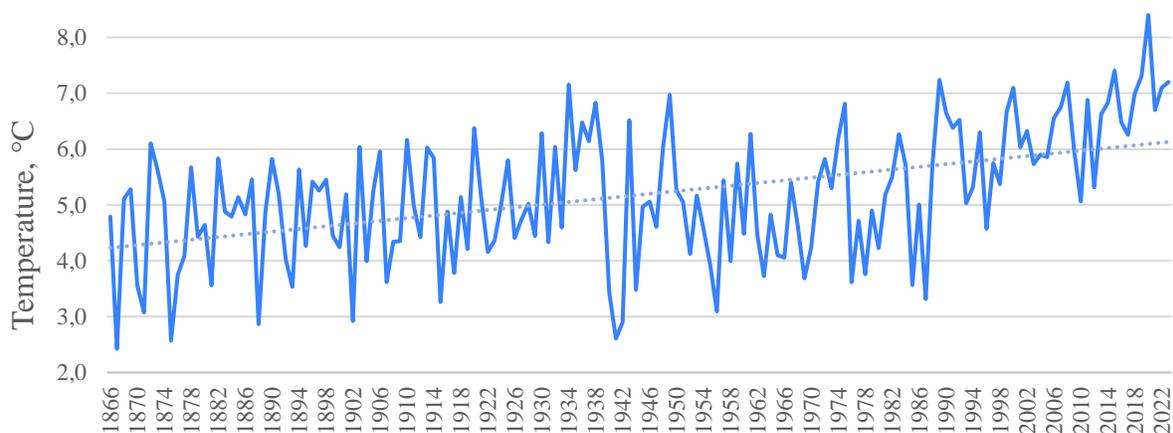


Figure 3.2 Average annual temperature values of Tartu-Tõravere meteorological station and the trend in the period 1866–2022

According to the report ‘Estonian future climate scenarios until 2100’³¹ the increase in the average annual temperature in Estonia since the middle of the twentieth century has been a bit faster than

²⁸ Eesti Pank. Economic forecast. Exports will bring growth to the Estonian economy. 2024. [www] <https://www.eestipank.ee/en/press/economic-forecast-exports-will-bring-growth-estonian-economy-13122024> (06.12.2024)

²⁹ Kallis, A et al. (2019). 100 aastat Eesti ilma (teenistust). [www] https://www.ilmateenistus.ee/wp-content/uploads/2019/05/100_aastat_Eesti_ilma_teenistust.pdf (06.12.2024)

³⁰ Keskkonnaportaali. Ilm. [www] <https://www.ilmateenistus.ee/kliima/rekordid/ohutemperatuur/> (06.12.2024)

³¹ Luhamaa, A et al. (2014). Eesti tuleviku kliimastenaariumid aastani 2100. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2021->

the global increase. The warming trend in winter, especially in January, can clearly be seen by month. Autumn of 2024 was the warmest since 1922, the average autumn temperature was 9.7 °C, that is 2.7 °C warmer than normal³².

As the annual precipitation is almost twice as high as evaporation, the climate is very humid. The average annual precipitation is approximately 550–700 mm, ranging from 520 mm on some islands to up to 740 mm on highlands. The seasonal fluctuation of the precipitation is similar all over the country. The driest months are February and March, with the precipitation gradually increasing in the following months. The wettest months are July and August, after which the precipitation decreases towards autumn and winter. The lowest annual precipitation in the coastal area may remain below 350 mm, but the highest in the inland region sometimes exceeds 1,000 mm. The highest measured daily precipitation was 148 mm (1972, Metsküla) and the highest annual precipitation 1,157 mm (1990, Nääri).³⁰

The duration, thickness, and water capacity of snow cover vary significantly by year. While the periods in the middle of the 1970s and at the end of the 1980s were dominated by mild winters with almost no snow cover, the winters in 1920–1933 were long and with a thick layer of snow. On average, there are 109 days with snow cover in Estonia per year, ranging from 61 to 155 days. A negative trend in the duration of snow cover has been detected for the period of 1961–2002: over the forty years, the average duration of snow cover decreased by 25.9 days. Snow cover develops first on the uplands of Haanja, Pandivere, and Otepää, on average in the beginning of December, and remains until the end of March. In Saaremaa and Hiiumaa, permanent snow cover usually develops in the middle of January. Some years, snow cover does not develop at all.²⁹

South-western, southern, and western winds prevail in Estonia. Northern winds are more frequent in spring and early summer. The average wind speed is 5–7 m/s in coastal areas and 3–5 m/s inland. The wind is strongest in the autumn and winter months, especially in November, December, and January (average wind speed of 4.1 m/s). The wind is weakest in summer (the average wind speed from July to August is 3.0 m/s). The strongest gust of wind measured by Estonian meteorological stations was 48 m/s measured in Ruhnu in November 1969.^{29,30}

In Estonia the hours of sunshine vary from 1,650 hours in inland regions to 2,060 hours on the islands. May, June, July are the sunniest and December is the least sunny. The multi-year mean duration of sunshine in the period of 1991–2020 was 1,830 hours.^{29,30}

3.1.1.6 Energy

The Estonian energy and fuel sector, the aim of which is to supply the state with electricity and thermal energy and high-quality fuels and ensure the optimum development of the sector, affects almost all fields of life. For example, heating and housing sectors influence the regional

[06/Milline%20on%20meie%20kliima%20tulevikus%2028Eesti%20tuleviku%20kliimastenaariumid%20aastani%202100%29.pdf](#) (06.12.2024)

³² Keskkonnaportaal. Sügis 2024. [www] <https://keskkonnaportaal.ee/et/meteoroloogiline-sugis-2024> (06.12.2024)

development of Estonia and public health. The decisions related to the production of biofuels have an impact on land use, rural life, and the foreign trade balance. The fuels selected for electricity generation have an impact on the Estonian environmental condition and on the efficiency of business activities. The main source of energy in Estonia is oil shale, which ensures the energy independence of the state, and at the same time is the biggest source of GHG emissions and having negative impact on air quality and public health. Renewable energy's share has gradually increased in Estonia over the years.³³

Energy sector's GHG emissions increased by 13% in 2022 compared to 2021. This increase was mainly due to the rise in electricity production from oil shale, driven by high electricity prices that allowed oil shale power plants to enter the market more frequently.³⁴

Estonia as a primary energy producer

Estonia is one of the largest primary energy producers per capita in the European Union. In 2022, Estonia's average primary energy production reached 147.6 GJ per capita, which is 11.2% higher than the EU average of 131 GJ per capita. Primary energy production peaked in 2018, driven by increased shale oil production volumes. However, production fell below 2016 levels in 2020, mainly due to higher EU ETS emission allowance prices, lower electricity prices, and the impact of the COVID-19 pandemic on energy demand (Figure 3.3). In 2022 the gross electricity production was 8 937 GWh – about 24.06% higher compared to 2021. This increase was largely attributed to higher electricity prices and growing energy demands, which made oil shale-based generation more viable. Consequently, electricity generated from oil shale accounted for over 57% of Estonia's total electricity production.³⁵

³³ Estonian Renewable Energy Association. Renewable energy yearbook 2023. [www] https://www.taastuenergeetika.ee/wp-content/uploads/2024/08/EOTEK_aastaraamat_2023_loplik.pdf (06.12.2024)

³⁴ Estonia National Greenhouse Gas Inventory Report 1990-2022 (2024). [www] https://kliimaministeerium.ee/sites/default/files/documents/2024-03/NID_EST_1990-2022_15.03.pdf (06.12.2024)

³⁵ Statistics Estonia, 2024. Energy. [www] <https://www.stat.ee/en/find-statistics/statistics-theme/energy-and-transport/energy> (13.08.2024)

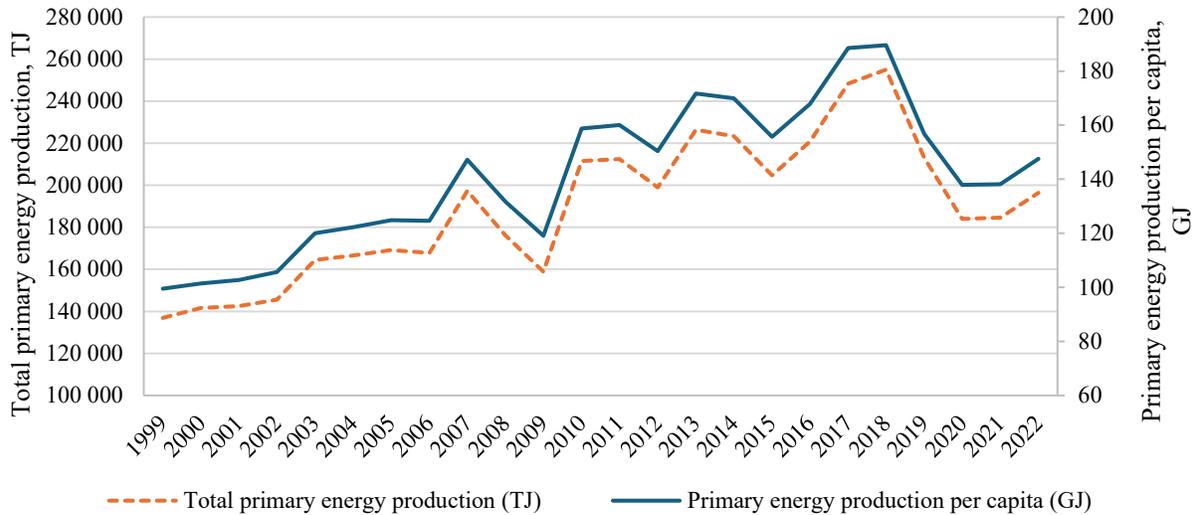


Figure 3.3 Total primary energy production (TJ) and primary energy production per capita (GJ)³⁵

A significant factor in Estonia's energy strategy is the high share of domestic fuels in the country's total energy resources and primary energy balance, which ensures strategic independence in electricity supply (Figure 3.4). Imported fuels account for approximately one-quarter of total supply, compared to the European Union average of about two-thirds. The share of exported electricity also heavily influences the role of oil shale in Estonia's primary energy balance – the larger the electricity exports, the greater the share of oil shale. Furthermore, the construction of new plants in recent years has contributed to the increase in shale oil production.³⁴

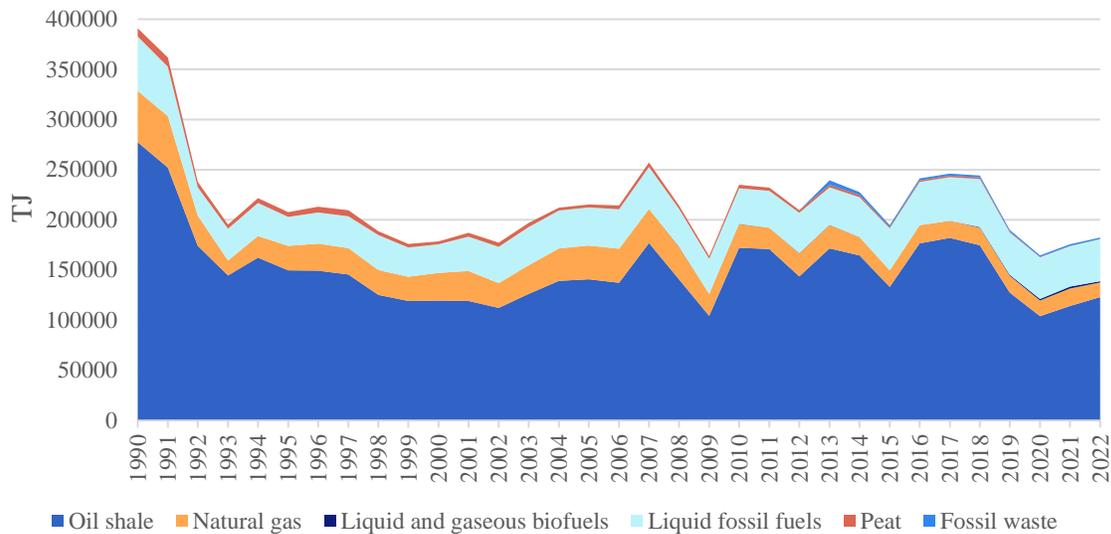


Figure 3.4 Gross available energy, 1990–2022, (TJ)³⁶

Heat and electricity production

The majority of electricity and heat produced in Estonia comes from oil shale, biomass, and natural gas; thereat, electricity is mainly generated from oil shale and various wood fuels are used in heat generation. Cogeneration of heat and electricity is the most efficient method of energy production from the perspective of environmental protection. The number of cogeneration plants has been consistently increasing. While there were 45 different cogeneration plants in Estonia in 2015, the figure had risen to 52 by 2022, with 16 of those using back-pressure steam turbines, 16 condensing turbines, and 20 internal combustion engines.³⁷

Renewable energy

Renewable energy is generated from wind, biomass, solar and small hydroelectric plants in Estonia. As electricity generation in wind parks has increased rapidly the proportion of renewable energy in energy production has intensified. In addition to the cheapening and availability of technology, the impulse for more active deployment of solar power plants in Estonia is provided by the support scheme for renewable electricity production (Figure 3.5).³⁷

In 2022, renewable energy production was 2.62 TWh, similar to the previous year's level (2.59 TWh). The share of renewable energy in gross final energy consumption in 2022 was 38.5%.³⁵

³⁶ Statistics Estonia, 2023. KE0240: Energy balance sheet, TJ by year. Primary production, total, TJ. Statistical database [www] https://andmed.stat.ee/en/stat/majandus_energeetika_energia-tarbimine-ja-tootmine_aastastatistika/KE0240/chart/chartViewLine (19.08.24).

³⁷ Estonian Renewable Energy Association, 2024. Renewable energy yearbook 2023. (11.12.2024)

The primary focus for accelerating the development of renewable energy is on wind energy, with efforts aimed at expediting projects already under development.³⁸

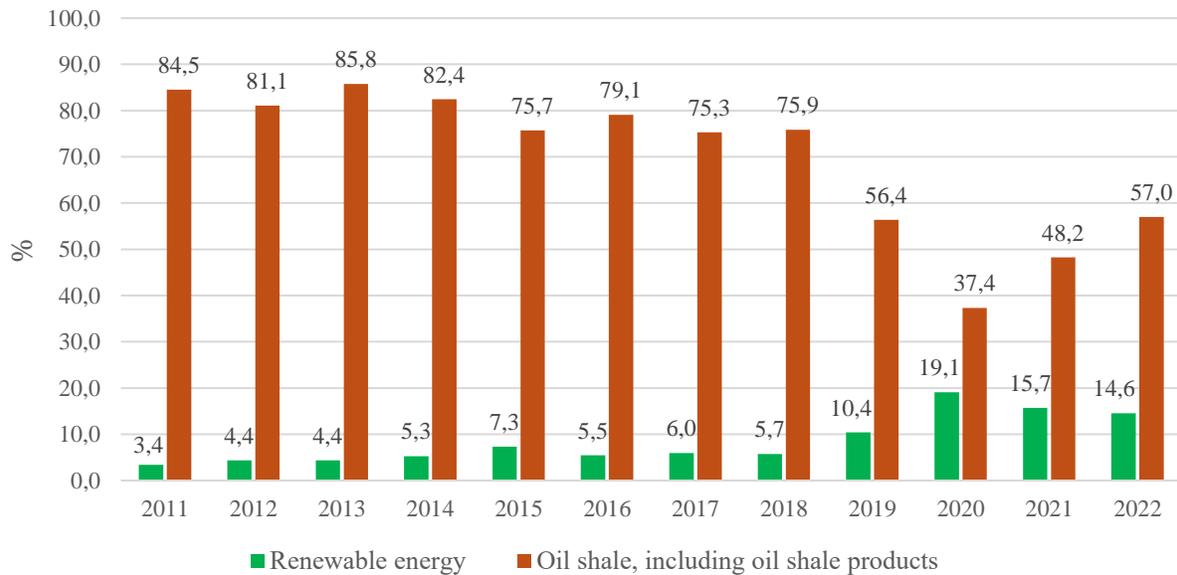


Figure 3.5 Share of renewable energy and oil shale in electricity production, (%)³⁹

Trade

Estonia has historically been a net energy exporter. However, fluctuations in electricity imports and exports over recent years have reflected changes in both domestic production capabilities and external market conditions.³⁹

In 2022, Estonia imported 7.18 TWh of electricity and exported 6.17 TWh, resulting in a slight net import position. While electricity imports decreased compared to 2021 (7.33 TWh in 2021), exports showed significant growth, increasing from 4.70 TWh in 2021 to 6.17 TWh in 2022, representing a rise of approximately 31.5%. This marks the second consecutive year of increased exports following a notable dip in 2019 and subsequent recovery in 2020.

3.1.1.7 Transport

Estonia is a relatively sparsely populated country with a population density of 31,6 people per square kilometer. A significant portion of the population lives in urban areas, with nearly 70% residing in cities and towns, including the capital Tallinn, Tartu, and Pärnu. However, a large part of the country remains rural, which necessitates an extensive and diverse transport network to connect urban and rural areas efficiently.¹¹

³⁸ Ministry of Climate (2024). *Energeetika ja maavarade programm 2024-2027*. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2024-02/Energeetika%20ja%20maavarade%20programm%202024-2027.pdf> (11.12.2024)

³⁹ Statistics Estonia, 2024. KE033: Production of power plants and consumption of fuels for energy generation [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_energeetika_energia-tarbimine-ja-tootmine_aastat statistika/KE033.px/ (06.12.2024)

The Estonian transport network consist of the infrastructure required for road, rail, water, and air traffic. As of 1. January 2024, the total length of the road network is 89,452 km of which 16,982 km is formed by state roads. This is complemented by 87.6 km of temporary ice roads, depending on the weather. Paved roads form 78% of all state roads.⁴⁰

The total length of the railways in Estonia is 2,164 km, of which 71.2% is in public use and 28.8% in non-public use. An electric railway of 132 km is part of the public railway. This is complemented by private railway sections at ports and the railway built for transporting oil shale.⁴¹

The length of the Estonian coastline is 3,794 km, featuring a dense network of ports. Including those located on internal water bodies, there are 245 ports registered in the Estonian State Port Registers⁴². The Port of Tallinn, the largest complex of freight and passenger ports in Estonia, experienced a consistent increase in passenger numbers until 2019, reaching 10.64 million passengers. However, this figure dropped sharply in 2020 due to the global COVID-19 pandemic, with the port serving just over 4.3 million passengers. The decline continued into 2021, with passenger numbers falling to 3.5 million. In 2022, a significant recovery occurred, with passenger traffic increasing by 98%, bringing the total to more than 7.0 million. The recovery continued in 2023, with a 13% increase, resulting in over 7.9 million passengers – approximately 74% of pre-pandemic levels. Considering both passenger and freight traffic, the Port of Tallinn remains the largest port complex in the Baltic Sea region.⁴³

There are seven airports in Estonia (two visual and five instrumental airports), in total, in Estonia, which served 3.02 million passengers in 2023, that is 7.0% more than in 2022, but still 9,3% less than in 2019.⁴⁴ The Tallinn Airport, which is the biggest airport in Estonia, was used by approximately 2.96 million passengers in 2023.⁴⁵

In 2022 the emissions from the transport sector formed 18.96% of the total greenhouse gas emissions of Estonia.³⁴ Road transportation is an essential emission source in the Transport sector covering 89.7% of the sector's emissions. Road transport includes all transportation on the roads in Estonia – the types of vehicles with combustion engines are passenger cars, vans, buses, lorries, motorcycles, and mopeds. The trend of GHG emissions follows, in general, the fuel consumption trend in the Road transport sector (**Figure 3.6**). Since 2010 there has been an increase in the number of passenger cars, which is attributable to the increment of economic wealth in Estonia.³⁴

⁴⁰ Estonian Transport Administration. Estonian road network. [www] <https://www.transpordiamet.ee/eesti-teedevork> (06.12.2024)

⁴¹ Ministry of Climate. Railway. [www] <https://kliimaministeerium.ee/liikuvus/raudtee> (21.08.24).

⁴² Estonian Transport Administration, 2024. [www] <https://www.transpordiamet.ee/sadamaregister> (06.12.2024)

⁴³ The Port of Tallinn. Annual Report of 2023. [www] https://www.ts.ee/wp-content/uploads/2024/04/Tallinna_Sadam_Annual_Report_2023.pdf (06.12.2024)

⁴⁴ Estonian Transport Administration. Aviation. [www] <https://www.transpordiamet.ee/instrumentaallennuvaljad> (06.12.2024)

⁴⁵ Tallinn Airport. Tallinn Airport Annual Report 2023. [www] <https://airport.ee/wp-content/uploads/2024/05/Tallinna-Lennujaam-2023-eng.pdf> (06.12.2024)

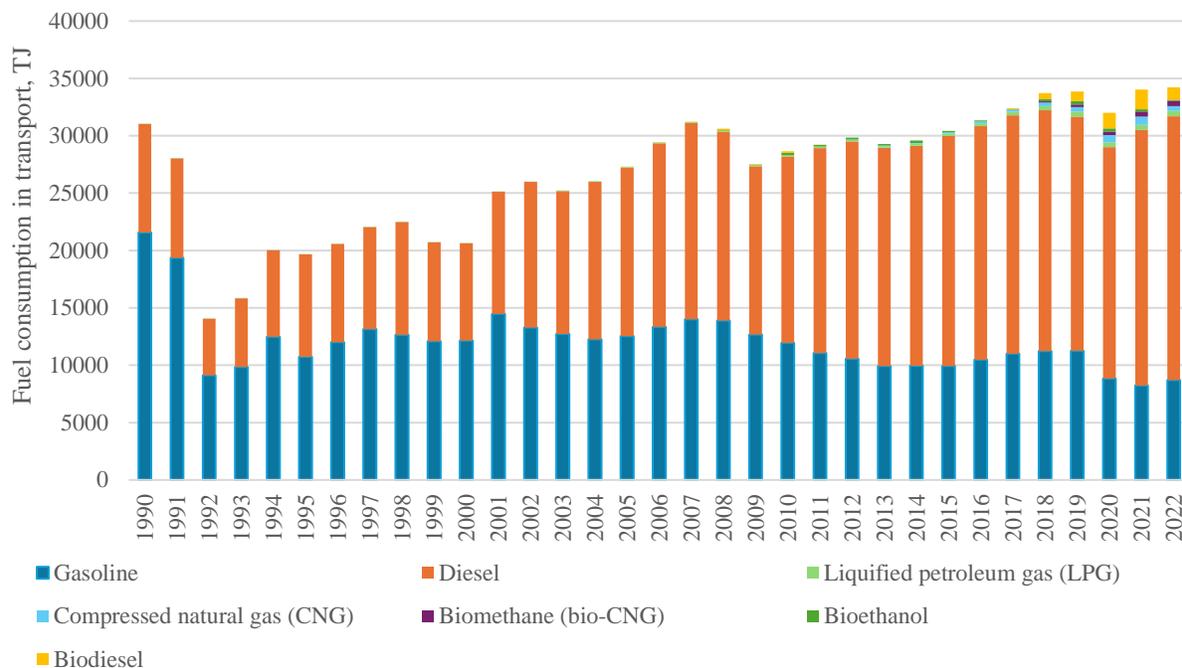


Figure 3.6 Fuel consumption trend in road transport, TJ³⁶

Estonian transport companies served a total of 198 million passengers in 2023. The same indicator has increased by 20% compared to the previous year, when 160 million people were served (Figure 3.7). The decline in passenger numbers in 2020 and 2021 is attributed to the global COVID-19 pandemic, during which domestic and international travel restrictions were imposed in the spring of 2020.⁴⁶

⁴⁶ Statistics Estonia, 2024. TS101: Passenger transport and passenger traffic volume of transport enterprises by type of transport (quarters) [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_transport_transpordi-uldandmed/TS101.px/ (28.08.24)

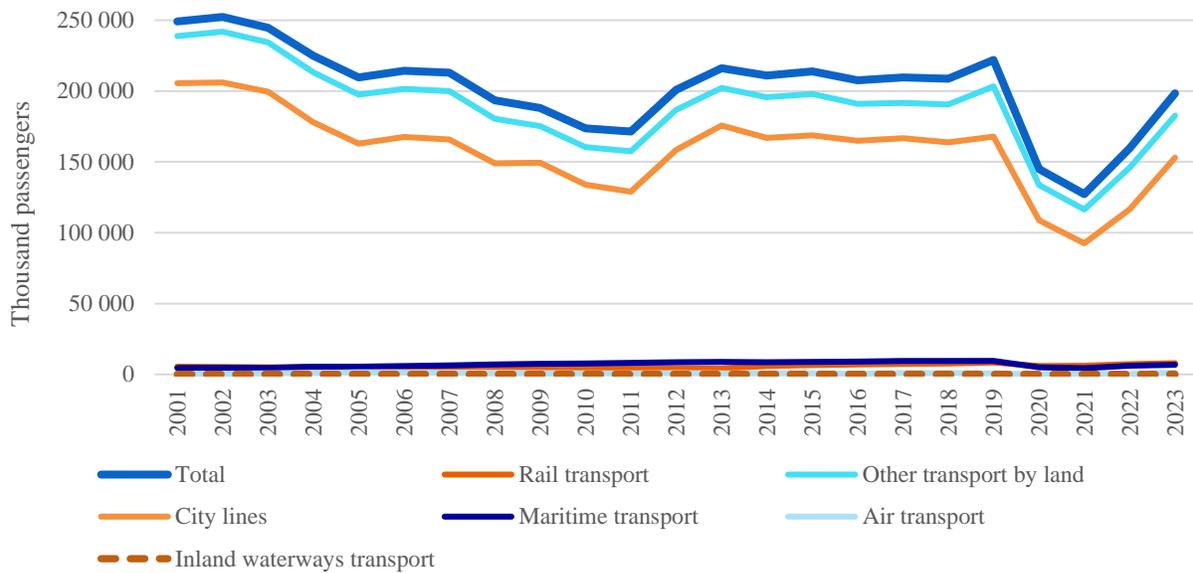


Figure 3.7 Passenger transport of transport companies, thousand passengers⁴⁶

In Estonia, public transport primarily relies on buses. In 2023, 122 million passengers used bus transport on city routes, accounting for more than half of domestic passenger transport. A total of nearly 183 million people traveled by bus, tram, and trolley, which is 20% more than in 2022.⁴⁷ The number of train users has been increasing year-by-year – the number of rail transport users exceeded the threshold of 8 million in 2019 but dropped by 29% in 2020 due to the COVID-19 restrictions on movement. By 2023, the number of train users had recovered, reaching nearly 8 million again.^{41, 48}

Compared to 2016, the freight transport volumes decreased by 45.8% in total in 2023, incl. freight transport by rail by 60.1%. This is also one of the reasons why the Estonian GHG emissions in the sub-category of rail transport decreased by 32.9% in this period. At the same time, road transport has been increasing steadily since the end of the recession, reaching the pre-crisis level in 2016, but has been continuously dropping since then due to a lower number of haulage operations.^{48, 49}

As the amounts of cargo transported by the Estonian transport companies by sea or air are very small, the figures of the maritime and air freight transport have been summarised in [Figure 3.8](#).

⁴⁷ Statistics Estonia, 2024. TS541: Passenger transport by bus on local and highway lines by indicator, type of transport, and reference period [www] https://andmed.stat.ee/en/stat/majandus__transport__maanteetransport/TS541/table/tableViewLayout2 (29.08.24).

⁴⁸ Statistics Estonia 2024. TS1420: Passenger and freight traffic on railways. [www] https://andmed.stat.ee/et/stat/majandus__transport__raudteetransport/TS1420/table/tableViewLayout2 (06.12.2024)

⁴⁹ Statistics Estonia, 2024. TS51: Freight carried by road [WWW Document]. URL https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus__transport__maanteetransport/TS51.px/ (11.12.2024)

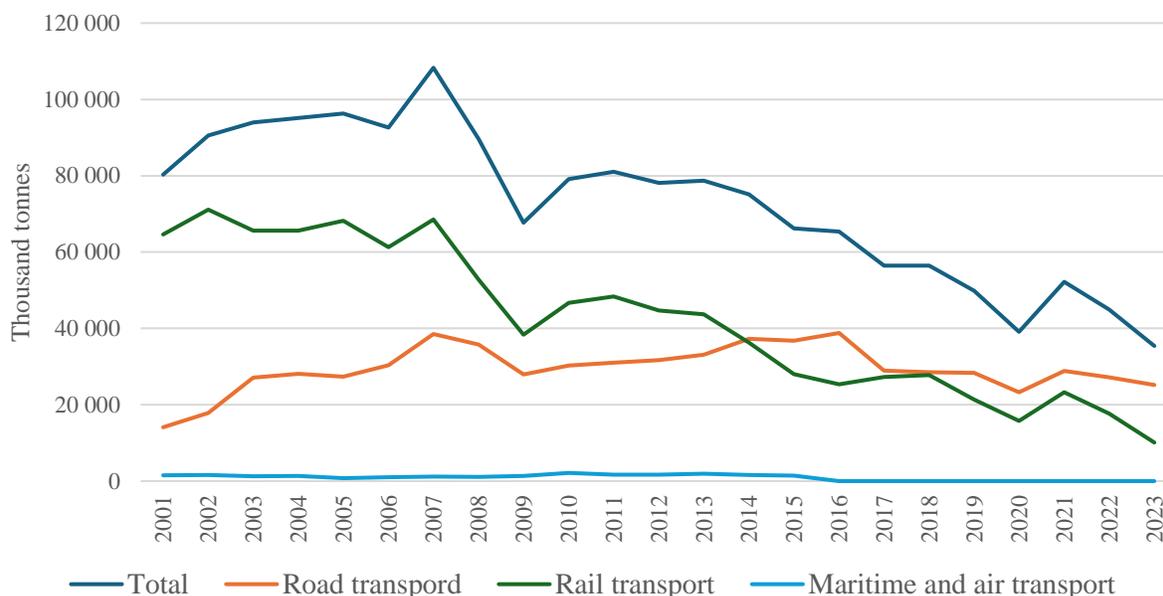


Figure 3.8 Freight transport by transport companies, thousand tonnes ⁵⁰

3.1.1.8 Industry

Estonia's key manufacturing industries include wood processing, metal products, electronics and optical equipment production, and food manufacturing (see [Figure 3.9](#)). The timber industry plays a vital role in Estonia's economy, as wood is one of the country's most valuable natural resources. In 2022, the timber industry accounted for nearly one-fifth of the entire manufacturing industry production and contributed 14% to Estonia's GDP.^{51,52} The second-largest subsector was metal products manufacturing, followed by electronics and optical equipment production, and food production. Together, these four subsectors generated approximately half of the total value added in the manufacturing sector.⁵³

There are over 9000 companies operating in the Estonian industrial sector, of which the majority are small or medium-sized companies. There are more than 150 companies with over 100 employees.⁵³

⁵⁰ Statistics Estonia, 2024. TS121: Transport of goods and freight turnover of transport enterprises by type of transport, quarter, indicator, and year [WWW Document]. URL https://andmed.stat.ee/en/stat/majandus__transport__transportidi-uldandmed/TS121/table/tableViewLayout2 (29.08.2024)

⁵¹ Statistics Estonia, 2023. RAA0050: Gross domestic product by country (ESA 2010) [www] [https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_rahvamajanduse-arvepidamine_sisemajanduse-koguprodukt-\(skp\)_regionaalne-sisemajanduse-koguprodukt/RAA0050.px/](https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_rahvamajanduse-arvepidamine_sisemajanduse-koguprodukt-(skp)_regionaalne-sisemajanduse-koguprodukt/RAA0050.px/) (06.12.2024)

⁵² Statistics Estonia, 2024. TO66: Manufacturing production by the list of manufacturing products (TTL) [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_toostus/TO66.px/ (06.12.2024)

⁵³ Statistics Estonia, 2023b. EM001: Financial statistics of enterprises by economic activity and number of persons employed [WWW Document]. URL https://andmed.stat.ee/en/stat/majandus_ettevetete-majandusnaitajad_ettevetete-tulud-kulud-kasum_aastatistika/EM001 (18.10.2024)

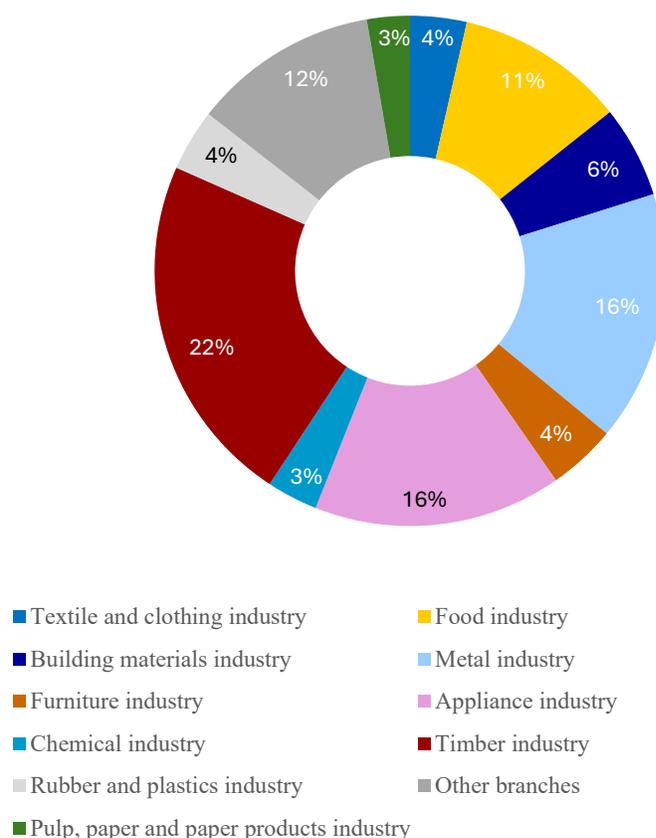


Figure 3.9 The structure of the manufacturing industry in Estonia based on added value, 2022⁵³

The general structure of the economy underwent large-scale changes in the beginning of the 1990s, as the service sector had not yet developed, and most of the factories were oriented to the Soviet Union market. The decrease in the industrial production in the course of the transfer from a planned economy to a market economy also brought along a significant drop in the GHG emissions.³⁴

The industrial sector has seen significant growth since 2008. In 2022, the added value of the industrial sector represented 24% of the Estonian economy, which is close to the European Union average of 23.4%.⁵⁴ Compared to 2015, the volume of the industrial sector increased by approximately 25%, and compared to 2008, it has grown 2.3 times in current prices. The sharp decline in industrial production in 2020 was primarily caused by the global COVID-19 pandemic, which disrupted trade, reduced demand, and constrained industrial operations. This event was temporary, as evidenced by the strong recovery in both production volume and prices starting from 2021 (Figure 3.10).

⁵⁴ Statistics Estonia, 2024. TO0053: Volume index of industrial production by economic activity (monthly) [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_toostus/TO0053.px/ (18.10.2024)

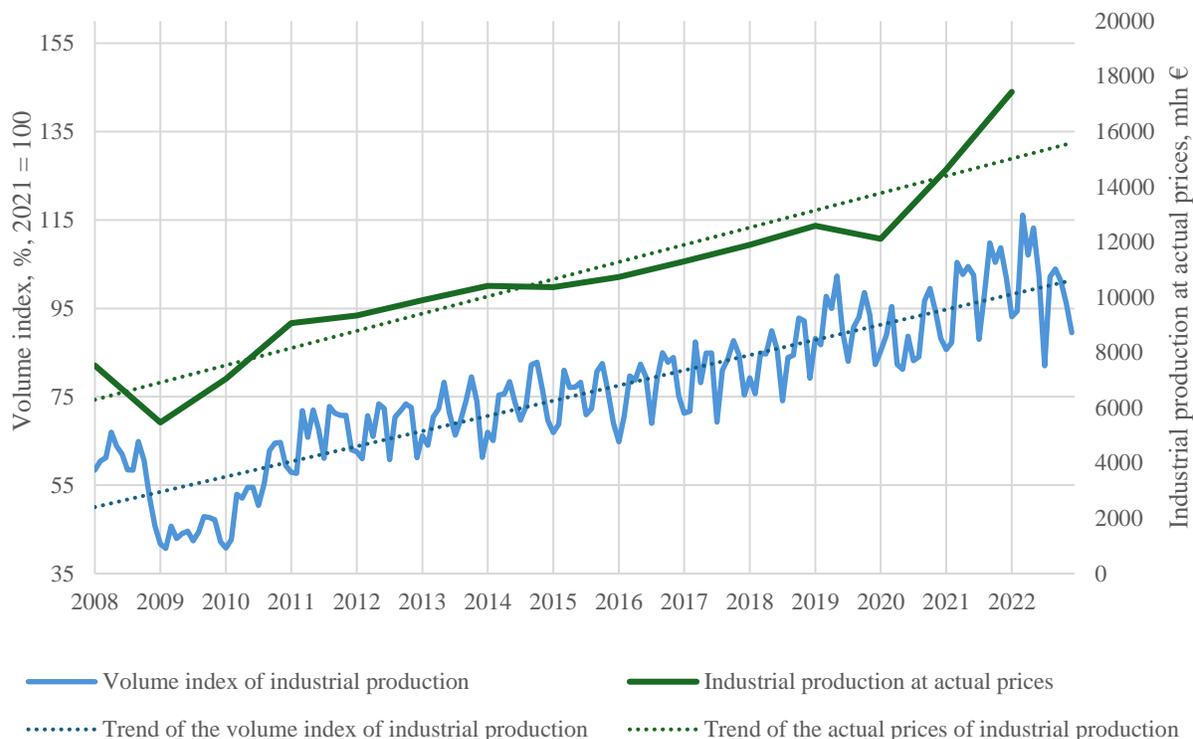


Figure 3.10 Estonian industrial production 2008–2022⁵⁴

In 2022, manufacturing industries and construction accounted for about 2.27% of total emissions in the energy sector. Emissions in the manufacturing and construction sectors decreased by 13.78% compared to 2021, mainly due to reduced energy consumption.³⁴

In 2022, the most significant energy sources in Estonia's industrial sector were natural gas (77%) and wood fuels (21%). Over the past decade, the share of natural gas has risen considerably, while wood fuels have decreased. Biomass, which was not used in 2012, accounted for 1 per cent in 2022, reflecting a small shift toward diversifying energy sources. Oil and coal have remained minimal, each contributing just 1 per cent (Figure 3.11)⁵⁵.

While the increased reliance on natural gas reflects a transition in energy use, many industrial companies in Estonia are actively working to improve energy efficiency in their processes. Through programs supported by the Environmental Investment Centre (EIC), such as resource efficiency projects, businesses are adopting innovative measures to optimize energy consumption and reduce environmental impacts.⁵⁶

⁵⁵ Statistics Estonia. KE0230: Energy balance sheet by type of fuel or energy (Eurostat methodology) [www] https://andmed.stat.ee/443/pxweb/en/stat/stat_majandus_energeetika_energia-tarbimine-ja-tootmine_aastatstatistika/KE0230.px/ (09.12.2024)

⁵⁶ Environmental Investment Centre. Resource efficiency of companies [www] <https://kik.ee/en/toetavad-tegevused/ettevotete-ressursitohusus> (11.12.2024)

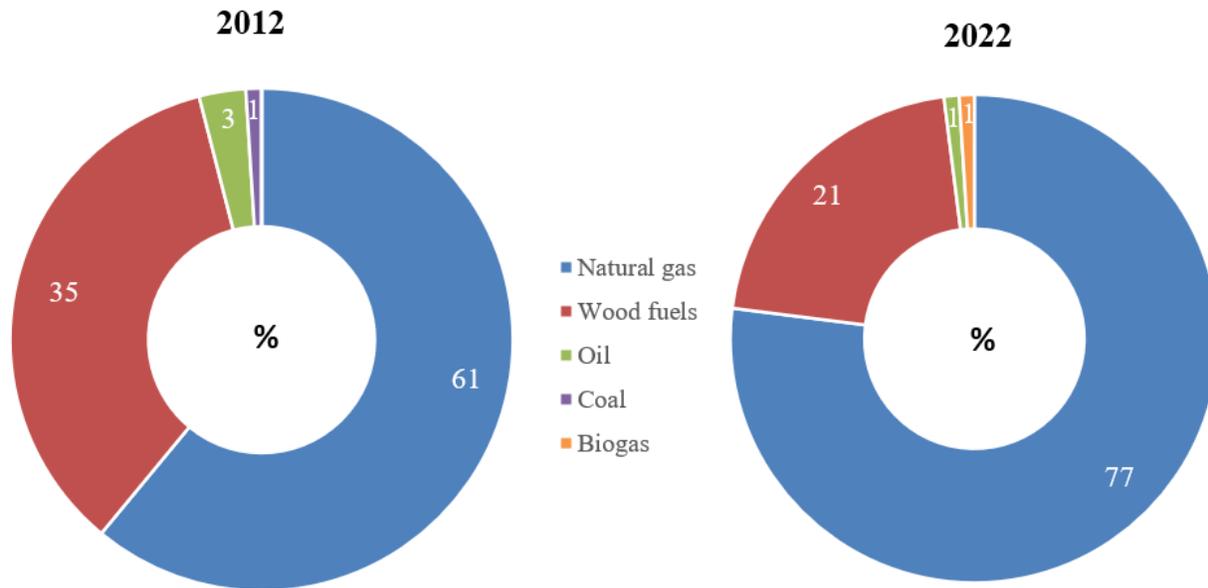


Figure 3.11 Energy use in industry by source in 2012 and 2022 ⁵⁵

3.1.1.9 Agriculture

Estonian Agriculture sector is highly dependent on weather conditions and the changing climate. Due to the long rainy periods and cold winters, only summer period is usually favourable for crop cultivation. After the collapse of the Soviet Union and the rapid decline in the agricultural sector, the area of agricultural land in Estonia has significantly decreased over the years. Since 1990, the number of livestock has decreased by 65.2%, compared to 2022 levels. The surface area of agricultural land dropped from 1,458,400 hectares in 1990 to 986,206 hectares in 2022 (decreased by 32%). Thereas, the agricultural land area has increased by 30,290 hectares in the past decade. In 2022, the growing area of arable crops was 707,319 hectares, of which cereals accounted for more than half (51%, 361,823 hectares), fodder crops covered 179,588 hectares (25%), industrial crops 95,655 hectares (14%), and potatoes, legumes, and vegetables together made up 53,868 hectares (8%) (Figure 3.12).^{34, 57}

⁵⁷ Statistics Estonia. PM0281: Agricultural land and crops by county [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_pellumajandus_pellumajandussaaduste-tootmine_taimekasvatussaaduste-tootmine/PM0281.px/ (06.12.2024)

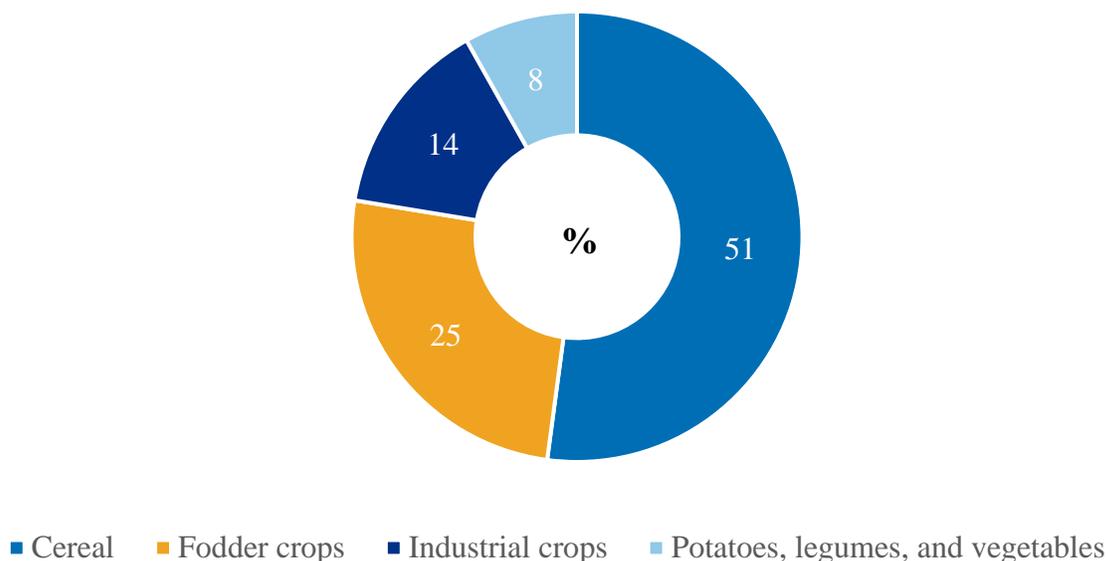


Figure 3.12 Distribution of arable crop growing areas in Estonia, 2022⁵⁷

Despite this recent growth in agricultural land, Estonia's agricultural production has been in decline, especially in the livestock sector. The number of agricultural animals has decreased, leading to a reduction in greenhouse gas emissions. By 2022, there were 249,600 cattle in Estonia (including 83,700 dairy cows), 269,400 pigs, 63,100 sheep, 4,000 goats, and 2,151,000 poultry (Figure 3.13). In 2022, the agricultural sector's CO₂ equivalent emissions were 41.5% lower compared to the base year of 1990, largely due to the decrease in livestock numbers and the reduced use of animal manure on fields. The economic difficulties that began in 2021, driven by rising production costs exceeding profits, further contributed to this decline. The EU energy crisis has led to higher prices for fertilizers, energy, and feed, putting additional pressure on farmers.^{34,58}

⁵⁸ Statistics Estonia, 2024. PM09: Livestock and poultry by county (QUARTERLY) [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_pellumajandus_pellumajandussaaduste-tootmine_loomakasvatussaaduste-tootmine/PM09.px/ (06.12.2024)

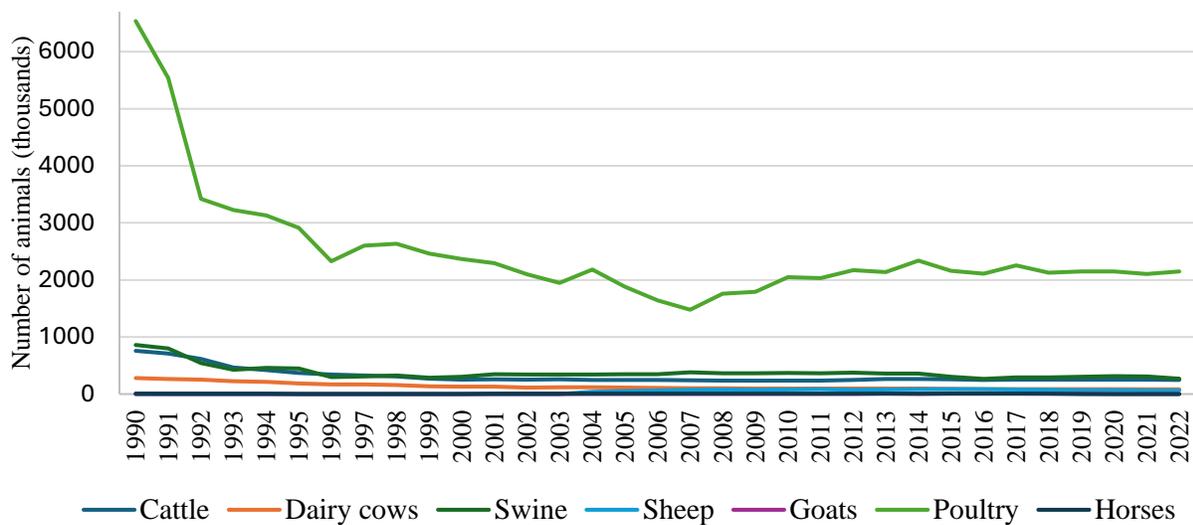


Figure 3.13 Livestock population 1990–2022, thousand⁵⁸

The dairy industry has particularly suffered due to economic sanctions imposed by Russia in 2014, which banned food imports from the EU, including dairy products. As a result, the number of dairy cattle dropped by 12.5% between 2014 and 2022, reaching record lows in the last two years. Similarly, the swine population declined by 24.7% from 2014 to 2022, initially due to the outbreak of African swine fever in 2015, and the situation worsened with further outbreaks in 2021. Although there was some recovery in the number of pigs due to improved economic conditions and a high demand for pork, the most popular meat in Estonia, the swine population dropped again in 2022 by 12.6% compared to 2021.

In 2022, the total output of the agricultural sector amounted to 1.63 billion euros, which is 30% more than the previous year. Of this, 652.9 million euros (40%) came from livestock production, and 817.5 million euros (50%) from crop production, which is the highest of the past twenty years (see Figure 3.14).⁵⁹

⁵⁹ Statistics Estonia, 2024. PM54: Agricultural output, intermediate consumption, value added, gross fixed capital formation in basic prices of the corresponding year and agricultural labour input [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_majandus_pellumajandus_pellumajanduse-majanduslik-arvepidamine/PM54.px/ (06.12.2024)

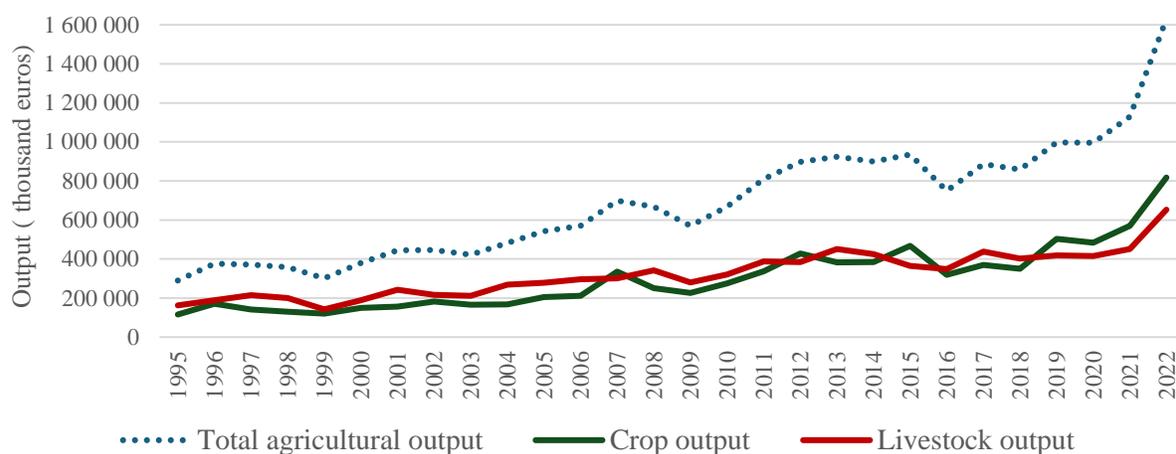


Figure 3.14 Agricultural output, 1995–2022, thousand euros⁵⁹

Organic farming in Estonia continues to expand. In 2022, the area of organic agricultural land increased to 233,872 hectares, accounting for 23% of all agricultural land in Estonia. Compared to the previous year, 4,472 hectares of organic land were added, marking a 2% increase. The number of organic producers remained almost the same, with 2,046 organic producers, 1,079 of whom raised organic livestock. A total of 130 new organic producers started, while 127 ceased operations. The average size of organic agricultural land per farm in 2022 was 114 hectares, and 22 farms had over 1,000 hectares of organic land. The largest share of organic land was in Hiiumaa, where it accounted for about two-thirds of the total agricultural land. Võrumaa had the highest number of organic farms, while Pärnumaa had the largest area of organic land. Although organic farming expanded, the market situation for organic production in 2022 was challenging, especially in export markets. There was no demand for certain cereals, and the price premium for organic products was either small or non-existent. Many organic animals were sold as conventional animals, as the price premium for organic production was insufficient to cover production costs. Nevertheless, the overall price level of agricultural products was higher than in previous years, encouraging producers to continue organic farming.⁶⁰

3.1.1.10 Forestry

Forests play a vital role in Estonia’s carbon cycle as the main greenhouse gas sequesters.³⁴ According to the National Forest Inventory²¹, more than half of land area is covered by forest. The area of forest land in Estonia is 2,447 kha by the FRA definition⁶¹ that is applied in the LULUCF sector reporting, and 2,334 kha by the national forest definition stipulated in the Forest Act⁶². The proportion of forest land has steadily increased since the late 1950s, reaching 51.5% of the total

⁶⁰ Estonian Organic Farming Foundation. Organic farming in Estonia 2022. [www] https://orgprints.org/id/eprint/50813/1/mahe_eestis_2022.pdf (11.12.2024)

⁶¹ FAO 2018. Terms and definitions FRA 2020. Forest resources assessment working paper 118. [www] <https://www.fao.org/3/I8661EN/i8661en.pdf> (06.12.2024)

⁶² Forest Act (2007). [www] <https://www.riigiteataja.ee/en/eli/ee/510022014001/consolide/current> (06.12.2024)

land area by the end of 2022. Since Estonia's accession to the EU, forest land area has stabilized due to agricultural subsidies that reduced the afforestation of agricultural lands (Figure 3.15).³⁴ Today, the State Forest Management Centre manages 1,071 kha, or 45.9% of Estonia's forest land.²¹

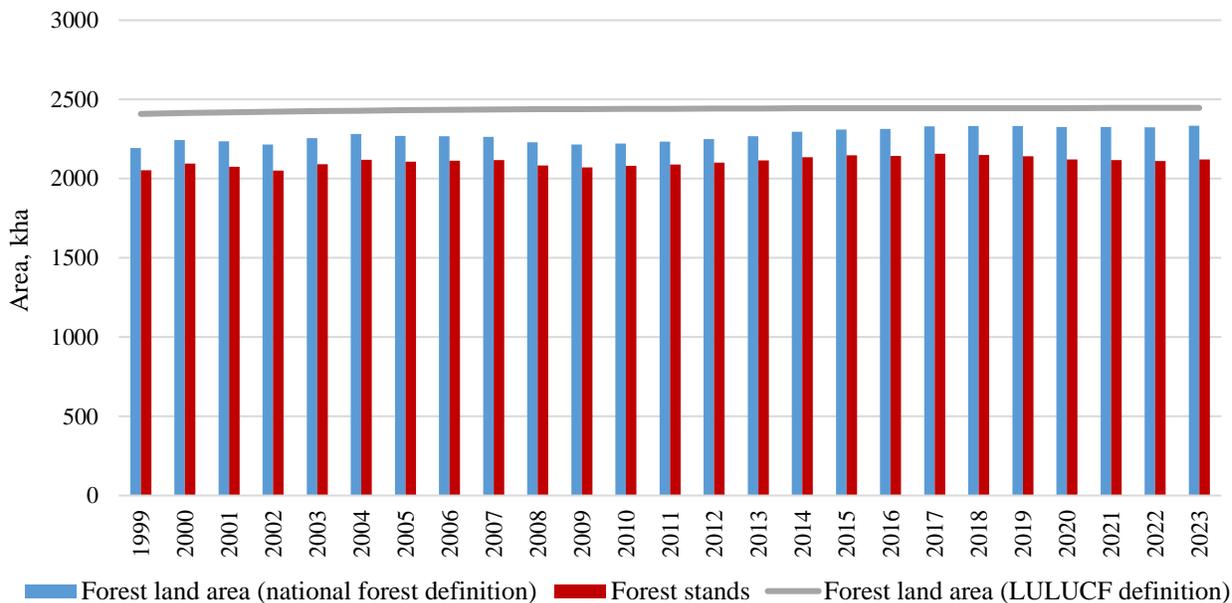


Figure 3.15 Area of forest land and forest stands in 1999–2023, thousand hectares²¹

Estonia's total forest growing stock is 453,8 million m³, equating to 194,4 m³ per hectare. There are 15.5 million m³ standing deadwood and 21.4 million m³ lying deadwood on forest land. The average dead wood stock is 15.8 m³ per hectare.²¹

Estonia is situated at the northern boundary of the hemiboreal climate zone, with deciduous and coniferous tree stands covering equal areas (each accounting for 50% of forest land). However, coniferous tree stands have a higher average growing stock per hectare, making up 55% of the total growing stock. The most common tree species are Scots pine, Norway spruce, and birches, which cover 78% of forest land and 80% of the total growing stock. Grey alder, aspen, and common alder make up 20.6% of forest land and 19% of the growing stock. Other tree species account for less than 2% in terms of both area and growing stock.²¹

The age structure of the forests is dominated by mature stands, with approximately 39% of forest stands being over 60 years old. The high proportion of mature and near-mature stands, along with an increasing share of areas in the early development stages (treeless areas, regenerating land, and young stands), has reduced the capacity for biomass carbon sequestration (Figure 3.16). Furthermore, the rate of conversion from other land categories to forest land (through afforestation and reforestation) has slowed, resulting in the stabilization of the total forest land area.³⁴ The long growing season and droughts in recent years have caused large forest damages by spruce bark

beetle, and the spread of bark beetles is not expected to slow down in the coming years.⁶³ The felling volume has also increased, remaining below the total increment.

Approximately 10% of forest stands will reach 60 years of age within the next decade, adding to the already significant proportion of mature forests. Around 18% of the forests are not available for wood supply due to environmental restrictions.^{21, 64}

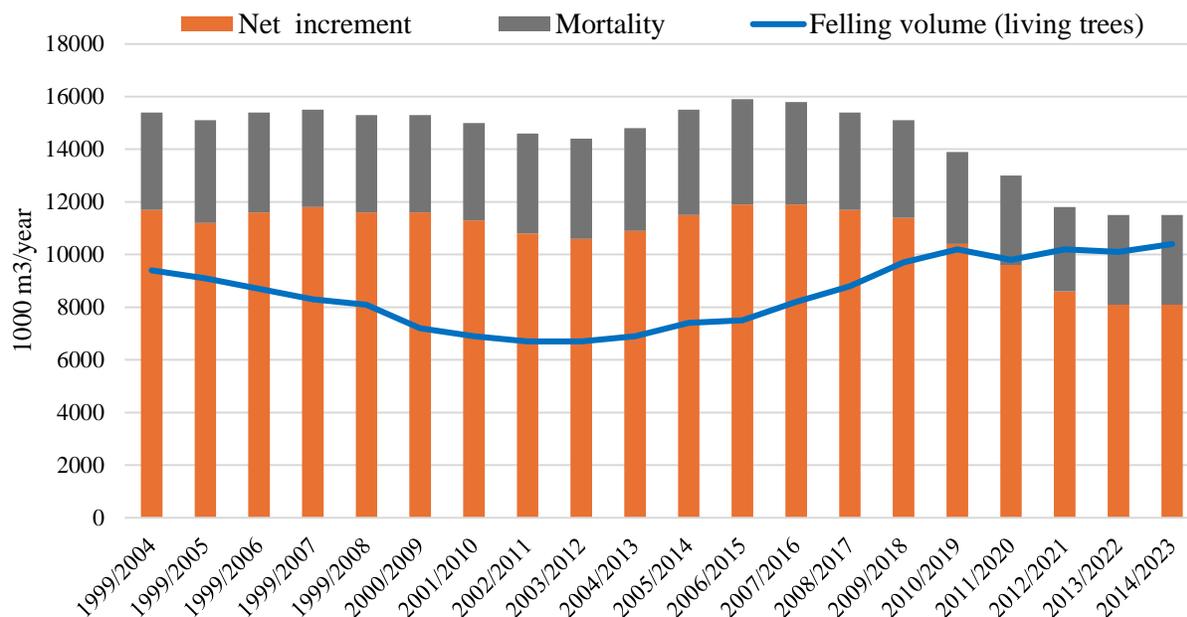


Figure 3.16 Net increment, mortality and felling volume in forest available for wood supply (averages of 10-year period)

There are around 3,900 companies operating in Estonia’s forest and wood sector, representing 3% of all registered companies in 2022. More than half of these businesses are involved in forest management. The sector employed an average of 30,266 workers, accounting for 6% of the total workforce. In 2022, the sector generated €1.88 billion in direct added value, making up about 8.5% of the total added value produced by all Estonian companies.⁶⁵

In addition to its direct economic contribution, the forest and wood sector significantly impacts other industries through its supply chain. In 2022, the estimated total added value generated by the sector amounted to €3.6 billion, or roughly 16% of the total added value in Estonia. Currently, the largest share of added value within the sector comes from the mechanical processing of wood.⁶⁵

⁶³ Estonian Environment Agency. Spruce bark beetle. Environmental Portal [Kuuse-kooreürask. Keskkonnaportaal] [www] <https://keskkonnaportaal.ee/et/teemad/mets/kuuse-kooreurask> (09.12.2024)

⁶⁴ Statistics Estonia. SN11: Sustainable development indicators according to UN goals [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_eri_valdkondade-statistika_saastev-areng/SN11.px/ (09.12.2024)

⁶⁵ Estonian Forestry and Wood Industry Association. Socio-economic impact of the forest and timber sector in 2022. [www] https://empl.ee/wp-content/uploads/2024/05/EY_EMPL_majandusmojud_2022_final.pdf (09.12.2024)

3.1.1.11 Waste

Estonia is currently undergoing a Waste Reform aimed at improving waste management practices, increasing recycling rates, and reducing environmental impacts. The reform focuses on aligning waste management systems with contemporary environmental standards and advancing the principles of a circular economy.⁶⁶

In addition to the ongoing reform, Estonia's national waste policy has consistently prioritized reducing the volume of waste deposited in landfills, enhancing the potential for recoverable waste, and minimizing the hazardousness of waste to the greatest extent possible. The National Waste Management Plan 2022–2028 supports the Waste Act, which outlines the requirements and regulations related to waste management. This comprehensive framework ensures that waste is managed efficiently, with an emphasis on mitigating environmental risks and promoting resource recovery through recycling and reuse initiatives.⁶⁷

In 2022, almost 23 million tonnes of waste was generated in Estonia (Figure 3.17), which is 15% more than the previous year. The largest share of waste came from the energy sector (50%) and the production of coke and refined petroleum products (14%), with most of it being of mineral origin. The amount of mineral waste was nearly 10 million tonnes (42% of all waste), while incineration waste, primarily from energy production at the Iru Waste-to-Energy Plant, amounted to about 6.5 million tonnes (28% of all waste).^{68,69}

The generation of municipal waste in 2022 amounted to 503,000 tonnes, representing a 4.2% decrease compared to the previous year. An analysis of waste recycling capacity revealed that biodegradable waste made up 19.6% of the total mass of mixed municipal waste in Estonia in 2022, which is 10% less than in 2020. Of the biodegradable waste, organic/food waste accounted for 69.7%, while garden waste made up 30.3%. Separately collected biowaste amounted to 43,700 tonnes.⁷⁰ The current National Waste Management Plan 2023-2028 foresees a broader implementation of biodegradable waste composting and anaerobic digestion technologies, which should help achieve recycling targets.⁶⁷

The majority of hazardous waste (an average of 97% between 2014 and 2020, and 77% in 2020) originates from oil shale energy and oil production, primarily consisting of oil shale ash and semi-coke. The generation of hazardous waste significantly decreased in 2020, when it accounted for only 10% of total waste. This reduction in hazardous waste was largely due to the reclassification of oil shale ash as non-hazardous waste starting in 2020.⁷¹

⁶⁶ Ministry of Climate. Waste Reform. [www] <https://kliimaministeerium.ee/jaatmereform> (02.12.2024).

⁶⁷ Ministry of Climate (2023). The National Waste Management Plan 2023-2028. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2023-12/Riigi%20j%C3%A4%C3%A4tmekava%202023-2028.pdf>. (09.12.2024)

⁶⁸ Statistics Estonia. KK82: Waste. [www] https://andmed.stat.ee:443/pxweb/en/stat/stat_keskkond_surve-keskkonnaseisundile_uldandmed/KK82.px/. (09.12.2024)

⁶⁹ Enefit Green. Waste-to-energy. [www] <https://enefitgreen.ee/en/koostootmine/jaatmeenergia> (09.12.2024)

⁷⁰ Ministry of Climate (2022). Analysis of Waste Recycling Capacity. [www] <https://storymaps.arcgis.com/collections/524ba61e26a74a39b63cc255c03ae5f9?item=1> (09.12.2024)

⁷¹ Statistics Estonia (2024) *SN11: Sustainable development indicators according to UN goals*. Available at: https://andmed.stat.ee:443/pxweb/en/stat/stat_eri-valdkondade-statistika_saastev-areng/SN11.px/. (11.12.2024)

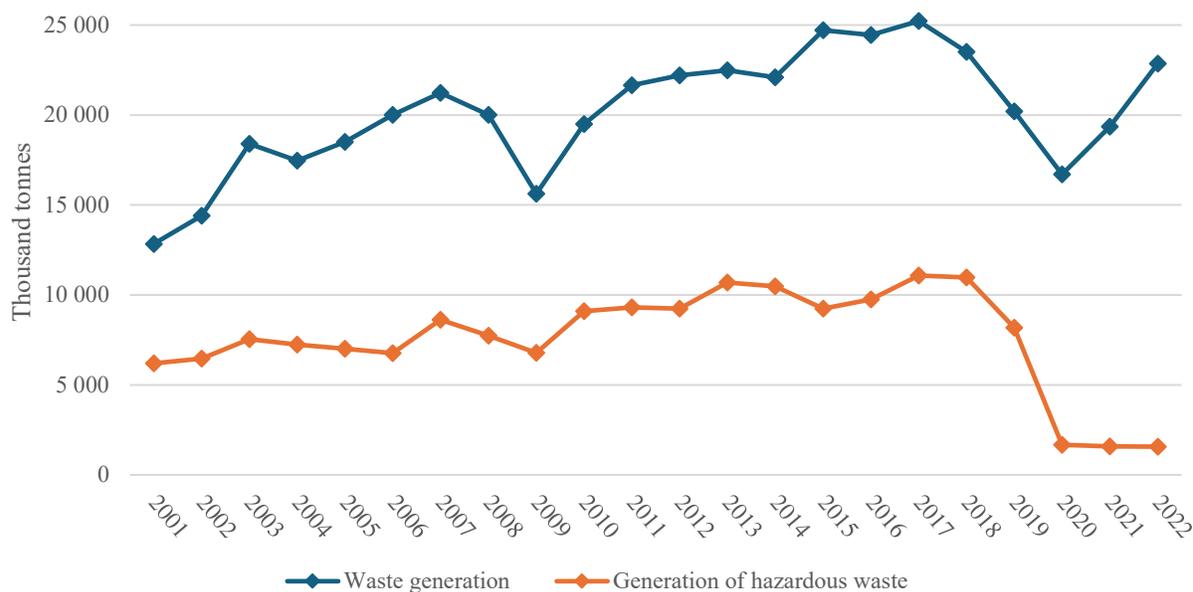


Figure 3.17 Waste generation from 2001–2022, thousand tonnes^{68, 71}

The collection of municipal waste by type is organized by local governments, which have been continuously expanding this activity and developing the construction of a network of waste stations. Local residents must follow the municipal waste management regulations of their local government, which specify where different types of waste can be disposed of within the territory.⁶⁷

There are five non-hazardous waste landfills operating in Estonia: the Tallinn Waste Recycling Centre, Uikala, Väätsa, Torma, and Paikre. These landfills fully comply with environmental and technical requirements and standards, serving more than one service area.⁶⁷

The oil shale industry remains a significant contributor to Estonia's total waste generation. While the production of oil shale-based electricity has declined since 2018, waste rock from oil shale extraction is increasingly being reused as raw material, primarily as crushed stone. Thanks to road construction and other infrastructure projects, such as Rail Baltica and a new solar power station in the Estonia mine area, the share of reuse and recycling of waste rock has steadily increased. For example, in 2014, around 3.3 million tonnes (less than 42%) of waste rock were recycled, rising to approximately 4 million tonnes (57%) by 2018. These initiatives highlight the growing focus on reducing the amount of waste rock deposited in spoil tips and advancing Estonia's circular economy efforts.⁶⁷

In 2022 recycling of waste in Estonia amounted for 14.9 million tonnes (Figure 3.18), which is 11.3% more than in 2021. The rate of circulating material in Estonia was 16% in 2022. This means that 84% of the material used in the economy was new raw material.⁶⁸

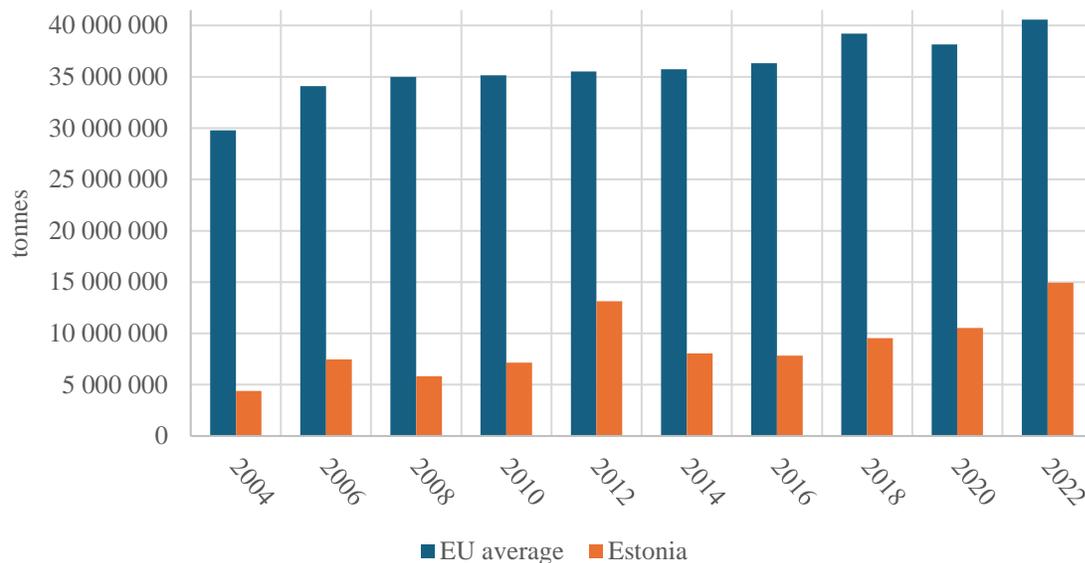


Figure 3.18 Comparison of total waste recycling volumes: Estonia vs EU average, 2004–2022⁷²

3.1.2 Institutional arrangements

3.1.2.1 Institutional arrangements for tracking progress in the European Union

The EU’s Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action (‘Governance Regulation’)⁷³ establishes a governance mechanism and specific arrangements to track the progress of the Union and its Member States towards the implementation and achievement of the EU’s climate and energy targets and commitments under the UNFCCC and the Paris Agreement. These arrangements include the monitoring of GHG emissions and removals, the reporting of policies and measures, projections of GHG emissions and removals and progress on adaptation to climate change.

Under the Governance Regulation, the EU has established a Union Inventory System to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the data reported by the EU and its Member States. This inventory system includes a quality assurance and quality control programme, procedures for setting emission estimates, and comprehensive reviews of national inventory data to enable the assessment of compliance towards climate goals.

⁷² Eurostat (2024) Treatment of waste-by-waste category, hazardousness and waste management operations. [www] https://ec.europa.eu/eurostat/databrowser/view/env_wastrt/default/table?lang=en (17.10. 2024).

⁷³ Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action. [www] <http://data.europa.eu/eli/reg/2018/1999/oj> (20.12.2024)

Each EU Member State compiles its GHG inventory in accordance with the requirements of the Paris Agreement⁷⁴ and the relevant Intergovernmental Panel on Climate Change (IPCC) guidelines⁷⁵. Inventory data on GHG emissions and removals, including information on methods, are submitted electronically using a reporting system managed by the European Environment Agency (EEA). The submitted data are subject to quality control procedures and feed into the compilation of the GHG inventory of the EU. Net GHG emissions, calculated from emissions and removals reported in the GHG inventory of the EU, are the key information used to track progress towards the EU's NDC target to reduce net emissions by 2030 by 55% compared to 1990.

Given the scope of the EU NDC related to international aviation and navigation, a specific share of international aviation and navigation emissions as reported in the GHG inventory data is calculated based on the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES)⁷⁶. Details on the methodology applied to identify GHG emissions from international aviation and navigation in the scope of the EU NDC, which are added to the national totals from the EU GHG inventory, are given in Annex 2 to this BTR.

Under the Governance Regulation each Member State must report to the Commission biennially on the status of implementation of its integrated national energy and climate plans (NECPs). This process allows the Commission to ensure that the EU and the Member States remain on track to achieve the climate-neutrality objective and progress on adaptation. Under the Governance Regulation, Member States operate national systems for policies, measures and projections and submit standardised information, which is subject to quality assurance and quality control. Based on the data submitted, the EEA compiles projections of GHG emissions and removals for the EU. This EU-wide information is summarised annually in the Climate Action Progress Report⁷⁷ by the European Commission and in the 'Trends and projections' report by the EEA.⁷⁸ Both the Union and the national systems are subject to continuous improvements.

Institutional arrangements for tracking progress in Estonia

At national level the monitoring and regular evaluation of policies and measures adopted and aiming to contribute to achievement of the set objectives and also GHG emission reduction targets is performed by the institution that is implementing the relevant strategy document or action plan.

⁷⁴ Chapter II of the annex to decision 18/CMA.1. [www] <https://unfccc.int/documents/193408>; and decision 5/CMA.3, <https://unfccc.int/documents/460951>. (09.12.2024)

⁷⁵ 2006 IPCC Guidelines for National Greenhouse Gas Inventories. [www] <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>; and on a voluntary basis: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. [www] <https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/>. (09.12.2024)

⁷⁶ European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, <https://publications.jrc.ec.europa.eu/repository/handle/JRC137809>.

⁷⁷ EU Climate Action Progress Report 2024. [www] https://climate.ec.europa.eu/document/download/7bd19c68-b179-4f3f-af75-4e309ec0646f_en?filename=CAPR-report2024-web.pdf (09.12.2024)

⁷⁸ Trends and Projections in Europe 2024. [www] <https://www.eea.europa.eu/en/analysis/publications/trends-and-projections-in-europe-2024> (20.12.2024)

Estonia's long-term **General Principles of Climate Policy until 2050 (GPCP 2050)**⁷⁹ is a vision document setting the long term GHG emissions reduction target and policy guidelines for adapting to the impact of climate change or ensuring the preparedness and resilience to react to the impact of climate change. Regarding tracking progress for the targets set in the GPCP 2050, the Government presents to the Riigikogu a report on considering the main principles of the climate policy in the preparation and implementation of cross-sectoral and sectoral strategies at least once in every four years. Such report for the years 2017-2021 was presented to Riigikogu in the beginning of 2022⁸⁰.

Goals set in Estonia's long term strategy **Estonia 2035** are monitored annually. Every member of the Government gives once a year an overview to Riigikogu on the activities in his field and plans to move towards the country's long-term goals set within the framework of the Estonia 2035 strategy, including the Minister of Climate on Estonia's 2050 climate neutrality goal. This process gives members of the Riigikogu the opportunity to get an overview of the main trends in all policy areas during the year.

Also, the Ministry of Climate has introduced the bill of **Estonian Climate Resilient Economy Act**⁸¹ to the Government in late 2024. In the Climate Resilient Economy Act that has been proposed, sector-wide and sector-specific emission reduction goals are set to ensure a smooth trajectory to reach climate neutrality by 2050. Setting Estonia's goals is based on the climate targets of the European Union, which are set for the years 2030 and 2050 in accordance with the Paris Agreement, and the pace of emission reduction that can be achieved with existing technologies. European Union requirements impose national emission reduction obligations in the Effort Sharing Regulation and the LULUCF regulation sectors.

In the current bill of the Estonian Climate Resilient Economy Act, a separate chapter for monitoring on Estonia's progress towards domestic climate change mitigation and adaptation targets though a separate climate report is foreseen. The climate report shall be prepared once a year and shall include the following: data from the national greenhouse gas emission inventory; an assessment of the achievement of climate change mitigation objectives; and an assessment of the achievement of climate change adaptation objectives. At least every other year, the climate report shall additionally include a national greenhouse gas emission projection and at least every fifth year an assessment of competitiveness and an overview of the relevance and adequacy of climate change mitigation and adaptation objectives. At least every tenth year, the climate report shall also include an assessment of climate risks.

This climate report shall be prepared by the end of first quarter of each year and shall be sent to the Climate Council⁸² for assessment. The Climate Council shall provide an assessment within two

⁷⁹ General Principles of Climate Policy until 2050 (2017). [www] <https://kliiaministeerium.ee/sites/default/files/documents/2023-03/310022023003%20%281%29.pdf> (09.12.2023)

⁸⁰ Ministry of Climate (2022). Ülevaade „Kliimapolitika põhialused aastani 2050“ elluviimisest I aruanne Periood 2017-2021. [www] <https://kliiaministeerium.ee/sites/default/files/documents/2022-07/Kliimapolitika%20p%C3%B5hialuste%20I%20aruanne.pdf> (06.12.2024)

⁸¹ Ministry of Climate. Estonian Climate Resilient Economy Act. [www] <https://kliiaministeerium.ee/esti-kliimaseadus> (20.12.2024)

⁸² Kliimanõukogu. [www] <https://xn--kliimanukogu-xib.ee/> (09.12.2024)

months of the submission of the report. The minister responsible for the area shall submit the climate report together with the assessment of the Climate Council to the Government after which the Government shall submit the climate report to the Parliament where the Climate Council shall present the assessment prepared.

Based on the climate report, development plans and action programs will be updated, as needed, to ensure the achievement of climate change mitigation and adaptation objectives and proposals shall be made, if necessary, for the adjustment of climate change mitigation and adaptation objectives or measures or for the setting of additional or new climate targets.

3.1.2.2 Institutional arrangements for implementation of the NDC

The EU and its Member States have set up a comprehensive system for the implementation of the EU climate change mitigation targets. The European Climate Law⁸³ sets the goal of climate neutrality by 2050 and the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. This target for 2030 corresponds to the target of the EU NDC.

To ensure that the EU and its Member States achieve their target, the 2030 Climate and Energy Framework was put in place. The main policies of this framework are the EU Emissions Trading System (EU ETS)⁸⁴, which caps GHG emissions in energy, industry, aviation and maritime transport; the LULUCF Regulation which includes national net removal targets for the LULUCF sector; and the Effort Sharing Regulation (ESR) which establishes national reduction targets for GHG emissions not covered by the EU ETS or the LULUCF Regulation i.e. domestic transport (excluding aviation), buildings, agriculture, small industry and waste. The implementation of the ESR is supported by additional sectoral policies and measures (details can be found in this BTR in the chapter on mitigation policies and measures). The legislative acts under the 2030 Climate and Energy Framework require the European Commission and the EU Member States to set up the institutional arrangements for implementing the specific policies and measures.

The revised EU ETS Directive increases the level of ambition in the existing system from 43% to 62% emissions reductions by 2030, compared to 2005 levels and extend the system to also apply to international maritime transport. A separate carbon pricing system will apply to fuel combustion in road transport and buildings and small-emitting sectors (ETS2) with a 42% emission reduction target compared to 2005 across the sectors covered. The amended Effort Sharing Regulation (ESR) increased, for the sectors that it covers, the EU-level GHG emission reduction target from 29% to 40% by 2030, compared to 2005, which translates in updated 2030 targets for each Member State.

⁸³ Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'). [www] <http://data.europa.eu/eli/reg/2021/1119/oj>. (09.12.2024)

⁸⁴ This refers to the ETS1, i.e. the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (chapter II of the ETS Directive). Note that the 'Emissions trading system for buildings, road transport and additional sectors' (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

The new LULUCF Regulation sets an overall EU-level objective of 310 Mt CO₂ equivalent of net removals in the LULUCF sector in 2030.

The ESR sets national targets for the reduction of GHG emissions in the Member States by 2030. Member States are also subject to gradually decreasing annual emission limits for each year from 2021 to 2030. The annual progress towards the national targets under the Effort Sharing Legislation is assessed by comparing GHG emission levels from the sectors covered by the ESR with the relevant annual emission allocations under the legislation (AEAs). To achieve compliance under the ESR, Member States are permitted to use flexibility options to a certain extent.

Progress in the implementation of these policies and measures is monitored under the Governance Regulation. Relevant information which is reported regularly and archived at the EEA include GHG inventories, approximated GHG inventories for the previous year, information on policies and measures, projections, and progress towards the implementation of integrated National Energy and Climate Plans (NECP). This information helps the EU and its Member States to correct their course if progress towards the targets of the 2030 Climate and Energy Framework is behind schedule. As an example, the European Commission assesses the drafts of new or updated NECPs and provides recommendations for improved planning and implementation. In addition, the reported information is subject to quality checks, and the GHG inventories reported by EU Member States are subject to comprehensive reviews in 2025, 2027 and 2032.⁸⁵

All EU legislation, including the legislation under the 2030 Climate and Energy Framework, is subject to a stakeholder engagement process. So-called ‘better regulation tools’ ensure that policy is based on evidence and the best available practice⁸⁶. During the preparation of legislative proposals, the European Commission invites citizens, businesses and stakeholder organisations to provide their views on the subject of the new legislation. These comments are documented in a dedicated portal⁸⁷, and the European Commission reports on how it takes these comments into account in the development of the legislative proposals. Furthermore, the Governance Regulation sets requirements for Member States to ensure that the public is given early and effective opportunities to participate in the preparation of the NECPs.

Institutional arrangements for implementation of the NDC in Estonia

As an EU Member State, Estonia contributes to the implementation of the European Union’s NDC (see paragraph 3.2) by designing and implementing its policies in the framework of EU directives, regulations, decisions and recommendations.

⁸⁵ Consolidated text (2023) of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action. [www] <https://eur-lex.europa.eu/eli/reg/2018/1999/2023-11-20> (20.12.2024)

⁸⁶ Decision-making process. [www] https://ec.europa.eu/info/strategy/decision-making-process/how-decisions-are-made_en (20.12.2024)

⁸⁷ Have your say – Public consultation and feedback. [www] https://ec.europa.eu/info/law/better-regulation/have-your-say_en (20.12.2024)

Estonia is currently in the process of preparing its first Climate Resilient Economy Act that covers the whole economy to set a clear path to meet the climate neutrality target by 2050 as well as to ensure the fulfilment of 2030 targets under the EU Fit for 55 package.

In the bill of the Climate Resilient Economy Act sector-wide and sector-specific goals have been proposed to ensure a smooth trajectory to reach climate neutrality by 2050. Setting Estonia's goals is based on the climate targets of the European Union, which are set for the years 2030 and 2050 in accordance with the Paris Agreement, and the pace of emission reduction that can be achieved with existing technologies. European Union requirements impose national emission reduction obligations in the Effort Sharing Regulation and LULUCF regulation sectors and implementation of the European Union emission trading scheme.

According to the bill public sector has an obligation to take into account the principles and objectives of climate change mitigation and adaptation, the climate risk report and, to the extent possible, the climate change mitigation and adaptation objectives set out in the Climate Resilient Economy Act, when preparing and implementing plans, strategic development documents and action plans; in the procurement procedure; and to take other appropriate measures to achieve these objectives.

The state is obliged to prepare a national energy and climate plan to achieve the climate change mitigation and adaptation objectives set out in this Climate Resilient Economy Act. Also, local governments are obliged to prepare local energy and climate plans in order to support achieving the climate change mitigation and adaptation objectives set out in this Act.

3.2. Description of the Nationally Determined Contribution

Under their updated NDC⁸⁸ the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The term ‘domestic’ means without the use of international credits.

The NDC consists of a single-year target, and the target type is ‘economy-wide absolute emission reduction’. The scope of the NDC covers the 27 Member State of the EU. Details on the EU NDC can be found in [Table 3.1](#).

⁸⁸ The update of the nationally determined contribution of the European Union and its Member States. [www] <https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf>. (20.12.2024)

Table 3.1 Description of the NDC of the EU

Information	Description
Target and description	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term ‘domestic’ means without the use of international credits.
Target type	Economy-wide absolute emission reduction.
Target year	2030 (single-year target)
Base year	1990
Base year value	Net greenhouse gas emissions level in 1990: 4 699 405 kt CO ₂ eq.
Implementation period	2021-2030
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)).
Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. International Aviation: emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO ₂ emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC, these comprise emissions in 2024-26 from flights between the EU Member States and departing flights to Iceland, Norway, Switzerland and the United Kingdom. International maritime navigation: waterborne navigation is included in respect of CO ₂ , methane (CH ₄) and nitrous oxide (N ₂ O) emissions from maritime transport journeys between the EU Member States.
Gases	Carbon Dioxide (CO ₂), Methane (CH ₄), Nitrous Oxide (N ₂ O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF ₆), Nitrogen trifluoride (NF ₃)
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	The EU’s at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Note: This table is identical to table ‘Description of a Party’s nationally determined contribution under Article 4 of the Paris Agreement, including updates,’ which has been submitted electronically together with this BTR. This table is also annexed to this BTR. *Source: Updated NDC of the EU⁸⁸*

3.3. Indicator, definitions, methodologies and structured summary

3.3.1 Indicator

For the tracking of progress towards implementing and achieving the NDC of the EU, an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen indicator is ‘annual total net GHG emissions consistent with the scope of the NDC in CO₂ eq’. Table 3.2 provides more information on this indicator.

Table 3.2 Indicator to track progress

Information	Description
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO ₂ eq.
Reference level and base year	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 699 405 kt CO ₂ eq.
Updates	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the EU GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope.
Relation to the NDC	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.
Definitions	Definition of the indicator ‘annual total net GHG emissions in CO ₂ eq’: Total net GHG emissions correspond to the annual total of emissions and removals reported in CO ₂ equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled ‘Reporting format for the description of a Party’s nationally determined contribution under Article 4 of the Paris Agreement, including updates.’ Indirect CO ₂ emissions are included from those Member States that report these emissions.

Note: The information in this table is identical to the information in Common Tabular Format (CTF) tables 1 (‘Description of selected indicators’) and 2 (‘Definitions needed to understand the NDC’), which were submitted electronically together with this BTR. *Source: The reference level is based on the Annual European Union GHG inventory 1990-2022.*

3.3.2 Methodologies and accounting approach

The EU use the following accounting approach for tracking progress towards the joint EU NDC: annual GHG data from the national GHG inventory of the EU, complemented for international aviation and navigation with estimations from the Joint Research Centre’s Integrated Database of the European Energy System⁷⁶. The total net GHG emissions are provided in the scope of the EU NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. The EU will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

Details on methodologies and accounting approaches consistent with the accounting guidance⁸⁹ under the Paris Agreement can be found in CTF table 3 ('Methodologies and accounting approaches'), which was submitted electronically together with this BTR.

3.3.3 Structured summary – status of progress

An important purpose of the BTR is to demonstrate where the EU and its Member States stand in implementing their NDC, and which progress they have made towards achieving it. The most recent information on GHG emissions and removals in the scope of the NDC constitutes the key information for tracking this progress. Table 3.3 summarises the current status of progress.

Table 3.3 Summary of progress towards implementing and achieving the NDC

	Unit	Base year value	Values in the implementation period			Target level	Target year	Progress made towards the NDC
			2021	2022	2030			
Indicator: total net GHG emissions consistent with the scope of the EU NDC	kt CO ₂ eq	4 699 405	3 272 650	3 205 223	NA	(55% below base year level)	2030	The most recent level of the indicator is 31.8% below the base year level.

NA: Not Applicable.

Note that an annual emissions balance consistent with chapter III.B (Application of corresponding adjustment) will be provided in a subsequent BTR upon finalisation of relevant further guidance by the CMA, based on the annual information reported under Article 6.2.

Note: More detailed information can be found in CTF table 4 ('Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement'), which has been submitted electronically together with this BTR. *Source: The indicator values are based on the Annual European Union GHG inventory 1990-2022.*

Based on the GHG inventory data and data on international aviation and navigation for 2022, the EU and its Member States reduced net GHG emissions by 31.8% compared to 1990. The EU and its Member States made progress towards implementing and achieving their NDC. The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030.

⁸⁹ Decision 4/CMA.1, Further guidance in relation to the mitigation section of decision 1/CP21, <https://unfccc.int/documents/193407>.

3.4. Mitigation policies and measures

3.4.1 Introduction

As a European Union Member State, Estonia also contributes to the achievement of EU's GHG emission reduction target of at least 55% in 2030 compared to 1990 levels and to reach climate neutrality by 2050, by designing and implementing its policies in the framework of EU directives, regulations, decisions and recommendations.

This chapter provides information on the Estonian general strategy documents as well as national key policies and measures implemented to reduce GHG emissions.

Policies and measures with a substantial impact on multiple climate sectors are described in the section on cross-sectoral policies and measures. In the sectoral chapters, focus is on those sectoral policies and measures that have the most significant impact on GHG emissions or removals and those impacting key categories in the national GHG inventory.

More detailed information on those cross-sectoral and sectoral policies and measures with the most significant impact on GHG emissions or removals and those impacting key categories in the national GHG inventory are presented in CTF Table 5.

3.4.2 General climate policy context

On 12 May 2021, the Parliament adopted Estonia's development strategy **Estonia 2035**⁹⁰. The strategy sets out five long-term strategic goals that are value-based goals which are the basis for making the country's strategic choices and to the implementation of which all Estonian strategic development documents contribute. They are also taken into account in the state budget strategy and in the preparation of the government's action programme. In order to reach the goals, it is necessary to take into account Estonia's development needs, global trends, the policy framework of the European Union, and the global objectives of sustainable development.

According to the strategy, by 2050, Estonia will be a competitive, climate-neutral country with a knowledge-based society and economy and a high quality and species-rich living environment, willing and able to reduce the adverse effects of climate change and make the best use of its positive aspects. Coordinated development of the cultural, social, environmental and economic fields is a prerequisite for achieving the goals of sustainable development. In Estonia, knowledge-based decisions are made, with effective and innovative approaches being preferred when choosing solutions.

⁹⁰ Estonia 2035 (2021). [www] https://valitsus.ee/sites/default/files/documents/2021-11/Eesti%202035_PUHTAND%20%C3%9CLDOSA_210512_ENG_0.pdf (09.12.2024)

The **Estonia 2035 Action Plan** is updated annually, if necessary, by the government based on domestic events affecting the development of Estonia and changes in the foreign environment. The Estonia 2035 action plan is also the Estonian reform plan submitted within the framework of the European Semester for the coordination of economic policies. The current action plan was approved by the government on April 25, 2024⁹¹.

Estonia's long-term **General Principles of Climate Policy until 2050 (GPCP 2050)**⁷⁹ is a vision document setting the long term GHG emissions reduction target and policy guidelines for adapting to the impact of climate change or ensuring the preparedness and resilience to react to the impact of climate change. In February 2023, the Parliament adopted an amendment to the long-term target in accordance with the 2050 climate neutrality goal set in Estonia's development strategy Estonia 2035. Estonia's long-term goal according to the GPCP 2050 is to balance GHG emissions and sequestration by 2050 at the latest, i.e. reduce net greenhouse gas emissions to zero by then.

In September 2023, the process of development of the Estonian **Climate Resilient Economy Act**⁸¹ was launched, which from 2025 onwards will provide a framework for all Estonian law-making and help turn a smaller environmental footprint and climate-friendly economy into Estonia's competitive advantage in the future. In the bill of the Climate Resilient Economy Act, sector-wide and sector-specific goals are set to ensure a smooth trajectory to reach climate neutrality by 2050. Sector-specific goals are set for the energy, industry, buildings, transport, agriculture, waste and land use sectors. Setting specific sector-based targets is necessary to ensure greater legal clarity and thus investment security.

Targets set in the bill of the Climate Resilient Act are based on public consultation and the climate targets of the European Union, which are set for the years 2030 and 2050 in accordance with the Paris Agreement, and the pace of emission reduction that can be achieved with existing technologies. European Union requirements impose national emission reduction obligations in scope of the Effort Sharing Regulation⁹² as well as for the LULUCF regulation⁹³.

Estonia's **2030 National Energy and Climate Plan (NECP 2030)**⁹⁴ is a communication that has been drawn up to meet the requirement laid down in Article 3(1) of Regulation (EU) No 2018/1999 on the Governance of the Energy Union and Climate Action⁷³. NECP 2030 includes both measures from national development documents and measures under discussion. NECP 2030 has been drawn up jointly by the Ministry of Economic Affairs and Communications, the Ministry of Climate and the Ministry of Regional Affairs and Agriculture based on the development documents and studies referred to above and other relevant analysis.

⁹¹ Estonia 2035 Action Plan (updated 25.04.2024). [www] https://valitsus.ee/sites/default/files/documents/2024-04/Eesti%202035%20tegevuskava_25.04.2024.pdf (09.12.2024)

⁹² Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, as amended. [www] <http://data.europa.eu/eli/reg/2018/842/2023-05-16>. (09.12.2024)

⁹³ Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from land use, land-use change and forestry in the 2030 climate and energy framework, as amended- [www] <https://eur-lex.europa.eu/eli/reg/2018/841/2023-05-11> (09.12.2024)

⁹⁴ Ministry of Climate, National Energy and Climate Plan 2030. [www] <https://kliimaministeerium.ee/energeetika-maavarad/energiapolitika/energia-ja-kliimakava> (20.12.2024)

3.4.3 Cross-sectoral policies

The main policies of the **EU 2030 Climate and Energy Framework** are the *EU Emissions Trading System (EU ETS)*⁹⁵, the *LULUCF Regulation* and the *Effort Sharing Regulation (ESR)*, which establishes national reduction targets for GHG emissions not covered by the EU ETS or the LULUCF Regulation.

The European Union Emissions Trading System (EU ETS)⁹⁶ is one of the key policy instruments implemented in the EU to achieve its climate objectives. The legislative framework of the EU ETS for its new trading period (phase 4 in 2021–2030) was revised in early 2018 to enable it to achieve the EU's 2030 emission reduction targets and as part of the EU's contribution to the Paris Agreement. According to the revision, the pace for annual reductions in allowances increased to 2.2% as of 2021. The share of Estonia's EU ETS emissions from all sectors is high – in 2022 about 60% (without LULUCF), according to Estonia's 2024 GHG inventory submission to the UNFCCC.³⁴

Emissions from sectors not covered by the EU ETS, i.e. under the so-called **Effort Sharing Regulation** (transport, agriculture, waste management and industrial processes, and small-scale power generation in installations with a nominal capacity of less than 20 MW) will have to be reduced by 40% by 2030 compared to 2005 levels in the European Union. The Effort Sharing Regulation establishes binding emission reduction targets for Member States of the European Union for the period 2021-2030 in sectors outside the scope of the EU ETS. Under the regulation, Estonia aims to reduce greenhouse gas emissions in the abovementioned sectors by 24% by 2030 compared to 2005 emission levels. It is up to each Member State to decide how these targets will be achieved, which national policies and measures are needed to fulfil the targets.

The Land Use, Land Use Change and Forestry (LULUCF) Regulation has an overall EU-level target of 310 Mkt CO₂ eq. net removals in the LULUCF sector by 2030. In addition, the LULUCF sectors are subject to the principle that Member States must ensure compliance with the no-debit rule in 2021-2025, i.e. the emissions of the sector must be offset by equivalent removals. However, for the period 2026-2029, Member States will be set a GHG removal budget (in 2025) and a relative target for LULUCF removals by 2030. Estonia will need to increase its GHG removals by 0.434 Mt CO₂ eq. by 2030 compared to the baseline level (average for 2016–2018).

The Estonian Recovery and Resilience Plan⁹⁷ is one of the annexes to the national strategy **Estonia 2035**, focusing on the objectives, reforms and investments financed from the Recovery and Resilience Facility. The aim is to contribute to the decarbonisation of Estonia's energy sector, to reduce the dependency on oil shale, incentivize uptake of renewable energy and improve the energy efficiency of buildings.

⁹⁵ This refers to the ETS1, i.e. the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (chapter II of the ETS Directive). Note that the 'Emissions trading system for buildings, road transport and additional sectors' (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

⁹⁶ EU Emissions Trading System [www] https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/scope-eu-ets_en (09.12.2024)

⁹⁷ Estonia's recovery and resilience plan (2023). [www] <https://pilv.rtk.ee/s/kwzABsf9cJY4mmb> (09.12.2024)

The European Commission endorsed **Estonia’s territorial just transitions plan** on 4 October 2022 (amended in September 2024).⁹⁸ The general objective of the plan is to enable the transition to a climate-neutral economy in Ida-Virumaa in a way that ensures the well-being of the local community, while supporting businesses in identifying and implementing new business opportunities linked to the transition.

Excise duty

Excise duties under the **Energy tax measure** (in Table 3.4) are one of the fiscal measures in Estonia with an impact on GHG emissions.

Table 3.4. Excise tax on fuels and electricity (as of November 2024)

Fuel/energy type	Unit	EUR/unit
Unleaded petrol	1,000 l	563
Leaded petrol	1,000 l	563
Aviation spirit	1,000 l	563
Kerosene	1,000 l	330.1
Diesel oil	1,000 l	399
Diesel oil for specific purposes	1,000 l	21 ¹
Light heating oil	t	399
Heavy fuel oil	t	456
Heavy fuel oil ²	t	58
Shale-derived fuel oil	t	447
Shale-derived fuel oil ³	t	57
LPG (used as heating fuel)	t	65.01
LPG (used as motor fuel)	t	193
Natural gas (used as heating fuel)	1,000 m ³	47.81
Natural gas (to a gas-intensive undertaking with a permit for exemption from excise duty)	1,000 m ³	11.30
Motor natural gas (which is used as motor fuel, including in stationary engines)	1,000 m ³	41.83
Motor natural gas in liquefied form (which is used as used as motor fuel, including in stationary engines)	1,000 kg	58.34
Solid fuels (coal, brown coal, coke, oil shale; heat production)	GJ (GCV)	0.93
Electricity	MWh	1.45
Electricity (to an electro-intensive undertaking with a permit for exemption from excise duty)	MWh	0.5

⁹⁸Estonia’s territorial just transitions plan (2024). [www] https://idavirufond.ee/sites/default/files/documents/2024-10/EE_TJTP_muudetud_EK-kinnitatud-2024-09-26.pdf (09.12.2024)

Pollution charges

Pollution charges are a second fiscal measure in Estonia with an impact on GHG emissions. The government's tax policy is based on objectives aimed at reducing environmental impact by increasing the rates of charges on pollution and resource use.

The Environmental Charges Act (2006)⁹⁹ provides the grounds for determining the natural resource charges, the rates of the pollution charge, the procedure for calculation and payment thereof, and the grounds and specific purposes for using state budget revenue obtained from environmental use. Environmental charges are established and imposed based on the need for environmental protection, the economic and social situation of the state and, in the events specified in this Act, also based on the value created by natural resources subject to the charge as well as the purpose and manner of use of the environment. A mineral resource extraction charge that exceeds the minimum rates provided for in this Act is established based on the state's goal of earning revenue. In the case of an energy mineral resource, the added value generated by the energy mineral resource is relied upon in addition to the goal of earning revenue. In Estonia a pollution charge for releasing CO₂ into the ambient air was introduced in the year 2000. Currently, the Environmental Charges Act obliges the owners of combustion equipment to pay pollution charges for several pollutants emitted into the air. The pollution charge in the case of emissions into ambient air must be paid by all enterprises that are required to have an air pollution permit. The air pollution permit is obligatory for all enterprises which own and operate combustion equipment (utilising solid, liquid or gas fuel) with a rated capacity equal to or higher than 1 MWth in one location. Thermal power producers pay a pollution charge for the CO₂ emissions into the ambient air based on the quantity of CO₂ emitted into the environment upon the amount of CO₂ emitted. The CO₂ charge is 25 EUR/t for the companies/installations not included in the European Union emission trading scheme. Installations that emit sulphur oxide, carbon monoxide, particles, except heavy metals and compounds of heavy metals, nitrogen oxides, volatile organic compounds, heavy metals and compounds of heavy metals into the ambient air also pay a pollution charge. CH₄ and fluorinated gases (HFC – hydrofluorocarbons, PFC and SF₆) are not subject to pollution charges.

As an exception, the Environmental Charges Act provides an option of substituting the pollution charge (incl. the CO₂ charge) with environmental investment by enterprises. The obligation to pay the pollution charge is substituted by the obligation to finance environmental protection measures for pollutants or types of waste whose quantity is reduced by at least 15% by the planned environmental protection measures.

In 2024 the Environmental Charges Act was amended by including also a deforestation charge in the act, please see additional information on this under chapter 3.4.4.5 *Land-use, land-use change and forestry (LULUCF)*.

⁹⁹ The Environmental Charges Act (2006). [www] [Environmental Charges Act–Riigi Teataja](#) (09.12.2024)

3.4.4 Sectoral policies and measures

3.4.4.1 Energy

The following chapter includes policies and measures for electricity supply, heat supply, energy consumption – commercial/institutional and residential sectors and energy consumption – and manufacturing industries. In the energy sector GHG emissions are mainly reduced through policies and measures that support achieving higher energy efficiency as well as shifting to zero or low emission alternative fuel use.

The Government of Estonia approved the **Estonian Energy Development Plan until 2030** (ENMAK 2030) in 2017.¹⁰⁰ The current ENMAK 2030 aims to consume renewable energy in a volume that would be at least 50% of the final energy consumption by 2030 (~16 TWh).

Since the European Union is increasing its renewable energy targets, Estonia has taken a major step towards more ambitious targets in 2022 with an amendment to the **Energy Sector Organisation Act (2016)**¹⁰¹, according to which by 2030 renewable energy must be at least 100% of gross final consumption of electricity. Thus, the production of electricity from oil shale will gradually decrease at the same time as ensuring that there is a certain degree of controllable generation capacity. Also, by 2030, renewable energy must account for at least 65% (~20.4 TWh) of national gross final energy consumption.

The objectives of the sectors set out in the Energy Sector Organisation Act by 2030 are as follows:

- **electricity:** at least 100% renewable energy in gross final consumption of electricity;
- **transport:** renewable energy used in road and rail transport accounts for at least 14% of total energy consumed in transport;
- **heat:** at least 63% renewable energy in gross final consumption of heat.

The Government of Estonia is currently updating the ENMAK 2030. The renewed **Energy Development Plan until 2035**¹⁰² aims to update the trends, goals and activities of the energy economy included in the ENMAK 2030. It will also include the development vision, goals, bottlenecks and policy instruments of the Estonian energy economy in moving towards climate-neutral energy production and consumption and ensuring energy security. The planned approval of the renewed Energy Development Plan until 2035 is set for the year 2025.

Several measures affecting the energy sector (incl. building sector), with estimated highest GHG reduction impact (in kt CO₂ eq.), are presented in CTF table 5.

¹⁰⁰ Estonian Energy Development Plan until 2030 (2017). [www] <https://kliimaministeerium.ee/sites/default/files/documents/2023-07/Energiamajanduse%20arengukava%20aastani%202030.pdf> (09.12.2024)

¹⁰¹ Energy Sector Organisation Act (2016). [www] <https://www.riigiteataja.ee/en/eli/517112024001/consolide> (09.12.2024)

¹⁰² Ministry of Climate. Energiamajanduse arengukava (ENMAK). [www] https://kliimaministeerium.ee/energiamajanduse_arengukava (09.12.2024)

Electricity supply

The Electricity Market Act (2005)¹⁰³ governs the generation, storage, transmission, sale, export, import and transit of electricity and the economic and technical management of the power system. This Act prescribes the principles of the operation of the electricity market, based on the need to ensure an effective supply of electricity, which is provided at a reasonable price, meets environmental requirements and the needs of consumers, and the utilization of energy sources in a balanced manner, in an environmentally clean way and with a long-term perspective. The act states that electricity undertakings shall always facilitate activities performed by consumers for the purpose of conserving electricity. Pursuant to §59 of the Electricity Market Act, support is paid to the electricity producer in order to meet the 2030 goal of electricity production from renewable energy sources (100%) (see [Table 3.5](#)).

Table 3.5. Support for renewable and efficient combined heat and power (CHP) based electricity production

Level of subsidy	Conditions for receiving the subsidy
	Subsidies are paid for electricity that is produced:
0.0537 €/kWh	Electricity generated from a renewable energy source except biomass if the net capacity of the production machinery does not exceed 125 MW
0.0537 €/kWh	From biomass in CHP mode. From 1 July 2010, producers who have started generating electricity from biomass can only get the subsidy for electricity generated in efficient CHP mode
0.032 €/kWh	In efficient CHP mode from waste as defined in the Waste Act, peat or oil shale retort gas
0.032 €/kWh	In efficient CHP mode using generating equipment with a capacity of not more than 10 MW

Electricity supply WEM scenario measures that affect the reduction of GHGs the most are connected to the Electricity Market Act. From its support more renewable and efficient CHP-based electricity production have been introduced. In addition, the act helps to increase the share of solar and wind power in electricity production (see CTF Table 5).

In addition to the WEM scenario measures, there are measures, which directly or indirectly help implement the WEM scenario measures. To support achieving those goals, measures like investment in a compensation measure in Northeast Estonia, acquisition of air surveillance radars, preliminary development of offshore wind farm, green procurements and reinforcement of the electricity grid will help more renewable energy to be introduced to the Estonian electricity system.

Renewable energy

Estonia's renewable energy trajectory derives from national renewable energy targets that are more ambitious than the targets set in the Directives ((EU) 2018/2001 and (EU) 2018/1999) agreed at

¹⁰³ Electricity Market Act (2005). [www] <https://www.riigiteataja.ee/en/eli/ee/528082014005/consolide/current> (09.12.2024)

European Union level, with an overall EU target of 42.5% + a possible 2.5% and a domestic target of 65%, including Estonia's renewable energy trajectory in line with milestones (at least 18% of the overall target in 2022, at least 43% of the overall target by 2025 and at least 65% of the overall target by 2027).

To support achieving this goal, measures like encouraging biomethane production, deployment of hydrogen technologies, accelerating the introduction of renewable electricity and a green fund are being implemented (see CTF Table 5).

Heat Supply

The District Heating Act (2003)¹⁰⁴ governs activities related to the production, distribution and sale of heat by way of district heating networks and connection to district heating networks.

In the past few years, a continuous transition to renewable sources has been happening in the heating sector. More and more boiler houses and cogeneration plants have switched to renewable fuels, and according to 2023 data, the share of renewable energy and waste heat in district heating was about 75%¹⁰⁵, of which 93% have received the label of efficient district heating.

Heat supply WEM scenario measures, which have the largest effect on GHG reduction, are connected to renovation of depreciated and inefficient heat pipelines, renovation of district heating boilers and fuel change and fuel oil boiler replacement with heating system renovation in households (see CTF Table 5).

Energy use in buildings

The housing and energy sector are very closely related, as the energy demand of buildings is an important part of Estonia's energy balance. In 2022, the energy consumption of buildings in Estonia made up 53%¹⁰⁶ of the total energy balance and therefore improvement of energy efficiency in the residential and tertiary sectors has an important role from the emissions reduction aspect.

In Estonia, policies implemented to improve energy efficiency increasingly lead to the adoption of energy-efficient buildings and the renovation of buildings to be more energy-efficient to reduce energy dependence and greenhouse gas emissions of the housing sector. Renewable energy solutions must be applied in making buildings more energy efficient, where possible and be based on the aspect of cost effectiveness.

Here, the impact of EU Directive (EU) 2018/844 of the European Parliament and of the Council amending Directive 2010/31/EU on the energy performance of buildings and Directive

¹⁰⁴ District Heating Act (2003). [www] <https://www.riigiteataja.ee/en/eli/ee/520062017016/consolide/current> (09.12.2024)

¹⁰⁵ Energatälgud. Eesti üleminek süsinikuneutraalsele soojus- ning jahutusmajandusele aastaks 2050. [www] <https://energiatälgud.ee/node/8931> (09.12.2024)

¹⁰⁶ Riigikantselei. Hoone indikatiivse energiatõhususe klassi reaalajas määramine ning energiatõhususearu järelevalve automatiseerimine. [www] <https://riigikantselei.ee/hoone-indikatiivse-energiatõhususe-klassi-reaalajas-maaramine-ning-energiatõhususearu-järelevalve> (13.12.2024)

2012/27/EU on energy efficiency (EPBD)¹⁰⁷ should be highlighted as these set minimum energy efficiency requirements for buildings, which set total energy consumption limits for the building. In Estonia, the implementation of the EPBD is the responsibility of the MoC. The provisions of the EPBD have been transposed into the Building Code. The **Building Code (2015)**¹⁰⁸ promotes sustainable development and ensures the safety, purposeful functionality and usability of the built environment, which is supported by the **Minimum building energy efficiency requirements regulation (2019)**¹⁰⁹.

In 2020, the government approved a **long-term reconstruction strategy (REKS)**¹¹⁰, the main goal of which is to completely renovate all buildings built before 2000 in Estonia by 2050. The strategy presents a long-term vision for the reconstruction of buildings and describes the activities and their scope necessary to achieve the goal. Based on this, Estonia is planning and developing necessary support measures for the building sector.

Energy use in buildings WEM scenario measures, which have the largest effect on GHG reduction, are connected to renovation of public (municipal, governmental) buildings, private households and apartment buildings (see CTF Table 5).

Energy efficiency

Energy Sector Organisation Act (2017)¹⁰¹ provides measures for achieving the national target of energy efficiency, the principles for promoting renewable energy and the requirements for improving energy efficiency and the parties on whom obligations are imposed in the public as well as in the private sector.

The Product Conformity Act (2010)¹¹¹ sets out the competence of authorities participating in market surveillance and stipulates that the Technical Surveillance Authority must exercise state surveillance over compliance of household appliances, heating appliances and devices with energy efficiency, energy performance labels and ecological design requirements.

Energy efficiency WEM scenario measures (additionally to the ones concentrating on building reconstruction presented in previous sections), which have the largest effect on GHG reduction, are connected to decreasing energy consumption in industries, exchanging old lighting for LED lighting in street lighting and public spaces (see CTF Table 5).

In addition, there are measures and programmes, which directly or indirectly help implement the WEM scenario measures. These measures for example are support for energy- and resource audits in industries, energy storage pilot program, adoption of resource-efficient green technologies,

¹⁰⁷ Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings. [www] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202401275&pk_keyword=Energy&pk_content=Directive (09.12.2024)

¹⁰⁸ Building Code (2015). [www] <https://www.riigiteataja.ee/en/eli/ee/510102024002/consolide/current> (09.12.2024)

¹⁰⁹ Minimum building energy efficiency requirements regulation (2019). [www] <https://www.riigiteataja.ee/akt/105072023309?leiaKehtiv> (09.12.2024)

¹¹⁰ Ministry of Climate (2020). Long-term reconstruction strategy. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2023-06/Hoonete%20rekonstrueerimise%20pikaajaline%20strateegia.pdf> (09.12.2024)

¹¹¹ Product Conformity Act (2010). [www] <https://www.riigiteataja.ee/en/eli/ee/515042021005/consolide/current> (09.12.2024)

energy taxes to support the continuity of local production and the change of business models, so that the products of Estonian production companies meet the goals of environmental and climate neutrality and are competitive in export markets.

Methodologies and assumptions used to estimate the GHG emission reductions or removals

In the energy sector, methodologies for estimating GHG emission reduction of policies and measures focus on calculating the impact through energy savings and/or the fuel exchange from fossil fuels to renewables. This kind of information is retrieved from institutions (e.g. ministries) responsible for the measures. Also, studies carried out in Estonia are used as input source for impact estimations. Assumptions about used fuel types and carbon content are taken from the national inventory datasets as they are particularly critical for accurate emissions estimates, as the national inventory defines the base year. Ultimately, rigorous methodologies and conservative assumptions help to ensure that reported GHG reductions in the energy sector are both realistic and credible, providing a sound basis for measuring and verifying climate benefits.

3.4.4.2 Transport

The main strategic development document for the transport sector in Estonia is the **Transport and Mobility Development Plan 2021–2035**¹¹², which focus is to reduce the environmental footprint of the transport means and system to contribute to the achievement of climate goals by 2050. In order to manage people’s behavioral changes in the future, emphasis is placed on the ‘polluter pays’ principle and, among other things, to taxation of fuels according to their emission factors and energy content. Also, according to the development plan, it is necessary to introduce low-carbon fuels in all modes of transport.

For this development plan, the Ministry of Economic Affairs and Communications (now the Ministry of Climate) also commissioned a report from the International Transport Forum (ITF) “The Future of Passenger Mobility and Goods Transport in Estonia” (2020)¹¹³, the goal of which was to assess Estonia’s transport sector and give recommendations for future improvements from an external observer’s perspective.

In the Transport sector GHG emissions are mainly reduced through policies and measures that can be divided widely in four by supporting: 1) reduction of forced movements and transport needs; 2) the availability of sustainable modes of movement; 3) increase in the share of energy efficient vehicles and; 4) increase in the proportion of fuels with lower emissions.

¹¹² Ministry of Climate (2021). Transport and mobility development plan 2021–2035. [www] https://kliimaministeerium.ee/sites/default/files/documents/2023-09/Transpordi%20ja%20liikuvuse%20arengukava%202021-2035_EN%20%281%29.pdf (09.12.2024)

¹¹³ International Transport Forum (2020). The Future of Passenger Mobility and Goods Transport in Estonia. [www] https://www.oecd.org/en/publications/the-future-of-passenger-mobility-and-goods-transport-in-estonia_9db7333e-en.html (09.12.2024)

The Liquid Fuel Act (2003)¹¹⁴ provides the principles and procedure for handling liquid fuel, the liability for violations of this Act and the arrangements for exercising state supervision, with a view to ensuring the payment of taxes and guaranteeing the quality of the more widely used motor fuels. According to §2¹ of the Act the total energy content of the petrol, diesel and biofuel released for consumption, as well as of the electricity supplied for use in road transport, by the seller of fuel or by a person holding an authorization for the import of fuel, must include, as a total energy content of biofuels – or of biomethane, hydrogen or electricity supplied for final consumption – at the value, as a weighted average for the calendar year, of at least 7.5% by the end of that year.

As road transport emits the biggest share of GHGs in the Transport sector, a lot of measures focus on decreasing the GHG impact from road transport. The transport sector WEM scenario measures, which have the largest effect on GHG reduction, are connected to increasing the share of biofuels (including electricity) in private and public transport, increasing the number of departures of the public transport, modal shift but also decreasing travel time to decrease the usage of personal cars.

Although a lot of measures focus on decreasing the GHG impact from road transport, there are also measures being implemented that are directed towards railroad and domestic navigation. The focus in railroad is electrification and in domestic navigation replacing ferries, which run on diesel for alternative fuel (electricity/hydrogen) ferries.

A number of measures affecting the transport sector with estimated highest GHG reduction impact (in kt CO₂ eq.) are presented in CTF Table 5.

Methodologies and assumptions used to estimate the GHG emission reductions or removals

In the Transport sector, methodologies for estimating GHG emission reduction of policies and measures primarily focus on assessing changes in fuel consumption, vehicle efficiency and modal shifts due to new initiatives. Key assumptions include travel distances, fuel economy, and vehicle stock, which help estimate baseline emissions that would occur without interventions. Accurate reductions are calculated by incorporating factors such as improvements in vehicle technology, the adoption of alternative fuels, and shifts to lower-carbon modes of transport like public transit or cycling. Emission factors and the baseline fuel consumption of the sector are taken from the national inventory datasets, as they are particularly critical for accurate emissions estimates, as the national inventory defines the base year. By using standardized methodologies and conservative assumptions, transport sector estimates ensure a credible understanding of GHG reductions, providing clear insights into the effectiveness of sustainable transport projects.

3.4.4.3 Industrial processes and product use (IPPU)

Emissions from the IPPU sector are regulated by the duty for manufacturing industries to implement the best available technologies (BAT) (stipulated in the Industrial Emissions Act (IEA)

¹¹⁴ Liquid Fuel Act (2003). [www] <https://www.rigiteataja.ee/en/eli/ee/531032014004/consolide/current> (09.12.2024)

(2013)¹¹⁵ and Industrial Emissions Directive 2010/75/EU¹¹⁶. The purpose of the IEA is to achieve a high level of protection of the environment taken as a whole by minimizing emissions into the air, water and soil and the generation of waste in order to prevent adverse environmental impacts. In addition, the IEA determines industrial activities of high environmental hazard, provides the requirements for operation therein and liability for failure to comply with the requirements, and the organization of state supervision. A production plant must comply with the BAT. The requirements of the IEA include emission limit values, monitoring and emission reduction measures through the implementation of BATs if an environmental permit is issued. This does not result in an additional reduction of emissions because all production plants have to comply with BATs as they operate.

In the IPPU sector, the main measures having an effect on GHG emissions are the Bans and duties from the Regulation (EU) 2024/573¹¹⁷ on fluorinated greenhouse gases (F-gases) and Directive 2006/40/EC¹¹⁸ related to emissions from mobile air conditioners (MACs).

Regulation (EU) 2024/573 establishes a timeline for the gradual reduction of F-gases by 2050, which will be implemented through the implementation of a system of import quotas and bans/restrictions for new equipment that is placed on the EU market. The objectives are to significantly reduce fluorinated greenhouse gas emissions and replace fluorinated greenhouse gases with refrigerants with low GWP, limiting the total amount of the most important F-gases sold in the EU from 2015 onwards and phasing new F-gas down by 2050. To achieve this, a phase-down scheme of F-gases brought onto the EU market is stipulated, bans on placing on the market and servicing of certain equipment, (certification) duties for operators and servicing personnel, duty of collecting the gases from decommissioned equipment.

The objective of MACs Directive 2006/40/EC is to reduce F-gas emissions from passenger cars and vans by prohibiting the use of F-gases with a GWP of more than 150 times greater than carbon dioxide (CO₂) in new types of cars and vans introduced from 2011, and in all new cars and vans introduced to the market from 2017.

Methodologies and assumptions used to estimate the GHG emission reductions or removals

Impacts of different policies and measures in the IPPU sector were not estimated due to missing base parameters. The collective impact of the existing measures can be seen through the sector's projections as 2024 inventory submission data was used as the basis for calculations.

¹¹⁵ Industrial Emissions Act (2013). [www] <https://www.riigiteataja.ee/en/eli/ee/525022019001/consolide/current> (09.12.2024)

¹¹⁶ Consolidated text: Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial and livestock rearing emissions (integrated pollution prevention and control). [www] <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02010L0075-20240804> (09.12.2024)

¹¹⁷ Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014. [www] <https://eur-lex.europa.eu/eli/reg/2024/573/oj> (09.12.2024)

¹¹⁸ Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air conditioning systems in motor vehicles and amending Council Directive 70/156/EEC. [www] <https://eur-lex.europa.eu/eli/dir/2006/40/oj> (09.12.2024)

3.4.4.4 Agriculture

Development of the Agriculture sector and the implementation of various targeted measures are mostly governed by the **Common Agricultural Policy (CAP) Strategic Plan 2023–2027** (approved 11.11.2022)¹¹⁹ and Agriculture and Fisheries Strategy 2030 (AFS2030)¹²⁰. In addition, there are some measures from the **Estonian rural development plan 2014–2020** (ERDP 2014–2020)¹²¹ that are still applying as funding for the implementation of the measures was/is in place until 2023 and/or 2024.

The CAP Strategic Plan 2023–2027 includes four specific objectives, that also contain climate-related actions:

1. Contribute to climate change mitigation and adaptation, including by reducing GHG emissions and enhancing carbon sequestration, as well as promoting sustainable energy. This specific objective includes the following identified needs:
 - to prefer environmentally sustainable production, investments, solutions based on circular bioeconomy;
 - to increase carbon sequestration in soils and protect soil organic carbon stocks.
2. Foster sustainable development and efficient management of natural resources such as water, soil and air. This specific objective includes the following identified needs:
 - continued support for land improvement investments;
 - contribution to the use of agricultural practices that conserve surface and groundwater;
 - neutralization of acidic soils;
 - encouraging the development and introduction of environmentally friendly technologies;
 - development of environmental consulting;
 - implementation of the requirements and measures resulting from the air pollutant emission reduction programme;
 - maintenance of soil fertility.
3. Contribute to the protection of biodiversity, enhance ecosystem services and preserve habitats and landscapes.
4. Improve the response of EU agriculture to societal demands on food and health, including safe, nutritious and sustainable food, food waste, as well as animal welfare. This specific objective includes the following identified needs:

¹¹⁹ Estonia's Common Agricultural Policy (CAP) Strategic Plan 2023–2027. [www] https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans/estonia_en#documents (09.12.2024)

¹²⁰ Ministry of Regional affairs and agriculture (2021). Agriculture and Fisheries Strategy 2030. [www] <https://www.agri.ee/en/ministry-news-and-contact/ministry-regional-affairs-and-agriculture/agriculture-and-fisheries> (09.12.2024)

¹²¹ Ministry of Regional affairs and agriculture. Estonian rural development plan 2014–2020. [www] <https://www.agri.ee/en/estonian-rural-development-plan-erdp-2014-2020> (09.12.2024)

- increasing organic production in organic agriculture by reducing the processing of organic products as conventional products;
- diversity of agricultural and garden (horticultural) crops, availability of varieties suitable for local conditions;
- increasing livestock keepers' knowledge of livestock health and well-being in general.

A number of the CAP Strategic Plan 2023–2027 measures, with estimated highest GHG reduction impact (in kt CO₂ eq.) are presented in CTF Table 5.

Estonia's Recovery and Resilience Plan⁹⁷ supports increasing production and uptake of sustainable biogas and biomethane. Biomethane production from animal manure decreases the methane emissions from manure management in the Agriculture sector. Although, it is more customary each year to add larger amounts of biowaste-based substrates into the biogas reactor in addition to animal manure – this increases N₂O emissions from Agricultural Soils category as the digestate is afterwards used on the agricultural land as a fertilizer.

Regarding impact on the environment, the **Organic Farming Act (2007)**¹²² is important among the legislation regulating the Agriculture sector, as it provides the requirements for operating in the area of organic farming to the extent not regulated by the regulations of the EU, as well as for the grounds and extent of supervision exercised over persons operating in the area of organic farming, and for the liability for violation of the requirements established by such legislation. In addition, several secondary legislative acts have been issued on the basis of this act to regulate aspects of organic farming.

Actions to reduce nitrogen losses from agriculture, for example, based on the requirements of the Directive 91/676/EEC (*Nitrates Directive*)¹²³, have led to reduced nitrogen emissions to the aquatic environment with indirect positive effects for the mitigation of climate gas emissions. The legislation which is relevant for the implementation of the *Nitrates Directive* is the *Water Act*, which was enacted in 1994 and has been revised since, especially in connection with the accession into the European Union. An updated *Code of Good Agricultural Practices* and a Government decree on water protection requirements for fertilizer, manure and silage (revised several times) were introduced. The **Water Act (2019)**¹²⁴ is one of the principal legal acts that the prime measures in the Estonian Water Management Plan measure programme 2022–2027 are grounded upon.

The Agriculture, Food and Rural Life Programme 2024–2027¹²⁵ includes activities contributing to GHG emission reduction. The programme includes actions that contribute to the development and competitiveness of Estonian agriculture and food industry, food safety and security, balanced development of rural and coastal areas and good rural life in general. It also contributes to the

¹²² Organic Farming Act (2007). [www] <https://www.riigiteataja.ee/en/eli/ee/529122021001/consolide/current> (09.12.2024)

¹²³ Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC). [www] <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01991L0676-20081211> (09.12.2024)

¹²⁴ Water Act (2019). [www] <https://www.riigiteataja.ee/en/eli/ee/527122019007/consolide/current> (09.12.2024)

¹²⁵ Ministry of Regional affairs and agriculture (2024). Programm "Põllumajandus, toit ja maaelu 2024–2027". [www] <https://www.agri.ee/sites/default/files/documents/2024-03/programm-2024-2027-maaelu.pdf> (09.12.2024)

welfare of plants and animals, the maintenance of good soil conditions and the preservation of a clean environment and biodiversity.

Methodologies and assumptions used to estimate the GHG emission reductions or removals

Impacts of certain WEM scenario measures have been estimated using alternative parameters from the Agriculture Projection Model (APM)¹²⁶. For the WEM scenario the APM, developed by the Agricultural Research Centre, provides two alternative scenarios with alternative parameters in case one of the two measures is not applied starting from 2024: **1) Eco-scheme for organic farming** and; **2) Animal Welfare Support**. This enables us to compare emissions to the WEM scenario emissions in case the specific measure would not be implemented. The scenario of not implementing the Eco-scheme for organic farming subsidy has an impact on the use of mineral fertilizers, since it is possible to use mineral fertilizers when replacing organic land with conventional cultivation. According to this scenario, the use of mineral Nitrogen fertilizers would increase by 13% by the year 2040 compared to 2024 because of changes in the production area of crops.

In the scenario of not implementing the Animal Welfare Support subsidy, direct subsidies (direct subsidy for raising dairy cows, direct subsidy for raising ewes and female goats, direct subsidy for raising suckling cows) will not be paid from 2024. Therefore, this scenario has an impact on the number of dairy cows, suckler cows, total cattle and total sheep and goats population. In 2040 the number of dairy cows, according to this scenario, would be 576 heads less, the number of lactating cows would be 3,807 heads more, and the number of sheep and goats would be 19,447 heads more compared to the WEM scenario.

According to the measure **Increasing the production and uptake of biomethane**, starting from 2027, there will be 3 new biogas production plants opening in Estonia. To calculate the impact of this measure, emissions in both cases can be compared – when the new biogas production plants will or will not be opened – that can be done by modifying the manure management systems distributions in both cases.

3.4.4.5 Land-use, land-use change and forestry (LULUCF)

The Forest Act (2007)¹²⁷ provides the legal framework for managing the Estonian forests to ensure protection and sustainable management of the forest as an ecosystem. The Forest Act encompasses the reforestation measure aiming at the recovery of the forest after logging or natural disaster. According to the Forest Act, the forest owner is obliged to ensure reforestation at the latest within five years after the logging or natural disaster. Supporting the fast reforestation after logging favours consistent carbon capture on the woodland and hence preservation of the GHG capture level of Estonian forests. The state also supports private forestry by the training of private forest

¹²⁶ Centre of Estonian Rural Research and Knowledge. Agriculture Projection Model. [www] https://metk.agri.ee/pollumajandustootmise_prognosisid#prognosis-2024 (09.12.2024)

¹²⁷ Forest Act (2007). [www] <https://www.riigiteataja.ee/en/eli/ee/510022014001/consolide/current> (09.12.2024)

owners and agricultural advisers, and investments aimed at increasing the economic, ecological, social and cultural value of the forest. Voluntary protection of key habitats in forests is encouraged through compensation for private forest owners.

The main objectives of the **Nature Conservation Act (2004)**¹²⁸ are the promotion and preservation of biodiversity, the preservation of the natural environments of cultural or aesthetic value, as well as the promotion of the sustainable use of natural resources. The Act also stipulates the application of compensatory measures for the Natura 2000 areas.

The **Estonian Forestry Development Plan until 2020 (EFDP 2020)**¹²⁹ determined the forestry targets for 2011–2020 and described the measures and resources to achieve these targets. The main objective of the EFDP 2020 was to ensure forest productivity and vitality, and the diverse and efficient use of this resource. The EFDP 2020 also included measures for the protection of natural processes and threatened species. Financing of the EFDP 2020 measures that are considered in the projections continues and they are also likely to be included in the next Forestry Development Plan.

The MoE (now the MoC) has prepared the draft **Forestry Development Plan until 2030 (EFDP 2030)**¹³⁰. Currently, the EFDP 2030 programme, or implementation plan, is being prepared. The aim of the development plan is to achieve a social agreement on the sustainable management of forests, taking into account social, economic, environmental and cultural aspects. Sustainable forestry means the management of forests in a way that ensures their current biological diversity, productivity, capability for regeneration, vitality and potential and enables the possibility to also perform all functions in the future, without causing harm to other ecosystems. The following planned policy directions have an impact on the LULUCF sector:

- adaptation of forestry to climate change – the aim is to increase the carbon sequestration and storage in forests in order to alleviate climate change and raise the resilience of forests to the effects of climate change;
- improving the state of biodiversity in forest ecosystems – forest management takes into account biodiversity, environmental and climate objectives;
- enhancing the competitiveness of the Forest sector – one aim of this policy is to ensure greater productivity, quality and good health status of forests;
- better valorisation of wood – more efficient and resource-efficient wood use is encouraged and supported in the forest and timber industries.

As of 2024, the **Environmental Charges Act (2006)**⁹⁹ includes the deforestation charge (see chapter 3.4.3), which is paid for the right to deforest forest land. The deforestation charge rate and the methodology for the calculation thereof is established by a regulation of the minister in charge of the policy sector.

¹²⁸ Nature Conservation Act (2004). [www] <https://www.riigiteataja.ee/en/eli/ee/515112018002/consolide/current> (09.12.2024)

¹²⁹ Ministry of Climate (2011). Estonian Forestry Development Plan until 2020. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2021-12/Eesti%20metsanduse%20arengukava%20aastani%202020%20%28kinnitatud%20Riigikogu%20otsusega%20nr%20909%20OE%2015.%20veebruari%202011.%20aastal%29.pdf> (09.12.2024)

¹³⁰ Ministry of Climate (2023). Metsanduse arengukava 2021-2030. [www] <https://kliimaministeerium.ee/MAK2030> (09.12.2024)

According to the **Earth's Crust Act (2017)**¹³¹, the owner of the extraction permit is obliged to restore the land disturbed by mining. The objective of the restoration is to adjust the land degraded by extraction to forest land, water body, land with recognised value or to any other kind of land that can be used for beneficial purposes.

In order to contribute to the preservation of Estonian semi-natural communities, an **action plan for semi-natural grasslands (2021–2027)**¹³² has been drawn up. By 2027, the goal is to maintain heritage meadows on at least 50,000 hectares. Planned activities include continued funding for the maintenance of semi-natural communities and the restoration of new habitats, considering the coherence and species protection aspects.

European structural and investment funds and LIFE programme have supported several projects to preserve and restore Estonian protected habitats and semi-natural grasslands, and to restore the water level in abandoned cut-away peatlands and degraded wet habitats.

Several activities for supporting the private forestry and maintaining semi-natural habitats and Natura 2000 sites are (co-)financed through the CAP. Specific objectives set in Estonian CAP Strategic Plan 2023–2027 include contribution to climate change mitigation and adaptation by reducing GHG emissions and enhancing carbon sequestration and promoting the sustainable and efficient management of natural resources. Number of LULUCF measures are presented in CTF Table 5.

Methodologies and assumptions used to estimate the GHG emission reductions or removals

Impacts of individual WEM scenario measures have not been estimated, as their effect on parameters that affect emissions (e.g. land-use changes, felling volume) has not been quantified in the development strategies/plans. The collective impact of the existing measures can be seen through the sector's projections as 2024 inventory submission data was used as the base for calculations. The WEM scenario generally assumes continuation of current land-use trends and management practices, methodologies for projecting GHG emissions/removals are described in chapter 3.6.4.5.

3.4.4.6 Waste management

The **Waste Act (2004)**¹³³ provides waste management requirements for preventing waste generation and the health and environmental hazards arising from waste, including measures for improving the efficiency of the use of natural resources and reducing the adverse impacts of such use and progressive reduction of landfilling of waste that is suitable for recycling or other recovery. The act also includes organisation of waste management including bases and extent of state supervision and liability for violation of the Act.

¹³¹ Earth's Crust Act (2017). [www] <https://www.riigiteataja.ee/en/eli/ee/513022017001/consolide/current> (09.12.2024)

¹³² Ministry of Climate (2021). Action plan for semi-natural grasslands (2021–2027). [www] <https://kliimaministeerium.ee/sites/default/files/documents/2021-07/P%C3%A4randniitude%20tegevuskava%20%28kinnitatud%202021%29.pdf> (09.12.2024)

¹³³ Waste Act (2004). [www] <https://www.riigiteataja.ee/en/eli/ee/520012015021/consolide/current> (09.12.2024)

The **National Waste Plan 2023–2028** (NWP 2023–2028)¹³⁴ adopted at the end of 2023, is a guiding document used to organize and set objectives for waste management in Estonia for the country as a whole, as well as for local authorities, businesses, producers and the general public. It describes the most important principles for the development of the sector and states the most important actions to be taken during the duration of the waste plan to achieve the waste policy objectives set out in the Waste Act and other related documents.

NWP 2023–2028 is based on the waste hierarchy principle, a principle stemming from the European Union Waste Framework Directive (WFD), which all Member States are expected to respect. The waste hierarchy consists of five stages: waste prevention - preparation for re-use – recycling of materials – other forms of waste recovery – disposal.

NWP 2023–2028 is based on three strategic goals:

1. sustainable, conscious production and consumption, promotion of waste prevention and re-use;
2. increasing safe material circulation;
3. consideration of the effects of waste management on both the human and natural environment as a whole.

The Circular Economy White Paper (2022)¹³⁵ brings together the vision of the ministries and interest groups, the principles of the circular economy and the directions of circular economy development, which are the basis for future activities. The document supports various parties to make the circular economy an overarching framework in planning, consumption, production, politics, lifestyle, culture and values. In the future, the circular economy activity plan includes the activities and metrics of various fields which are highlighted.

Some of the themes from the Circular Economy White Paper related to waste management include minimizing waste production, improving the division of waste by type in the collection to enable higher rates of recycling, increased digitalization of the waste management system.

The revised Urban Wastewater Treatment Directive (2024)¹³⁶ aims to protect human health and the environment through regulating wastewater treatment in the Member States. The renewal of the directive, not yet published, sets higher minimum standards than before for the quality of wastewater treatment from settlements of over 2000 and 10 000 inhabitants. Similarly to the current directive that is in force, it guides Member States to identify and protect sensitive areas and calls Member States to monitor the performance of treatment plants and receiving waters. As of 3 July 2023, Estonia had 56 wastewater collection areas with over 2000 population equivalent

¹³⁴ Ministry of Climate (2023). National Waste Plan 2023– 2028. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2023-12/Riigi%20j%C3%A4tkava%202023-2028.pdf> (09.12.2024)

¹³⁵ Ministry of Climate (2022). The Circular Economy White Paper. [www] https://ringmajandus.envir.ee/sites/default/files/2022-06/Ringmajandus_valge_raamat.pdf (09.12.2024)

¹³⁶ European Council. Urban wastewater: Council adopts new rules for more efficient treatment. [www] <https://www.consilium.europa.eu/en/press/press-releases/2024/11/05/urban-wastewater-council-adopts-new-rules-for-more-efficient-treatment/> (09.12.2024)

(p.e) and 474 smaller wastewater collection areas. Number of Waste management related measures are presented in CTF Table 5.

Methodologies and assumptions used to estimate the GHG emission reductions or removals

Impacts of different measures in the Waste sector were not estimated due to missing base parameters. The collective impact of the existing measures can be seen through the sector's projections as 2024 inventory submission data was used as the base for calculations.

3.4.5 Other information

3.4.5.1 Actions, policies and measures that are no longer in place compared with the most recent biennial transparency report

Information on actions, policies and measures that are no longer in place compared with the most recent biennial transparency report will be included starting from the second BTR submission.

3.4.5.2 Actions, policies and measures that influence GHG emissions from international transport

Eurocontrol forecasts an annual 1.9% increase¹³⁷ in European aviation flights until at least 2040, which is also considered in the Aviation bunkering projections. In the Marine bunkering projections, the forecast from the Ministry of Climate is taken into account, which states that international shipping will stay around 2022 level.

Regarding international aviation, Estonia has updated and submitted its State Action Plans to International Civil Aviation Organization (ICAO) at the end of August 2023, which includes measures to introduce sustainable aviation fuels (SAFs), as SAFs are inevitable in order to reduce carbonisation in aviation. Estonia has started to introduce SAFs requirements and consultations with sector. As SAFs' production costs are many times higher in comparison to traditional fuels, Estonian State started to look for different options to increase the availability of SAFs. Additionally, in cooperation with the MoC the Latvian Transport Ministry and European Commission SAFs' feasibility study has been launched with a deadline of the end 2025. The aim is to give input of this region for policy making process and for a better understanding of market conditions and production options in Estonia and Latvia. Additionally, one of the best long-term solutions might be hydrogen powered aircrafts and local production at the Tallinn Airport, but as technology is not ready yet the ambitious work to reach carbon free environmental goals for commercial air transport should continue.

¹³⁷ Eurocontrol. (2018). European aviation in 2040 Challenges of growth. [www] Challenges of growth - European aviation in 2040 | EUROCONTROL (09.12.2024)

Regarding international shipping, in 2022 the **Maritime Economy White Paper 2022-2035**¹³⁸ was adopted, where environmentally friendly, sustainable and safe marine economy is marked as one of the priorities, with an aim that the maritime transport sector is moving towards climate neutrality. According to the white paper, it is important to develop the use of sustainable alternative fuels both in sea transport and inland shipping.

Increasing funding for research is supported, with the aim of identifying more efficient and environmentally friendly technological solutions for the use of alternative fuels in shipping, both for new and existing ship models.

In addition to the above maritime transport was included in the EU ETS from the 1st of January 2024. In case of aviation the free allocation will be phased out which will set a stronger price signal to the sector. For maritime transport, the inclusion will set a price on emissions, giving the sector a strong signal to decarbonise.

3.4.5.3 Information about how its actions, policies and measures are modifying longer-term trends in GHG emissions and removals

Estonia's development strategy **Estonia 2035**⁹⁰ sets out five long-term strategic goals that are value-based goals which are the basis for making the country's strategic choices and to the implementation of which all Estonian strategic development documents contribute. They are also taken into account in the state budget strategy and in the preparation of the government's action programme. In order to reach the goals, it is necessary to take into account Estonia's development needs, global trends, the policy framework of the European Union, and the global objectives of sustainable development.

According to the strategy, by 2050, Estonia will be a competitive, climate-neutral country with a knowledge-based society and economy and a high quality and species-rich living environment, willing and able to reduce the adverse effects of climate change and make the best use of its positive aspects.

Estonia's long-term **General Principles of Climate Policy until 2050 (GPCP 2050)**⁷⁹ is a vision document setting the long term GHG emissions reduction target and policy guidelines for adapting to the impact of climate change or ensuring the preparedness and resilience to react to the impact of climate change. Principles and guidelines in the document have to be taken into account when renewing and implementing the cross-sectoral and sectoral strategies and national development plans. Estonia will be transformed into an attractive environment primarily intended for the development of innovative technologies, products and services reducing the emission of GHGs. In addition, the export and global implementation of such technologies, products and services shall

¹³⁸ Ministry of Climate (2022). Maritime Economy White Paper 2022-2035. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2023-07/Meremajanduse%20valge%20raamat%202022-2035.pdf> (09.12.2024)

be facilitated for the resolution of global problems. The general sectoral policy guidelines and principles of GPCP 2050 include:

- efficient interaction of the system as a whole when planning energy consumption centres and new production capacities;
 - facilitating the implementation of technologies with a low emission factor of CO₂ and the efficient use of resources in manufacturing processes;
 - considering the economy and energy efficiency of the system as a whole when renovating the existing building stock and planning and constructing new buildings.
 - Considering the economy and energy efficiency when planning, building, managing and reconstructing grids within energy systems with the aim of achieving maximum energy and resource efficiency;
 - moving towards enhancing energetic value and the production of products with higher additional value to minimise GHG emissions in the oil shale treatment process in a way that does not entail an increase in other negative environmental impacts;
 - directing major participants in the energy and industry sectors towards a successful and cost-efficient reduction of GHG emissions while continuing the use of market-based mechanisms;
 - ensuring energy security and security of supply with a gradual wider exploitation of domestic renewable energy sources in all sectors of final consumption with a view to increasing the welfare of the society;
 - facilitating a well-functioning transportation system and reducing forced traffic through the integration of the planning of settlements and transportation and the design and implementation of mobility plans;
 - influencing the purchase of economical vehicles and sustainable alternative fuels through investments and tax policies of the public sector;
 - prioritising the development of public transportation, non-motorised traffic and energy-efficient carriage of goods;
 - increasing and maintaining the soil's carbon stock incl. developing and maintaining significant carbon stock of land areas;
 - encouraging the efficient and ecological use of agricultural land while avoiding the falling out of the agricultural use of such land;
 - enhancing the use of plant nutrients and replacement of mineral fertilisers with organic fertilisers and eco-friendly soil conditioners;
 - enhancing the production of bioenergy and using it in energy-intensive manufacturing processes;
 - increasing the productivity of agriculture, with a focus on eco-friendlier manure management for limiting ammonia emissions;
 - increasing forest increment and the ability to sequester carbon through the timely regeneration of forests;

- promoting the use of wooden products and increasing carbon storage in wooden products and buildings will help replace non-renewable natural resources and develop domestic wood production;
- promoting the preservation of the existing forest area and increasing carbon sequestration and emission reduction in other land-use categories;
- preserving and increasing carbon stocks in wetlands. Avoiding further wetland drainage and already drained wetlands will be rewetted if possible to avoid further degradation;
- preferring the development of research studies in the Land use and forestry sector that will help to increase carbon sequestration and to find alternative uses for wood;
- continuing the reduction of waste generation and making the separate collection of waste more efficient;
- facilitating research, development and innovation that will help to increase the development of efficient energy technologies, renewable energy production technologies, sustainable transportation and mobility, sustainable agriculture, carbon sequestration in forestry and finding alternative uses for timber will be preferred.

Also, the Ministry of Climate has introduced the bill of **Estonian Climate Resilient Economy Act**⁸¹ to the Government in late 2024. In the Climate Resilient Economy Act that has been proposed, sector-wide and sector-specific goals are set to ensure a smooth trajectory to reach climate neutrality by 2050. Setting Estonia's goals is based on the climate targets of the European Union, which are set for the years 2030 and 2050 in accordance with the Paris Agreement, and the pace of emission reduction that can be achieved with existing technologies.

3.4.5.4 Assessment of the economic and social consequences of response measures

The assessment of the environmental, economic and social consequences of policies and measures is a key component of the European Union's policymaking process. The economic and social consequences of new policies and measures are not only assessed within the EU, but also related to developing countries which may be affected by them. The EU and its Member States have committed to policy coherence for development (PCD). Through PCD, they seek to take account of development objectives in policies that are likely to have an impact in developing countries. PCD aims at minimising contradictions and building synergies between different EU policies¹³⁹. The Better Regulation Toolbox, which is used by the European Commission when preparing new initiatives, includes specific guidance for analysing the potential impact of EU policy initiatives on developing countries. This helps to ensure that impacts on developing countries are taken into account at an early stage in preparing an initiative.¹⁴⁰ See further information in The First Biennial

¹³⁹ European Commission. Policy coherence for development. [www] https://ec.europa.eu/international-partnerships/policy-coherence-development_en (09.12.2024)

¹⁴⁰ European Commission. 'Better regulation' toolbox, Tool 34. [www] https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en (09.12.2024)

Report from the European Commission to the United Nations Framework Convention on Climate Change under the Enhanced Transparency Framework.¹⁴¹

In Estonia, impact assessments (which include the environmental impacts) are carried out in the early stages of the policy making process.

Estonia also takes measures aiming to reduce GHG emissions through energy savings and aiming the promotion of renewable energy sources to other Parties, including developing country Parties. Estonia is supporting achieving climate policy goals in developing countries. The objective of the application round is to bring knowledge and solutions in the field of green technology developed in Estonia to developing countries. Also supported are activities needed for increasing the capacity and capabilities of developing countries.¹⁴² The connection between the expected results of the project and climate change must be definable in connection with OECD methodology (so-called Rio markers).

3.5 Summary of greenhouse gas emissions and removals

For a summary of historic greenhouse gas emissions and removals, see Chapter 2 of this BTR. Summary information of GHG emissions and removals can also be found in CTF table 6. Estonia's National Inventory Report (NIR) **Greenhouse Gas emissions in Estonia 1990–2022** is available as separate stand-alone submissions on the UNFCCC website.

3.6 Projections of greenhouse gas emissions and removals

The main objective of this chapter is to give an indication of future trends of greenhouse gas emissions in Estonia, given the policies and measures implemented and adopted. Projections are given for all greenhouse gases considered in the United Nations Framework Convention on Climate Change (UNFCCC), presented in the following sectors: Energy; Transport; Industrial processes and product use (IPPU); Agriculture; Land use, land use change and forestry (LULUCF); and Waste. Projections of GHG emissions have been calculated for the period of 2023–2040. The year 2022 has been used as a reference year. Activity data for the base year of 2022 is in accordance with the latest, 2024 National Greenhouse Gas Inventory Report 1990–2022. Projections have been calculated using Global warming potentials (GWP) from AR5¹⁴³

¹⁴¹ The First Biennial Report from the European Commission to the United Nations Framework Convention on Climate Change under the Enhanced Transparency Framework (2024). [www] <https://unfccc.int/sites/default/files/resource/EU%20FIRST%20BTR.pdf> (09.12.2024)

¹⁴² Environmental Investment Centre. Climate policy objectives for developing countries. [www] <https://www.kik.ee/en/grants/climate-policy-objectives-developing-countries> (09.12.2024)

¹⁴³ IPCC AR5 Synthesis Report: Climate Change 2014. [www] https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf (09.12.2024)

For indirect emissions, activity data for the base year 2022 and trends are in accordance with the Estonian Informative Inventory Report¹⁴⁴ submitted under the Convention on Long-Range Transboundary Air Pollution.

Two projection scenarios are presented: 1) With Existing Measures (WEM) scenario, which evaluates future GHG emission trends under current policies and measures and; 2) Without Measures (WOM) scenario, which illustrates future GHG emission trends where measure from the WEM scenario would not be implemented.

3.6.1 Total projected GHG emissions of Estonia

Estonia's greenhouse gas emissions are expected to decrease by around 34.9% in the WEM scenario with LULUCF and GHG emissions without LULUCF are expected to decrease by around 49.8% by 2040 compared to the base year of 2022. Estonia's total projected GHG emissions and historical inventory information using AR5 GWP are presented in [Figure 3.19](#).

While the Energy sector's subcategory Energy industries dominated total emissions in 1990, its emissions decreased sharply in the beginning of the time series and fluctuate but are projected to continue on a decreasing pathway, reaching a reduction of 89.5% by 2040 compared to 1990.

Emissions from the Transport sector are driven by the Road transport category, as its share of the total transport sector was approximately 89.7% in 2022. Therefore, it will also be the biggest driver for the decrease of GHG emissions in the road transport sector due to the uptake of electric vehicles. The total decrease of emissions by 2040 compared to 1990 is projected to be 38.1% in the WEM scenario.

Historically, the IPPU sector emissions were driven by the Mineral industries subcategory, however the cement industry ceased burning clinker in wet process kilns and does not foresee future production. The overall emissions from the IPPU sector are projected to decrease by 89.8% from 1990 until 2040 in the WEM scenario. The main decrease after 2020 comes from the product uses as substitutes for ODS (F-gases).

Agriculture emissions are projected to decrease by 41.3% compared to 1990 in the 2040 WEM scenario. Estonia's agriculture sector is driven by the Enteric Fermentation and Agricultural soils subcategories that are an important food source.

According to the projections, the LULUCF sector is expected to remain a source of GHGs in the WEM scenario from – 5,235.3 kt CO₂ eq. total sequestration in 1990 to 2,304.60 kt CO₂ eq. in 2040 according to the WEM scenario. In the WEM scenario (total felling volume is 11 mln m³ year⁻¹), Forest land will act as a net source. Projected changes in forest growing stock primarily depend on the age distribution of forests – due to the high proportion of mature and premature forest stands and increasing proportion of forest area belonging to the first development classes (treeless area, area under regeneration and young stands), the capacity of carbon sequestration in

¹⁴⁴ Estonian Environmental Agency (2024). Estonian Informative Inventory Report 1990-2022. [www] https://keskkonnaportaal.ee/sites/default/files/Estonian%20Informative%20Inventory%20Report%202024_v1.pdf (06.12.2024)

tree biomass has decreased in recent years and the decline is expected to continue during the next decades.

According to the WEM scenario, the total emissions from the Waste sector will decrease by 52% between 1990 and 2040, from 404.97 kt CO₂ eq. to 194.52 CO₂ eq., accordingly. The emission decrease in the Waste sector until 2040 is mainly related to the increase of reusing and recycling waste materials and the decreasing amount of biodegradable waste deposited in landfills.

3.6.2 Projections by gas

In 2022 the most important GHG in Estonia was carbon dioxide (CO₂), contributing 84.27% to total national GHG emissions (without LULUCF) expressed in CO₂ eq. (including indirect CO₂), followed by methane (CH₄) with 8.05%, and nitrous oxide (N₂O) contributing 6.24%. Fluorocarbons (so-called 'F-gases') account for about 1.44% of total emissions. Between 1990 and 2040, emissions of all gases are projected to decrease (see [Table 3.6](#), [Figure 3.20](#), [Figure 3.21](#)) except for SF₆. Emissions of SF₆ reported under the CRT subcategory Other product manufacture and use are projected to rise steadily until 2037 because additional switchgears are needed. SF₆ insulated electrical equipment is directly affected by the new F-gas Regulation (EU) 2024/573¹¹⁷. From the year 2038 emissions start to decrease due to the bans set in the regulation.

Table 3.6 Historic emissions 1990–2022 (NIR 2024) and projected GHG emissions for 2025–2040 for WEM scenario, kt CO₂ eq.

	GHG emissions and removals (kt CO ₂ eq) (2024 NIR)						GHG projections (kt CO ₂ eq)			
	1990	2005	2010	2015	2020	2022	2025	2030	2035	2040
By sector:										
Energy (excluding transport) WEM	33,610.93	14,389.79	16,365.66	13,143.72	6,733.69	9,124.91	6,341.17	5,131.53	4,042.63	3,117.83
Transport WEM	2,571.10	2,239.31	2,360.74	2,443.64	2,458.66	2,644.59	2,420.99	2,217.91	1,905.52	1,591.63
Industrial processes and product use WEM	963.14	723.69	535.31	512.67	288.08	274.99	229.3	175.24	134	98.69
Agriculture WEM	2,723.45	1,211.80	1,297.40	1,444.18	1,549.81	1,593.02	1,556.85	1,584.66	1,599.15	1,599.76
Land use, land-use change and forestry WEM	-5,235.27	-2,927.27	-4,669.48	898.06	1,242.90	339.29	2,427.3	2,230.63	2,180.81	2,304.61
Waste WEM	404.97	568.29	537.15	369.56	313.14	314.03	277.75	239.01	211.99	194.52
Total WEM (without LULUCF)	40,273.58	19,132.89	21,096.26	17,913.77	11,343.38	13,951.55	10,826.06	9,337.25	7,882.21	7,000.3
Total WEM (with LULUCF)	35,038.31	16,205.61	16,426.78	18,811.83	12,586.28	14,290.84	13,253.36	11,567.88	10,063.02	9,304.91
By gas, CO₂:										
Energy (excluding transport) WEM	33,432.16	14,295.28	16,274.26	13,065.3	6,649.30	9,035.54	6,247.46	5,033.96	3,946.85	3,430.74
Transport WEM	2,511.15	2,196.01	2,322.11	2,414.37	2,429.80	2,613.56	2,396.11	2,198.3	1,888.72	1,578.02
Industrial processes and product use WEM	958.29	588.4	358.15	290.37	102.38	71.69	69.86	69.79	69.56	69.41
Agriculture WEM	13.11	8.63	9.37	9.07	16.26	36.06	32.68	33.03	32.73	32.73
Land use, land-use change and forestry WEM	-5,545.74	-3,245.9	-4,996.76	563.58	901.91	-2.40	2,083.54	1,887.22	1,838.00	1,963.21
Waste WEM=WAM	2.25	1.46	0.84	0.51	0.50	0.33	0.29	NO	NO	NO
CO₂ WEM emissions with net CO₂ from LULUCF	31,371.22	13,843.88	13,967.98	16,343.2	10,100.16	11,754.77	10,829.95	9,222.28	7,775.87	7,074.11
CO₂ WEM emissions without net CO₂ from LULUCF	36,916.96	17,089.78	18,964.73	15,779.62	9,198.25	11,757.18	8,746.409	7,335.07	5,937.86	5,110.9
By gas, CH₄:										

Table 3.6 Historic emissions 1990–2022 (NIR 2024) and projected GHG emissions for 2025-2040 for WEM scenario, kt CO₂ eq.

	GHG emissions and removals (kt CO ₂ eq) (2024 NIR)					GHG projections (kt CO ₂ eq)				
	1990	2005	2010	2015	2020	2022	2025	2030	2035	2040
Energy (excluding transport) WEM	153.40	76.20	65.57	52.18	53.91	53.40	58.06	56.88	56.67	56.80
Transport WEM	24.7	10.93	7.14	4.56	3.54	3.40	3.00	2.80	2.37	1.74
Industrial processes and product use WEM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Agriculture WEM	1,606.57	690.81	726.65	756.89	800.19	794.33	805.71	827.49	845.27	844.99
Land use, land-use change and forestry WEM	72.78	74.02	74.29	75.12	75.22	74.96	75.59	75.59	75.59	75.59
Waste WEM	367.71	533.95	494.77	326.72	271.24	271.84	236.36	198.29	171.8	154.94
CH₄ WEM emissions with CH₄ from LULUCF	2,225.15	1,385.9	1,368.42	1,215.48	1,204.11	1,197.94	1,178.72	1,161.05	1,151.7	1,134.07
CH₄ WEM emissions without CH₄ from LULUCF	2,152.38	1,311.89	1,294.13	1,140.36	1,128.89	1,122.98	1,103.12	1,085.46	1,076.10	1,058.48

By gas, N₂O:										
Energy (excluding transport) WEM	25.36	18.31	25.83	26.25	30.48	35.97	35.66	29.61	28.02	28.17
Transport WEM	35.25	32.37	31.5	24.71	25.32	27.63	21.83	16.81	14.43	11.87
Industrial processes and product use WEM	4.85	6.03	4.54	3.44	2.75	3.06	2.83	2.81	2.79	2.77
Agriculture WEM	1,103.77	512.37	561.37	678.22	733.36	762.64	718.47	724.14	721.15	722.03
Land use, land-use change and forestry WEM	237.7	244.61	252.99	259.36	265.78	266.73	268.17	267.82	267.21	265.8
Waste WEM	35.01	32.89	41.54	42.33	41.39	41.86	41.11	40.72	40.19	39.57
N₂O WEM emissions with N₂O from LULUCF	1,441.93	846.57	917.77	1,034.30	1,099.08	1,137.89	1,088.01	1,081.9	1,073.79	1,070.21
N₂O WEM emissions without N₂O from LULUCF	1,204.23	601.96	664.78	774.94	833.29	871.16	819.93	814.08	806.59	804.41

Table 3.6 Historic emissions 1990–2022 (NIR 2024) and projected GHG emissions for 2025–2040 for WEM scenario, kt CO₂ eq.

	GHG emissions and removals (kt CO ₂ eq) (2024 NIR)						GHG projections (kt CO ₂ eq)				
	1990	2005	2010	2015	2020	2022	2025	2030	2035	2040	
By gas, F-gases:											
HFCs	NO	128.15	170.73	216.43	179.92	197.10	152.18	98.07	57.25	22.38	
PFCs	NO	NO, NA	NO	NO	NO	NO	NO	NO	NO	NO	
Unspecified mix of HFCs and PFCs	NO										
SF ₆	NO	1.11	1.89	2.42	3.03	3.13	4.43	4.57	4.41	4.13	
NF ₃	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

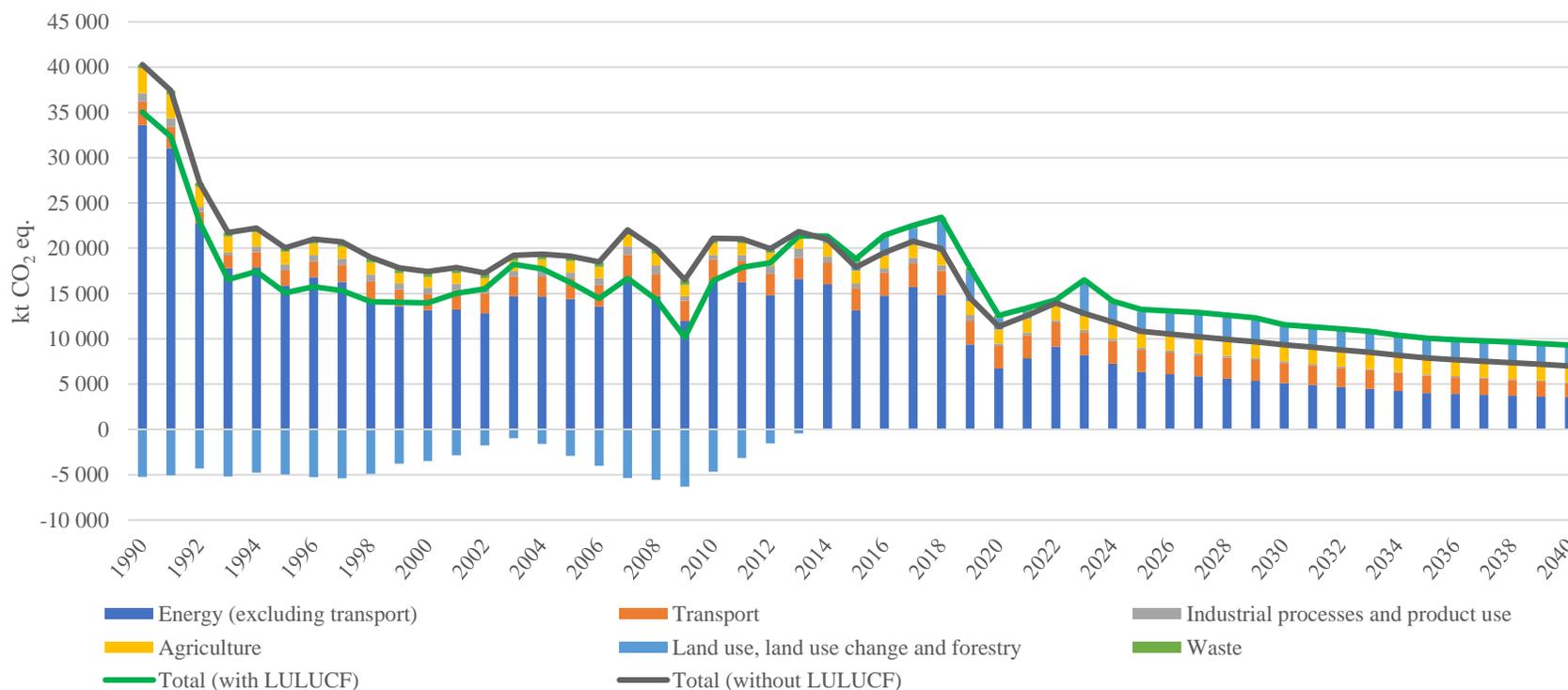


Figure 3.19 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) for the WEM scenario, kt CO₂ eq.

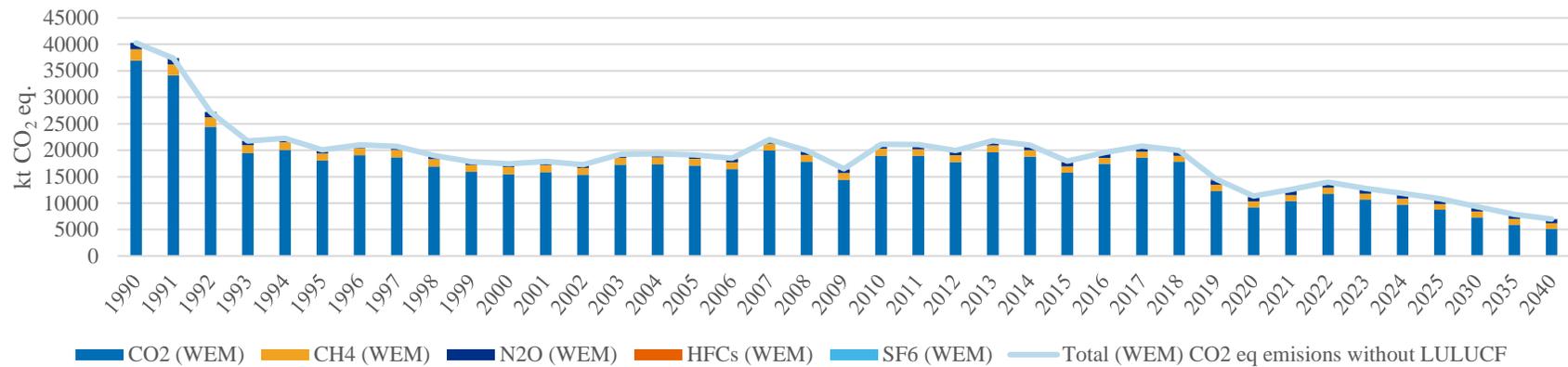


Figure 3.20 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) for the WEM scenario (without LULUCF) by gas, kt CO₂ eq.

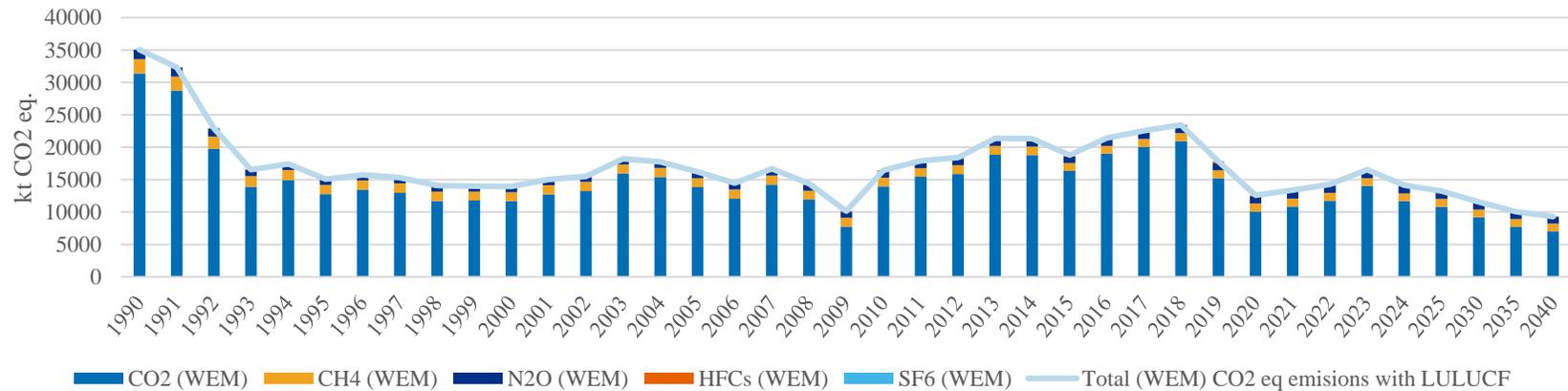


Figure 3.21 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) for the WEM scenario (with LULUCF) by gas, kt CO₂ eq.

3.6.3 Projections by sector

3.6.3.1 Energy sector (excluding transport)

The Energy sector (excluding transport) includes GHG emissions from the consumption and production of fuels and energy (electricity and heat). The main sub-sectors in this sector are Energy industries; Manufacturing industries and construction; Other sectors, including Commercial/institutional (buildings), Residential (buildings), Agriculture/Forestry/Fishing/Fish farms (excluding mobile machinery, e.g. tractors, harvesters etc.) and Fugitive emissions from natural gas distribution. The GHG emission increase in 2022 (the base year) compared to the previous two years, came primarily from the Energy industries, because of the lack of power generation capacities, which led to higher electricity prices and made electricity production from oil shale profitable.

The Energy sector's projected emissions in the WEM and WOM scenarios, together with the 2024 NIR historic inventory information, are presented in [Figure 3.22](#). The WEM scenario evaluates future GHG emission trends under the current policies and measures and the WOM scenario illustrates a future where measure from the WEM scenario would not be implemented.

In the WEM scenario, the emissions are projected to decrease by 61.5% from 2022 to 2040. The largest absolute decrease occurs in the Energy industries.

The main electricity producer in Estonia is Enefit Power AS incl. the Eesti Power Plant and the Balti Power Plant. Both plants use mainly oil shale for electricity production. Enefit power plants are also the largest producers of GHG emissions in Estonia. The decrease in the WEM scenario is due to the phasing out of oil shale pulverised combustion in these plants, while using mainly a more effective Auvere oil shale combustion plant and fluidised bed combustion units in older plants. It is planned by the companies to capture CO₂ in solid heat carrier technology-based shale oil plants, which lead to further decrease in GHG emissions between the years 2040 and 2050. The GHG emissions are projected to decrease by 67% by 2040 compared to 2022 in the Energy industries sector.

GHG emissions in the Manufacturing and construction sector (divided into iron and steel; non-ferrous metals; chemicals; pulp, paper and print; food processing, beverages and tobacco; non-metallic minerals; and other industries) are projected to increase by 27.5% by 2040 compared to 2022, as there are no concrete fuel swapping plans developed yet.

The emissions in Other sectors (Commercial/institutional (buildings), Residential (buildings) and Agriculture/Forestry/Fishing/Fish farms) are expected to decrease by 10.5% in 2040 compared to 2022.

In the WOM scenario, the emissions in the Energy sector are projected to increase by 8.3% during the period of 2022–2040, if the current measures and plans would not be applied. The increase of GHGs in the WOM scenario results from the lack of higher energy efficiency requirements for buildings (entails additional funding for renovation purposes) and district heating networks, which

help to decrease energy consumption for heat production. In addition, there is no CO₂ capturing by the shale oil industry.

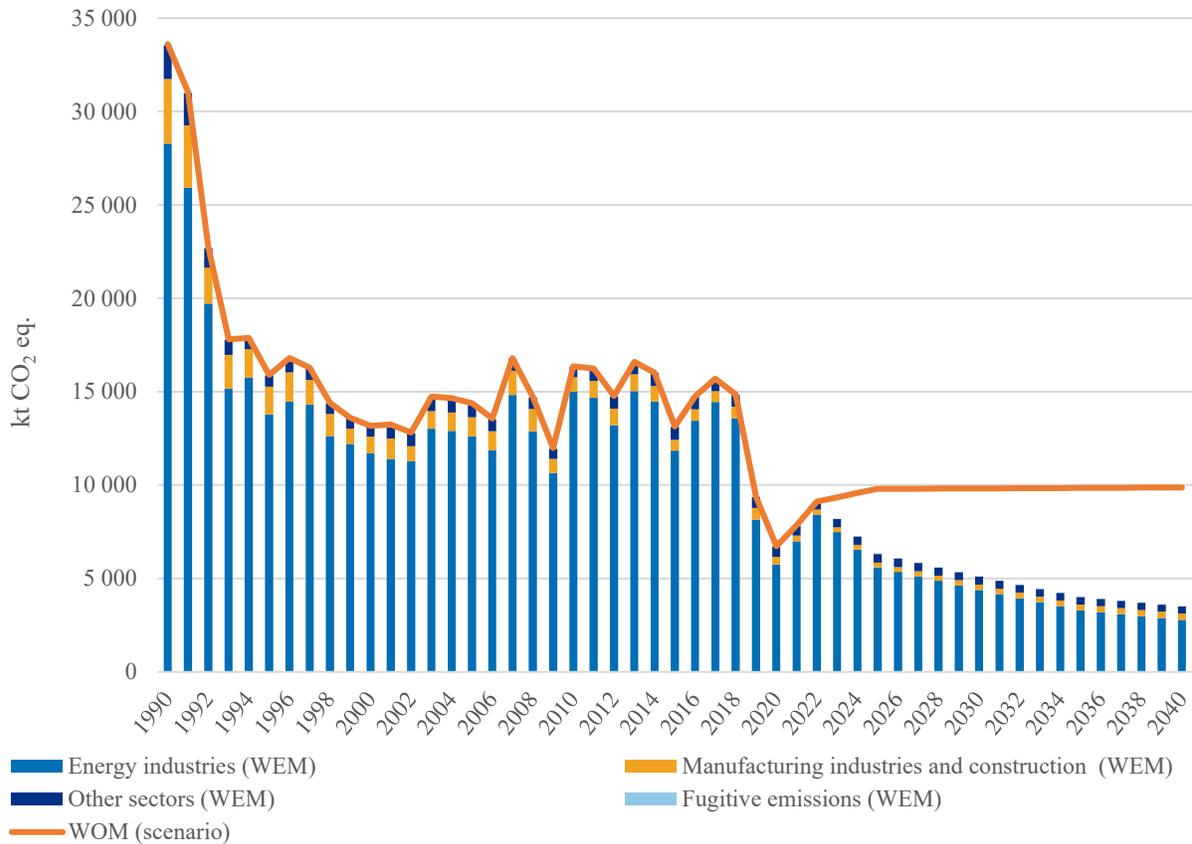


Figure 3.22 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) from the Energy sector according to the WEM and WOM scenarios, kt CO₂ eq.

3.6.3.2 Transport

Transport section projections of GHG emissions have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. Two projection scenarios are presented – the WEM scenario evaluates future GHG emission trends under the current policies and measures and the WOM scenario illustrates a future where measure from the WEM scenario would not be implemented.

The main share of GHG emissions in the Transport sector originate from road transport. In 2022, the share of GHG emissions from road transport was around 89.7% of total GHG emissions of the Transport sector.

The emissions in the Transport sector’s WEM scenario are expected to decrease by 39.8% in 2040 compared to 2022. In the WEM scenario, Domestic aviation emissions are expected to increase by 1.1 kt CO₂ eq. during the period of 2023–2040 and in Domestic navigation, Railroad and Road transport emissions are projected to decrease compared to the base year. The largest emission reductions occurs in the Road transport sector (emissions are projected to decrease in both the WEM and WOM scenarios) — emissions are projected to decrease by 41.9% in 2040 compared to 2022 to a total of 1378.7 kt CO₂ eq. in the WEM scenario, which is the result of implementing measures that will help lower the demand for private transport and switching public transport to alternative fuels. However, the biggest driver for the steep decrement of GHG emissions in the WEM scenario is the uptake of electric vehicles. Although there are measures implemented that help to decrease the overall projected mileage of the road transport fleet, they aren’t currently enough to reverse the mileage upward trend.

As road transport emits the biggest share of GHGs in the Transport sector, a lot of measures focus on decreasing the GHG impact from road transport. However, there are measures being implemented that are also directed towards railroad and domestic navigation. The focus in railroad is electrification and in domestic navigation replacing ferries, which run on diesel for alternative fuel (electricity/hydrogen) ferries.

In the WEM scenario, GHG emissions are lower by 577.98 kt CO₂ eq. compared to the WOM scenario in 2040. The difference comes mainly from the measures that are being implemented and the biggest contributor in the decrease is the road transport.

The total projected GHG emissions in the WEM and WOM scenarios are presented in [Figure 3.23](#).

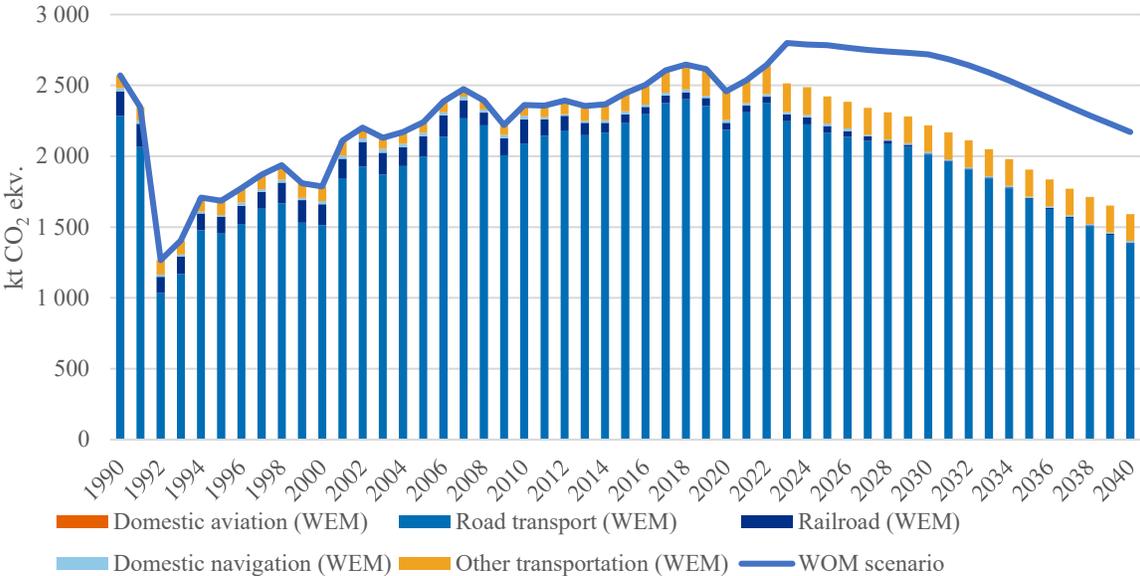


Figure 3.23 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) from the Transport sector in the WEM and WOM scenarios, kt CO₂ eq.

3.6.3.3 IPPU

IPPU sector projections of GHG emissions have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. Emissions from the IPPU sector are projected only according to the WEM scenario.

The overall emissions from the IPPU sector are projected to decrease by 64.1% from 2022 until 2040 in the WEM scenario. The main decrease comes from the product uses as substitutes for ODS (F-gases).

The emissions from the Mineral and Metal industry by 2040 are estimated to remain at a similar level to 2022.

Emissions (both direct and indirect CO₂) from non-energy products from the Fuels and solvent subsector use (2.D.3) are projected to decrease in the WEM scenario – 7% from 2022 until 2040. Emissions from most subcategories (Use of diesel exhaust fluid AdBlue, lubricants and solvents) are projected to decrease but emissions from the subcategory paraffin wax use are projected to increase. A smaller part of these emissions are the CO₂ emissions from urea containing diesel exhaust fluid use which decreases from 1.82 kt CO₂ eq. to 1.31 kt CO₂ eq. (28%) from 2022 until 2040 in the WEM scenario which is mainly caused by curbing diesel fuel consumption and urea containing diesel exhaust fluid consumption as a result of implementing measures in the Transport sector. Emissions from lubricants are projected to decrease by 14% from 2022 until 2040, based on the average consumption during the years 2020–2022.

Emission of NMVOCs from the Solvents sector and indirect CO₂ from NMVOCs is projected to decrease by 7.4% from 2022 to 2040. The consumption of solvent containing products has had an upward trend in recent years but when taking into account a longer trendline (10 years) then a declining trend is foreseen.

Emissions of HFC-s (substitutes for ozone-depleting substances (ODS)) are projected to decrease from 197.1 CO₂ eq. in 2022 to 22.4 CO₂ eq. in 2040 (89%) mainly due to the bans set out in the F-gas Regulation. The majority of R-404A containing equipment (to which installation and servicing bans apply from 2020) should be decommissioned until 2035. The same applies to most old split-type air conditioners and heat pumps.

Directive 2006/40/EC has a gradual effect on HFC emissions until 2030 when most old vehicles equipped with HFC-134a based air conditioners should be replaced (when taking into account the average lifespan of a car).

Emissions of SF₆ reported under the CRT subcategory Other product manufacture and use are projected to rise steadily until 2037 because additional switchgears are needed. SF₆ insulated electrical equipment is directly affected by the new F-gas Regulation (EU) 2024/573. From the year 2038 emissions start to decrease due to the bans set in the regulation. Emissions in 2040 are 32% higher compared to 2022 emissions. As the lifetime of SF₆ equipment is considered to be 40

years then emissions from the switchgears are projected from the equipment in operation until 2055.

N₂O emissions from the subcategory Other product manufacture and use are projected to decline from 2022 to 2040 by 9.5% as the use of N₂O in the medical applications and technical aerosols (e.g. whipped cream cans) is connected to declining population numbers.

The historical (1990–2022) and projected (2023–2040) emissions according to the WEM scenario are depicted in Figure 3.24.

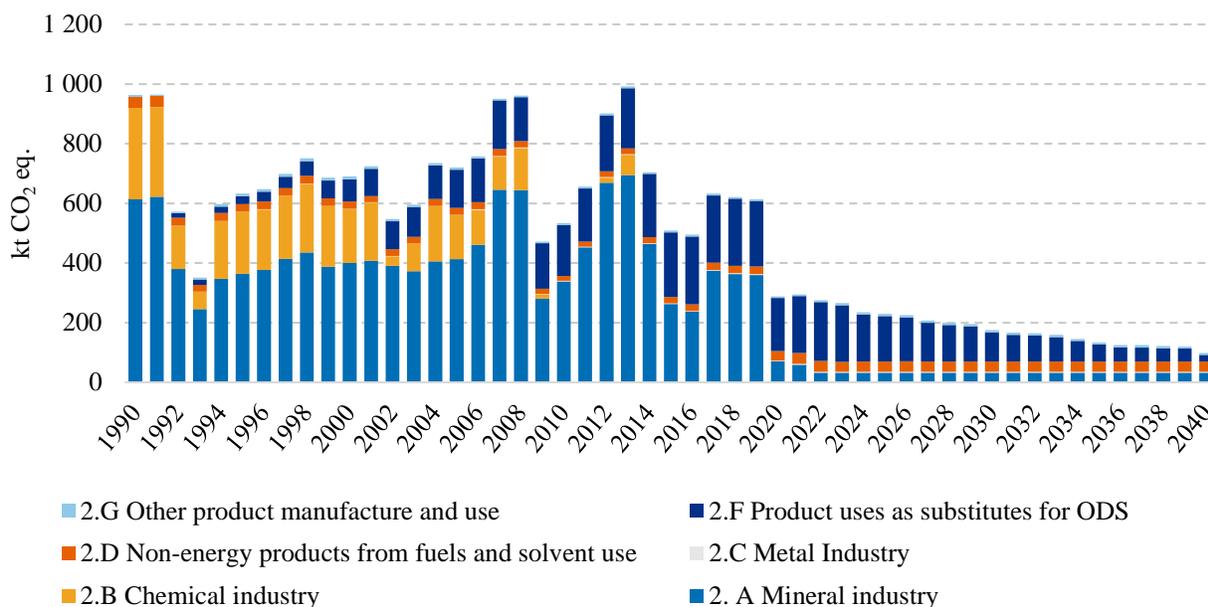


Figure 3.24 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) from the IPPU sector in the WEM scenario, kt CO₂ eq.

3.6.3.4 Agriculture

Agriculture sectors projections of GHG emissions have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. Two projection scenarios are presented – the WEM scenario evaluates future GHG emission trends under the current policies and measures and the WOM scenario illustrates a future where some measure from the WEM scenario would not be implemented.

According to the WEM scenario, the emissions from the Agriculture sector will increase from 1,593.02 kt CO₂ eq. in 2022 to 1,599.76 kt CO₂ eq. (0.42%) by 2040 (see Figure 3.25). Emissions are projected to increase in Enteric Fermentation and in Urea application sub-sectors, in other sub-

sectors (Manure Management, Agricultural Soils and Liming) the emissions are projected to decrease. The increase in the Enteric fermentation sub-sector between 2022-2040 is projected to be 56.34 kt CO₂ eq. and is caused mainly by slightly higher dairy cow population and the increase in milk yield per cow. Decrease in the Manure management sub-sector between 2022–2040 is projected to be 9.28 kt CO₂ eq. and is mainly caused by the opening of new biogas production plants, in Agricultural soils the decrease of 37 kt CO₂ eq. between 2022–2040 is caused mostly by lower crop production and fertilizer usage, in Liming sub-sector the decrease of 3.56 kt CO₂ eq. is caused by lower lime fertilizer usage projections, and in Urea application sub-sector the emissions are projected to increase by 0.24 kt CO₂ eq. in 2040 compared to 2022.

According to the WOM scenario, emissions will increase from 1,593.02 kt CO₂ eq. to 1,605.52 kt CO₂ eq. (0.78%) by 2040. Differences between the WEM and WOM scenarios are caused by not implementing the support measures from the CAP Strategic Plan 2023-2027 as of the year 2024. As a result, in the WOM scenario, the agricultural land area would decrease by 53,410 ha in the case of cereals, and the growing area of more profitable crops would increase (wheat, barley; total of 3% by 2040), the leguminous area would significantly decrease (78% by 2040), as the growing area of legumes is strongly related to environmental subsidies. Also, fertilizer use would decrease depending on crop surface changes by 3% for mineral N-containing fertilizers. This will affect the emissions from Agricultural Soils category. Due to a 1% reduction in dairy cow population, the total amount of milk produced would also decrease. The loss of subsidies will have a greater impact on beef cattle and sheep and goat breeding, where the population of the herd would have to be increased by 14% for beef cattle and 36% for sheep and goats, to maintain the current income that the producers receive with all the subsidies applied. The number of poultry and pigs are the same for the WOM and WEM scenarios. The animal population numbers and milk yield per dairy cow mostly affect Enteric fermentation and Manure management categories where the emissions will be higher in the WOM scenario than in the WEM scenario.

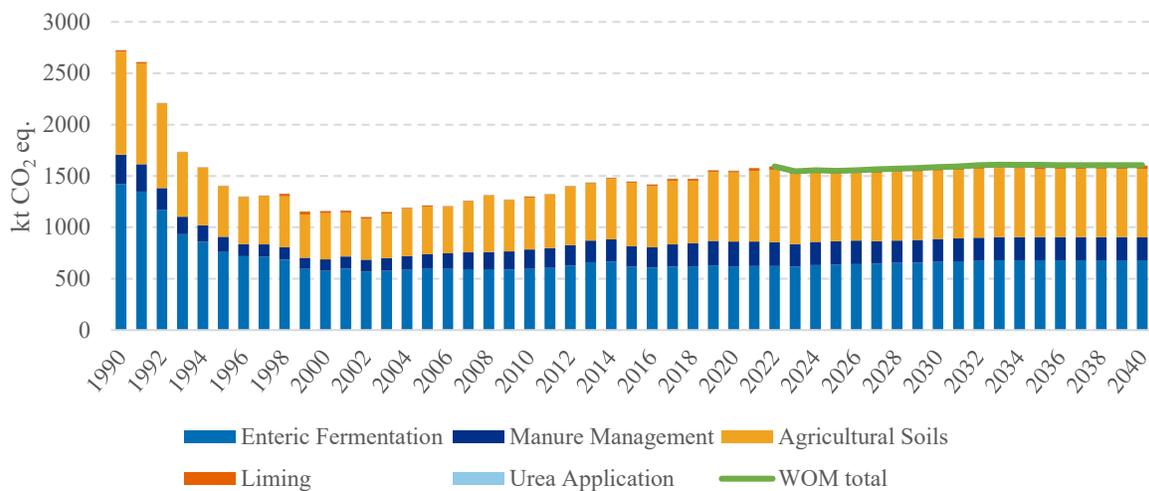


Figure 3.25 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) from the Agriculture sector in the WEM and WOM scenarios, kt CO₂ eq.

3.6.3.5 LULUCF

Two projections scenarios of GHG emissions have been calculated for the LULUCF sector. The WEM scenario evaluates future GHG emission trends under current policies and measures whereas the WOM scenario reflects the situation where all the measures from the Common Agricultural Policy (CAP) Strategic Plan 2023–2027 are not applying from the year 2024.

According to the WEM scenario projections, the LULUCF sector is expected to remain a source of GHGs, meaning that total emissions arising from the sector will exceed total removals. Total emissions will increase from 339.29 kt CO₂ eq. in 2022 to 2304.61 kt CO₂ eq. by 2040. The projections do not reflect annual fluctuations, rather expected decadal trends. The exception is 2023, for which activity data were partially available and were considered in calculations. 2023's projected emissions are the highest for the entire period – 3,704.76 kt CO₂ eq (see [Figure 3.26](#)).

The LULUCF sector includes emissions and removals of GHGs from Forest land, Cropland, Grassland, Wetlands, Settlements, Other land and Harvested wood products (HPW).

Forest land is the most important category that affects LULUCF sector trends, and its C balance is affected by several factors, including changes in the area of forest land, age structure of forests, and the felling volumes. The WEM scenario assumes the continuation of current forest management practices and intensity. Projected changes in forest growing stock primarily depend on the age distribution of forests – due to the high proportion of mature and premature forest stands and increasing proportion of forest area belonging to the first development classes (treeless area, area under regeneration and young stands), the capacity of carbon sequestration in tree biomass has decreased in recent years and the decline is expected to continue during the next decades. According to the WEM scenario, total forest growing stock will be approximately 5% lower in 2043 than it is now. In addition, conversion from other land categories to Forest land has been slowing in recent years, and in the future, cumulative areas of Land converted to forest land categories will decrease further. Net emissions from the Forest land category will generally increase compared to the base year of 2022, when they were -1,359.71 kt CO₂ eq. Highest emissions were projected for 2023 (1,894.90 kt CO₂ eq.), as the preliminary estimate for 2023 exceeds the felling volume of 2022 and the projected felling volume for the period of 2024–2040. After 2023 the net emissions will decrease and remain relatively stable (an average 523.13 kt CO₂ eq. for the period 2024–2040).

C sequestration in HWP will decrease in the WEM scenario from -641.58 kt CO₂ eq. in 2022 to -464.06 kt CO₂ eq. by 2040. Main part of the HWP sink is from the wood panels and sawnwood subcategory. C sequestration in HWP was decreasing in 2022 due to reduced production of sawnwood and wood-based panels (the factory, which produced particle boards, was closed) and from 2023 onwards, particle board production will no longer continue under the projections.

Emissions from the Cropland category are expected to decrease by 183.36 kt CO₂ eq. by 2040 compared to the base year (852.28 kt CO₂ eq. in 2022). In particular, emissions from mineral soils

will be reduced, as agricultural land use and management practices are not expected to change significantly in the future, leading to the stabilization of soil organic carbon stocks.

Net emissions from the Grassland category were -171.97 kt CO₂ eq. in 2022. As the area of grassland decreases, as well as conversion of croplands to grasslands, carbon sequestration on grasslands will also decrease by 2040. In addition, emissions from deforestation are expected to increase. In 2040, the projected emissions from the Grassland category are -95.34 kt CO₂ eq.

In total, projected emissions from the Wetlands will decrease from 1307.30 kt CO₂ eq. in 2022 to 1142.21 kt CO₂ eq. in 2040. Out of this, 961.96 kt CO₂ eq. result from the production and use of horticultural peat and 166.89 kt CO₂ eq. are emitted by peat extraction sites. Projected emissions are lower compared to the base year, because the peat extraction volume in 2022 was higher than the 2019–2023 average applied in the projections.

Under the Settlements and Other land categories, only emissions arising from the land conversions have been reported and projected. The construction of the Rail Baltic route will increase the land conversion to Settlements and cause increase in emissions. Projected emissions will rise from 322.18 kt CO₂ eq. in the base year to 434.44 kt CO₂ eq. in 2040. Deforestation resulting from the establishment and development of training grounds of the Estonian Defence Forces up to 2030 was considered under the Other land category. Projected emissions for the Other land will reach the maximum value (515.20 kt CO₂ eq.) in 2029 and then decline to 88.98 kt CO₂ eq. in 2040, which is 188.93% higher compared to the base year.

The WOM scenario differs from the WEM scenario only for the Cropland category and assumes that all support measures of the CAP Strategic Plan will not be implemented as of the year 2024. This would cause a decrease in cultivated land area and increase in soil carbon sequestration. According to the WOM scenario, GHG emissions are lower by 68.24 kt CO₂ eq. compared to the WEM scenario in 2040.

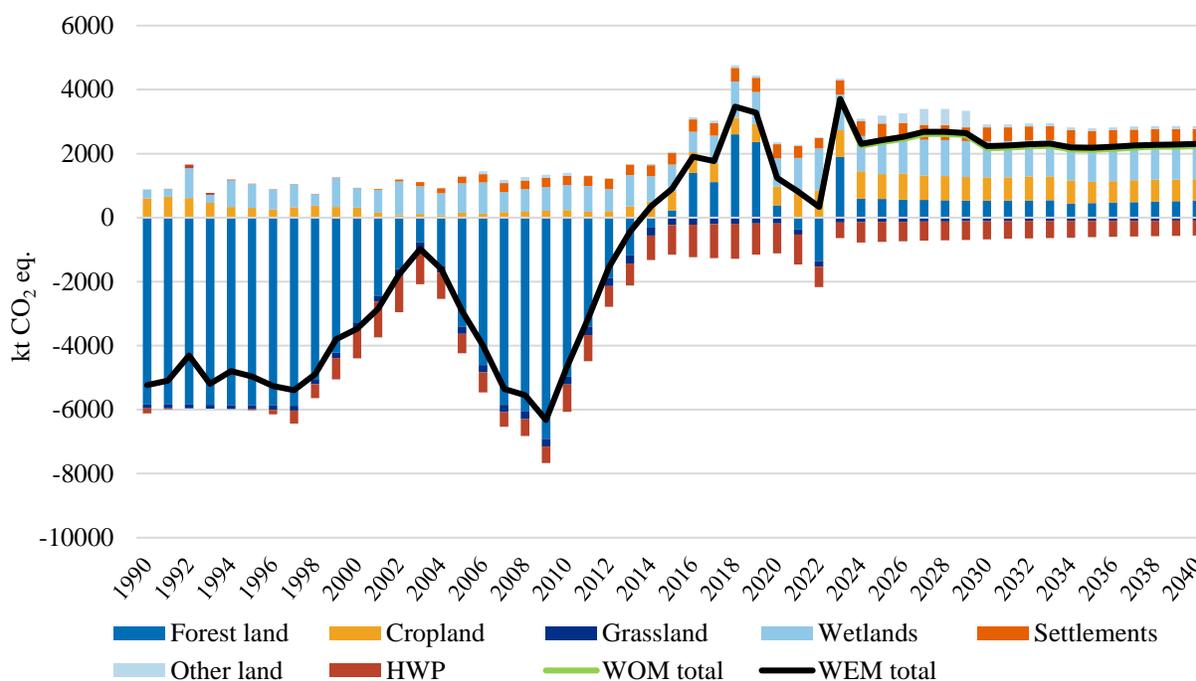


Figure 3.26 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) from the LULUCF sector according to the WEM and WOM scenarios, kt CO₂ eq.

3.6.3.6 Waste

According to the WEM scenario, the total emissions from the Waste sector will decrease by 38.1% between 2022 and 2040, from 314.03 kt CO₂ eq. to 194.52 CO₂ eq., accordingly (Figure 3.27).

The sub-category of Biological treatment of solid waste is the only sub-sector where emissions are projected to increase slightly: from 30.34 kt CO₂ eq. in 2022 to 30.67 kt CO₂ eq. in 2040 (1.08%). The increase is caused by less biodegradable waste being deposited in solid waste disposal sites and more being sent to biological treatment as well as the opening of a new biogas production plant with waste input. It is important to note that the base year of the projections was taken from the national GHG inventory submission of 2024 where anaerobic digestion category was not included as the emissions from Biological treatment category were well below 0.05% of the total national GHG emissions. Although the emissions from this category are projected to remain a small fraction of the national emissions until 2040, the category was included in the projections as the foreseen increase in biogas production in the country has a significant effect on the emissions from Biological treatment of solid waste as well as the total emissions from Waste sector.

In other Waste sector categories, a decrease in emissions is foreseen. In the category of Solid waste disposal, a decrease of 58% is foreseen: from 190.75 kt CO₂ eq. in 2022 to 80.22 kt CO₂ eq. in 2040, the main reason for the change being decrease in total waste generation as well as decrease in waste deposited in solid waste disposal sites. For Waste Incineration and Open burning, a 100%

decrease by 2030 is projected: from 0.54 kt CO₂ eq. in 2022 to 0 kt CO₂ eq. in 2030 according to an expert judgment regarding burning of waste without energy recovery stopping in Estonia by that time. For Wastewater treatment, a 9% decrease of emissions is foreseen: from 92.39 kt CO₂ eq. in 2022 to 83.63 kt CO₂ eq. in 2040, the main reason for the change being expansion of the sewage network and upgrading of the wastewater treatment systems in low-density settlements.

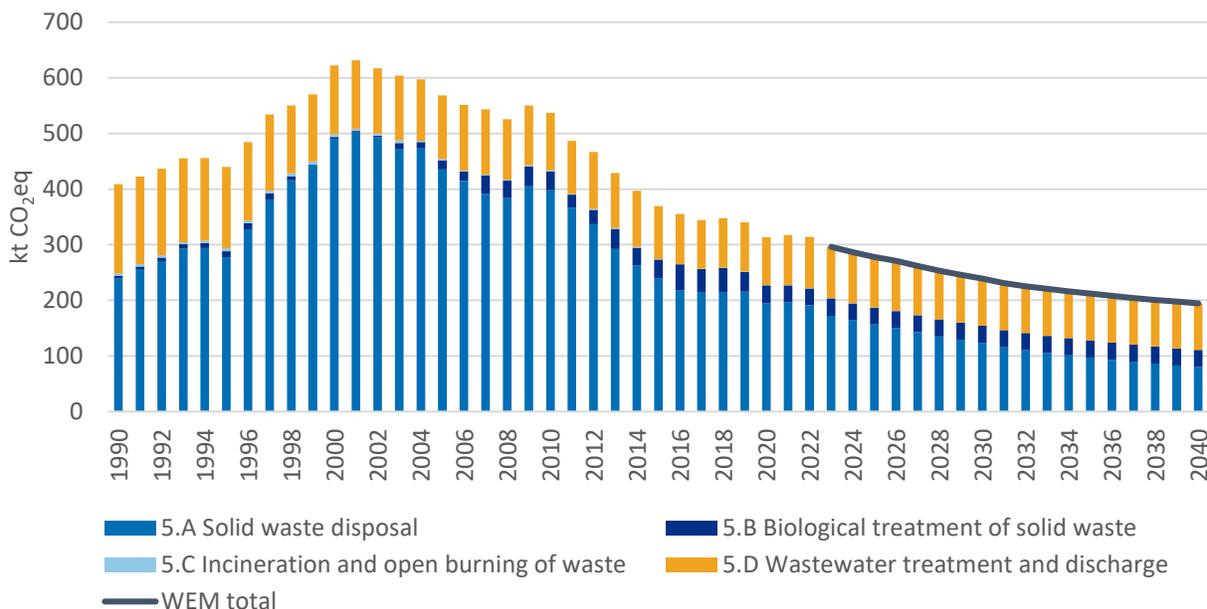


Figure 3.27 Historical GHG emissions (1990–2022)³⁴ and projected emissions (2023–2040) from the waste sector according to the WEM scenario, kt CO₂ eq.

3.6.4 Information in describing the methodology used to develop the projections

3.6.4.1 Energy sector (excluding transport)

Projections of GHG emissions have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. Two projection scenarios are presented – the WEM scenario evaluates future GHG emission trends under the current policies and measures and the WOM scenario illustrates a future where measure from WEM scenario wouldn’t be implemented.

The scenarios projecting GHG emissions in the Energy sector are mainly based on the measures of the Ministry of Climate, which are funded through, Environmental Investment Centre and the State Shared Service Center (e.g. funding from the Recovery and Resilience Facility as well as revenues from the EU ETS). In addition, the scenarios were updated based on certain inputs on parameters received from the Ministry of Climate and industries (incl. planned renewable energy capacities, use of various fuels etc.). Also, future EU ETS allowance price and GDP growth were taken into account. The GHG impact of the measures are mainly calculated through their energy

saving or fuel exchange that they initiate. See CTF Table 11 for detailed information on parameters used for projections.

The main assumption for electricity supply in the WEM scenario is that step-by-step, the use of oil shale shall decrease to produce electricity and increase to produce shale oil. The retort gas that occurs as a side product during the production of shale oil is used for electricity production. Information about the amounts of oil shale used in the shale oil industry and the amounts of retort gas produced is an input from the oil shale industry.

Electricity generation from wind and solar also substantially increases based on the input from the MoC. The projected future usage of fuels through the impact of the measures is applied for the calculations while using the emission calculations of the 2006 IPCC Guidelines.

The projections for heat supply in the WEM scenario are based on the renovation rate of buildings, boilers and heat pipes. The projections also consider the building rate of new and dropout rate of old buildings.

3.6.4.2 Transport

Projections of GHG emissions have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. Two projection scenarios are presented – the WEM scenario evaluates future GHG emission trends under the current policies and measures and the WOM scenario illustrates a future where measure from WEM scenario wouldn’t be implemented.

Sybil baseline model¹⁴⁵ is used for the GHG projections in the road transport sector. The model uses a bottom-up approach requiring data about the vehicle fleet, technology (EURO class) and road activity. The biggest strength of the model is that it is compatibility with COPERT model¹⁴⁶, which is used for the compilation of road transport emission estimates in the national inventory report and kept up to date by EMISIA, the same team as for COPERT. Its weakness is the high time consumption of calculating the effect of each individual measure. For that reason, it is easier to calculate separately the effects of the measure and insert the sum effect into the model.

The projections in the Transport sector are based on the information and parameters from the ITF report “The Future of Passenger Mobility and Goods Transport in Estonia”¹⁴⁷, the TalTech report “Traffic survey manual and the business as usual forecast”¹⁴⁷ and the Ministry of Climate.

For instance, rail diesel projected consumption is based on five-year historical values (2018–2022) from the 2024 NIR. Changes in national aviation traffic are derived from the EUROCONTROL Aviation Outlook 2050¹⁴⁸, while maritime traffic adjustments are referenced from the 2024 NIR report. CO₂ emission metrics, such as those for new passenger vehicles (in gCO₂/km) and heavy trucks (as a percentage compared to 2019), are sourced from EU regulations. Additionally, data

¹⁴⁵ Sybil baseline model. [www] <https://copert.emisia.com/sybil-baseline/> (06.12.2024)

¹⁴⁶ COPERT model. [www] <https://copert.emisia.com/> (06.12.2024)

¹⁴⁷ Kaal, L.; Metsvahi, T.; Kendra, A. (2020). Liiklusuuringu juhendi ja baasprognoosi koostamine. Tallinna Tehnikaülikool. [www] https://transpordiamet.ee/sites/default/files/documents/2021-11/bp-2050_aruanne.pdf (06.12.2024)

¹⁴⁸ EUROCONTROL Aviation Outlook 2050 (2022). [www] https://www.eurocontrol.int/archive_download/all/node/13448 (06.12.2024)

on vehicle purchases, categorized into new and used cars or trucks, is provided by AMTEL (Association of Estonian Car Sales and Service Companies)¹⁴⁹. This comprehensive parameter selection ensures a robust foundation for the evaluation, leveraging reliable and diverse sources to guide the projections. See CTF Table 11 for information on parameters used for projections.

To estimate GHG emissions, emission factor data from the 2006 IPCC and EMEP/EEA 2019 Guidebook along with country-specific emission factors are used.

The projections for the WEM scenario are also in line with Regulation (EC) No 2019/631 of the European Parliament and of the Council. In addition, it is also taken to account that by 2035, the average emissions target for a new passenger car is 0 gCO₂/km and 130 gCO₂/km for light duty vehicles.

3.6.4.3 IPPU

WEM projection scenario for GHG emissions has been calculated for the period 2023–2040. The reference year 2022 used in the projections is consistent with Estonia's 2024 GHG inventory submission to the UNFCCC³⁴. Emissions from the IPPU sector are projected according to the WEM scenario, which evaluates future GHG trends under current policies and measures.

The Estonian industry sector is relatively small. The majority of emissions from subcategories, such as the Mineral industry, Non-energy products from fuels and solvents, and Other product manufacture, as well as their respective subcategories, comprise emissions from the activity of only a few companies who also influence the emissions' trend. In most subsectors bottom-up data gathering, companies' production forecasts, population projection (by Statistics Estonia), the long-term real GDP growth rate (by the Ministry of Finance) and expert judgements are combined and used. This approach ensures the most proximate projections that reflect the actual situation in subcategories with a limited number of emitting agents.

The Mineral industry's projected emissions are based on previous inventory trends and industries' operator projections where input was received taking into account planned production capacities and/or maximal production capacities according to companies' environmental permits. The Chemical (ammonia) industry is no longer active in Estonia and emissions from that sector are 0. The Metal industry's projected emissions are based on previous trends.

Emissions from urea-based catalyst AdBlue are projected taking into account:

1. broadening of NO_x emission standards to light vehicles (Euro 6 standards);
2. the forecast of the number of vehicles and their average fuel consumption, which is consistent with the projections of the Transport sector.

Emissions of fluorinated gases are projected according to the GHG inventory's calculation methods. Emissions from each group of HFC-containing equipment are projected separately. Bans

¹⁴⁹ Autode müügi- ja teenindusettevõtete Eesti Liit. [www]<https://amtel.ee/> (06.12.2024)

and restrictions stipulated in the Regulation (EU) No 2024/573¹¹⁷ and Directive 2006/40/EC¹¹⁸ are taken into account in the projections.

Emissions are calculated from large and small commercial refrigeration equipment, industrial refrigeration and cooling, stationary air conditioning/cooling, mobile refrigeration, mobile air conditioning, fire protection equipment and foam producing by taking the following bans from Regulation 2024/573 into account:

1. bans on placing on the market;
2. ban of refilling equipment that contains HFCs with certain GWP.

It is assumed that due to the new F-gas regulation the majority of commercial and industrial refrigeration is switching to alternative refrigerants (CO₂, NH₃ and HF based systems respectively). It is assumed that HFC refrigerants are properly collected from discharged equipment.

SF₆ emissions (from Other product manufacture and use category) are regulated by the Regulation (EU) 2024/573. The plans of SF₆ electrical network operators and emissions from equipment in operation are taken into account.

Consumption of N₂O in aerosols is calculated with the projection of population size.

3.6.4.4 Agriculture

Projections of GHG emissions have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia's 2024 GHG inventory submission to the UNFCCC³⁴. Projections of emissions are calculated based on the 2006 IPCC methodology applied in the Estonian Greenhouse Gas Inventory. Two projection scenarios are presented – the WEM scenario evaluates future GHG trends under current policies and measures and the WOM scenario reflects the situation where all the measures from the **Common Agricultural Policy (CAP) Strategic Plan 2023–2027** are not applying from the year 2024.

In the WEM scenario, the projected numbers of animals, crop productions, the amounts of mineral and lime fertilizers used are based on the results of the Agriculture Projection Model (APM)¹⁵⁰, developed in 2021 by Centre of Estonian Rural Research and Knowledge. The model projects the data for the next ten years, so for the years 2023–2033. Projected activity data for the period 2033–2040 is interpolated. The APM model considers the characteristics common to Estonia and provides opportunities to analyze different policy scenarios and changing market and macroeconomic conditions. All animal numbers from the APM results are rounded to an integer. Also, annual average sheep, goat and poultry numbers were calculated for keeping consistency with the GHG inventory methodology. The quarterly sheep and goat numbers are divided with the last five-year average ratio to sheep and goats, respectively, used in the inventory. Poultry, layers and other poultry projections are based on the APM result, as well as projections for the population

¹⁵⁰ Centre of Estonian Rural Research and Knowledge (2021). Projekti "Põllumajandusloomade ja väetiste osas integreeritud KHG ja õhusaasteainete prognoosimise süsteemi loomine". [www] <https://metk.agri.ee/media/1797/download> (06.12.2024)

of horses. The total number of broilers is projected based on the last five years' data from the 2024 NIR. The number of other hens and roosters is calculated based on the average ratio of the animal group to Poultry total population used in the 2024 NIR. To project the rabbit population year 2022 value was used from the 2024 NIR until the year 2040.

The highest impact on CH₄ emissions comes from Enteric fermentation due to the projected increase of dairy cattle population and milk yield. Agricultural Soils is the second largest GHG emission source in Estonia, of which emissions are mostly driven by synthetic N-containing fertilizers applied to soils, however also organic soils cultivation, crop production, other organic fertilizers applied to soils (such as compost, sewage sludge and waste-based digestates), and data about mineralization are affecting the total projections. Other categories, e.g. Manure management (driven by the livestock numbers and manure management systems distribution), CO₂ emissions from Liming and Urea fertilization do not have a significant impact on the GHG emission trend.

Main activity data for calculating CH₄ emissions from Enteric fermentation and CH₄ and N₂O emissions from Manure management are livestock population, distribution of animal waste management systems (AWMS) and milk yield and pregnancy rate for dairy cows. Estonia-specific volatile solids (VS) and Nitrogen excretion rates (kg/head/year) of dairy cattle have been calculated on the basis of projected milk yields. For projecting the number of animals, the purchase price of agricultural products is taken into account in the APM, the future direction of which is related to the corresponding price changes of meat and cheese presented in the OECD-FAO report published in 2023. The influencers are the price of forage, which in the case of herbivores depends indirectly on the price of fuel (the production cost of grass fodder) and in the case of grain eaters on the price of wheat. Production-related subsidies paid for the respective animal species are taken into account as a price supplement, the budget of which is reduced per production unit.

At the end of 2023, there were a total of 241,400 cattle, including 83,300 dairy cows and 28,700 suckling cows. In a ten-year perspective, in the WEM scenario, it is projected that the number of dairy cows will increase by 1,108 heads and the number of suckling cows will decrease by 994 heads, so the total number of cattle by 2033 would be 0.5% higher than in 2023. The number of cattle is projected to stay at the 2033 level until 2040. At the same time, milk production per cow is projected to increase by 22% in ten years, and total milk production by 23% by the year 2033. After 2033, milk production is projected to stay at that the same level until 2040. Developments for increasing the herd of dairy cattle and their milk yield will be supported by the direct production-related subsidies paid per dairy cow and suckling cow and the interrelationship between the purchase price of milk and feed costs.

At the end of 2023, there were a total of 275,000 pigs, including 24,100 sows. It is predicted that the number of pigs will increase by 7% in a ten-year perspective, reaching 293,230 animals in 2033. After 2033, the number of pigs is projected to stay at the same level until 2040. The number of pigs is affected by the predictable ratio of wheat and pork prices.

At the end of 2023, there were a total of 58,700 sheep and goats, including 27,400 ewes and female goats. It is predicted that the number of sheep and goats will decrease by 15%, and by 2033 there

will be 53,888 sheep and goats. After 2033, the number of sheep and goats is projected to stay at that the same level until 2040. The number is affected by the production-related subsidy for ewe and female goats. The assumption of the APM model is that the producer wants to maintain their income according to the market situation. If the price or the subsidy decreases, the herd should be increased, and if the price or the subsidy increases, there is no direct need to increase the herd.

At the end of 2023, there were 2,211,775 poultry, including 662,500 laying hens. The number of poultry is projected to increase to 2,229,798 in 2033 and stay at that level until 2040. The poultry population in the projections is affected by the change in the price of wheat (as a feed cost).

The number of horses is projected to decrease a bit in 2023 compared to 2022, then rise from 4,900 to 7,182 animals in 2024 and then stay at that level until 2040. The population of rabbits is projected to stay at the 2022 year level from the 2024 NIR until the year 2040. The population of fur animals will decrease steadily to zero in 2026, when fur farms will be banned in Estonia.

Feed intake parameters and the methane conversion rate are harmonized with the national GHG Inventory. Gross energy intake of dairy cows is calculated on the basis of projected milk yields. Fat content in milk (%) for the projected period is assumed to remain at the same level as in 2022 (3.95%) until 2040.

Projected N₂O emissions from the Agricultural soils subsector are based on the amounts of organic and synthetic N-containing fertilizers applied to soil, quantities of harvested crops, carbon stock change in mineral soils, and area of cultivated organic soils. Direct N₂O emissions include emissions from synthetic and organic fertilizers applied to agricultural soils, emissions from animal waste, emissions from crop residues, emissions from the cultivation of organic soils and emissions from mineralization associated with loss of soil organic matter. Indirect N₂O emissions include emissions from atmospheric deposition and from leaching and run-off. The quantities of sewage sludge and composted organic waste applied to soils are harmonized with the Waste sector projections (see Waste sector GHG projections chapter), data for calculating carbon stock change in mineral soils and organic soils cultivation are provided by the LULUCF sector expert. The projections on the use of synthetic fertilizers are projected by the APM. The amounts of N-containing fertilizers are projected to decrease by 8,5% compared to 2022 by the year 2040. Fertilizer use is estimated taking into account the crop yield and the amount of N, P₂O and K₂O fertilizers used for this purpose according to the calculation of the marginal revenue at a given yield level. Estonia's crop production is projected also with the APM model. The yield of crop production is most affected by weather conditions, as well as the price ratio of fertilizers and product. As a price margin, the budget for area-related subsidies for the amount of production has been taken into account. The future price direction is shaped by the price of wheat shown in the OECD-FAO 2023 report. Based on historical data, it is assumed that the current weather conditions will continue, and that the farmers will base their decisions on cost efficiency – for every euro spent on fertilizer, they would want to get back a certain income per ha. Based on these assumptions, the predicted yield on cereals and rape varies from -6% (buckwheat) to +15% (spring barley). The development of technology is not considered in the projections model. The total

production is found through multiplication of the area of the agricultural crop and the yield of the crop. The volume of the total production of cereals will decrease by 10% by 2033, for rape and rapeseed by 13%, for legumes by 3%.

The area of agricultural land covered with lime fertilizers has been added to the projections model according to the CAP Strategic Plan 2023–2027, and the amount used is based on historical data based on the amount given per hectare. Therefore, emissions from liming are projected to decrease by 9.88% by the year 2040 compared to 2022.

In the WOM scenario, the projected numbers of animals, crop productions, the amounts of mineral and lime fertilizers used are also based on the results of the Agriculture Projection Model (APM). According to the WOM scenario, all support measures of the CAP Strategic Plan taken into account in the projections model will not be implemented as of the year 2024. The subsidy budget of the CAP Strategic Plan is included in the projections model as an addition to the market price of production, so if the subsidies are removed, the income per unit of production will decrease and the ratio of input costs and product prices will change. As a result of this scenario, the agricultural land area would decrease by 53,410 ha in the case of cereals, and the growing area of more profitable crops would increase (wheat, barley; total of 3% by 2040), the leguminous area would significantly decrease (by 78%) by 2040, as the growing area of legumes is strongly related to environmental subsidies. Fertilizer use would decrease depending on crop surface changes by 3% for mineral N-containing fertilizers. Due to a 1% reduction in dairy cows, the total amount of milk production would also decrease. The loss of subsidies will have a greater impact on beef cattle and sheep and goat breeding, where the income of the herd would be increased by 14% and 36%, respectively. The number of poultry and pigs is not affected by this scenario.

3.6.4.5 LULUCF

Two projections scenarios of GHG emissions have been calculated for the period 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. The WEM scenario evaluates future GHG emission trends under current policies and measures. The second scenario, WOM reflects the situation where all the measures from the Common Agricultural Policy (CAP) Strategic Plan 2023–2027 are not applying from the year 2024.

Land use projections are based on the following assumptions and planned activities:

- annual land conversions will generally continue to occur at the same level as the average of 2018–2022, except for the conversions described below;
- deforestation of 1200 ha of Forest land due to the restoration of heritage meadows (Grassland category) is divided equally between 2023–2027 in the WEM scenario (MoC);
- the construction of Rail Baltic is expected to increase the area of Forest land converted to settlements by 806 ha in the period of 2023–2028;

- deforestation due to the establishment and development of training grounds of the Defence Forces is considered under Forest land converted to other land category. Total projected deforested areas in 2024–2029 are ~7120 ha (Estonian Centre for Defence Investment);
- shares of drained organic soils from the total area of organic soils for Forest land and Grassland are projected as an average of 2018–2022.

Projected areas of land use categories and methods described in the NID 2024 Chapter 6 were used for estimating GHG emissions and removals. Additional assumptions for specific categories are stated below.

WEM projections for Forest land are based on the business-as-usual scenario composed by the Estonian Environment Agency. The following assumptions and methods were applied in WEM scenario projections for Forest land category:

- Total final felling volume in 2024–2042 was expected to be 11 mln m³ year⁻¹, which is the average of five felling seasons.²¹ In 2023, the felling volume 12.1 million m³ year⁻¹ has been used as an expert assessment;
- In modelling the final fellings, actual harvesting distribution between dominant tree species in recent years is used. The calculation of the final felling area is only applied in the case of forest available for wood supply. Strictly protected forests are modelled without fellings;
- Final fellings are projected by dominant tree species and site quality classes depending on the age, diameter and stocking of the stand;
- The growing stock volume in Forest land is projected by decade and is obtained by multiplying the area in age class with the average growing stock per hectare in the relevant age class;
- Distribution of forest area by dominant tree species remains the same during the entire period;
- The area of the forest not available for wood supply (strictly protected area) is 482.5 kha²¹. It is projected to remain at the same level;
- In the case of forest available for wood supply with additional protective measures (excluding water protection forests on banks), in total 219.6 kha, half of the uniform final felling coupe intensity is applied;
- Growing stock in Forest land remaining forest land is calculated as the difference between projected value for total forest land and estimated Land converted to forest land growing stocks;
- Living biomass in Forest land remaining forest land in 2023 is calculated using preliminary harvesting estimates;
- Dead wood C stocks in Forest land remaining forest land are expected to increase in the future due to natural disturbances. Therefore, the 2020–2022 period average net removals by the dead wood pool are increased by 10% for the projections;

- Non-CO₂ emissions from drained organic forest soils are estimated by multiplying the 5-year average emissions per hectare by the projected area.

Estimations for the HWP pool are based on the projected harvest levels. The fraction of harvest for the HWP commodity production and the share of HWP commodities were assumed to remain at the current level, except for wood-based panels (the factory, which produced particle boards, was closed, and the production was projected as zero).

For calculating C stock changes in the mineral soils of the Cropland remaining cropland category, areas under different crops are projected based on the results of the Agriculture Projection Model (APM) developed by the Centre of Estonian Rural Research and Knowledge¹⁵⁰. The same model was also applied in the Agriculture sector. According to the APM base scenario, the utilized agricultural area will remain stable until 2033, with no significant changes expected in land use. After 2033, the crop areas are projected to stay at the same level until 2040. It is assumed that the present management practices (shares of areas under full tillage, reduced tillage and no-till) will continue.

Most emissions from the Wetlands category derive from the horticultural use of peat. The amount of peat removed for horticultural use is calculated as the difference between total peat production and the primary production of energy peat. The projected annual peat extraction (884 kt) is estimated as the average of the period 2019–2023. The use of energy peat has had a declining trend which is expected to continue, and, after 2035, all extracted peat is projected to be used in horticulture. Country-specific carbon fraction of peat is used in calculations and peat is assumed to be oxidized in the year of extraction. The area of peat extraction sites was 25.81 kha in 2022 and the same area is also applied in projections.

CH₄ and N₂O emissions from wildfires are estimated as the average of the period 2018–2022. Reported and projected non-CO₂ emissions from biomass burning in Land converted to forest land areas are included under the Forest land remaining forest land category. Similarly, CH₄ and N₂O emissions from biomass burning in the Grassland remaining grassland category also include emissions from Land converted to grassland and Wetlands categories. GHG emissions from wildfires are not estimated for Croplands and Settlements as they are considered insignificant in terms of the overall level and trend in national emission.

The WOM scenario differs from the WEM scenario only for the Cropland category and is in line with the WOM scenario for the Agriculture sector. According to the WOM scenario, all support measures of the CAP Strategic Plan considered in the Agriculture Projection Model will not be implemented as of the year 2024. The subsidy budget of the CAP Strategic Plan is included in the projections model as an addition to the market price of production, so if the subsidies are removed, income per unit of production will decrease and the ratio of input costs and product prices will change. As a result of this scenario, the agricultural land area would decrease by 53 410 ha by 2033.

3.6.4.6 Waste

The waste sector WEM scenario GHG projections have been calculated for the period of 2023–2040. The reference year 2022 used in the projections is consistent with Estonia’s 2024 GHG inventory submission to the UNFCCC³⁴. The WEM scenario evaluates future GHG emission trends under the current policies and measures.

GHG emissions emitted from the Waste sector include CO₂, CH₄ and N₂O. CO₂ is emitted from the Waste incineration category. The main share of CH₄ from the Waste sector comes from Solid waste disposal on land. CH₄ and N₂O are emitted from Wastewater treatment and discharge, Biological treatment and Waste incineration.

CH₄ emission projections in the Solid waste disposal on land (SWD) subcategory are done using the 2006 IPCC Waste Model, which has been developed by the IPCC for estimating CH₄ emissions from solid waste disposal sites, for projections, additional sheets have been interlinked with the existing Waste model template sheets which are easy to adjust to reflect the country specific needs. Also, it is possible to interlink cells making the calculations easy. It is difficult to point out the weakness of the model as the calculations’ difficulties depend on the adjustments and activity data. In the IPCC 2006 Waste Model, synergies of waste decomposition over time period are taken into account in the calculation. There are no overlaps, because the input data is clearly divided to different waste groups.

The municipal solid waste (MSW) generation projections consider population projection (by Statistics Estonia) and the long-term real GDP growth rate (by the Ministry of Finance), see CTF Table 11. Also, according to the NWP 2023–2028¹³⁴, from 2030 the quantity of municipal solid waste deposited in a landfill shall not exceed 10% by weight of the total quantity of municipal solid waste generated in the same year, and no more than 20% of the landfilled MSW can be biowaste. Additionally, for the separately collected municipal waste a recycling rate of 55% by 2025, 60% by 2030, and 65% by 2035 as mentioned in the NWP 2023–2028¹³⁴ is applied.

Mixed Municipal Solid Waste Composition Study carried out in 2020¹⁵¹ is used for a MSW composition projection.

Projections in the subcategory Biological treatment of solid waste are based on the long-term real GDP growth rate projections by the Ministry of Finance applied to the previous year’s biologically treated solid waste amount. To this projected amount, an addition is done from the amount of biological waste that will be separated from mixed municipal solid waste and will not go to landfilling, and a subtraction due to the demand of energy neutrality of wastewater treatment plants with a capacity of 10 000 population equivalent or more by 2040 in the updated Urban Wastewater Treatment Directive¹³⁶ that results in all the mentioned treatment plants sending their sludge to the

¹⁵¹ Stockholm Environment Institute Tallinn Center SA. (2020). A research of the composition and amounts of mixed municipal waste, separately collected paper and packaging waste, and electronic scrap. (In Estonian) [www] <https://www.sei.org/wp-content/uploads/2020/10/sortimisuuringu-lopparuanne.pdf> (09.12.2024)

anaerobic digestion and no longer to composting. Additionally, a subtraction in the size of known and planned biological waste input of a new biogas production plant that opened in 2023 was done. Only a small amount of waste gets incinerated without energy recovery. Projections in the subcategory Waste incineration and Open burning are done using the expert judgment that open burning and incineration will finish by 2030. Open burning is calculated as a yearly decreasing percentage of the amount of MSW generated. MSW generation is in accordance with the subsector Solid waste disposal on land. Activity data about generated MSW is projected under the SWD subcategory.

Projections of GHG emissions in Wastewater treatment and discharge subcategory are based on the population projections (by Statistics Estonia) and the objectives set for the coverage of centralised wastewater system by the MoC as well as the foreseen changes in the different wastewater treatment systems covering both high- and low-density settlements. GHG emissions from Industrial wastewater are based on the plans of the companies and the resulting change in the industrial wastewater production.

3.7 Sensitivity analysis

For the GHG projection compilation, trajectories for parameters for reporting on national GHG projections in 2025 (to European Commissions according to Regulation (EU) 2018/1999) were provided by the European Commission (EC) for all the EU Member States. These include harmonised values to be considered for the 2025 national GHG projections on the international oil, gas and coal import prices, the EU ETS carbon prices, population and GDP.

For the projection compilation, it was possible to use Estonia's Ministry of Finance's updated long-term real GDP growth rate from September 2023 and population projection by Statistics Estonia which were considered more up to date. The beforementioned EC parameters are used for the IPPU and Waste sectors' sensitivity analysis to validate national data used in the projections. Sensitivity analysis is also conducted for the Transport and LULUCF sectors, on these see more details below.

(1) Transport

Sensitivity analysis for the Transport sector is based on different scenarios of the uptake of electric passenger cars, as they have the highest GHG impact on the sector. Although Regulation (EC) No 2019/631 will have the largest impact on consumer choice for new vehicles in the future, it does not guarantee currently that all vehicles are running on alternative fuels or energy sources by 2040. The baseline composition of the vehicle fleet before 2035 may have a bigger impact on 2040. By the end of 2022, there were around 4.5 thousand electric passenger cars in Estonia.

The SEN analysis considers the GHG impact of different uptake of electric passenger cars by 2030 (Figure 3.28):

- WOM scenario – 30 thousand electric passenger cars;

- SEN1 scenario – 40 thousand electric passenger cars;
- SEN2 scenario – 80 thousand electric passenger cars.

The SEN1 scenario projections are similar to the WOM scenario projections with the difference of 1.5% in emissions by 2030. The difference between the WOM and SEN2 scenarios is around 8.0% by 2030. The assumption after 2030 in all the scenarios is that the new vehicle exchange rate in the fleet stays on average the same as in the past, which is around 25 thousand new passenger cars annually.

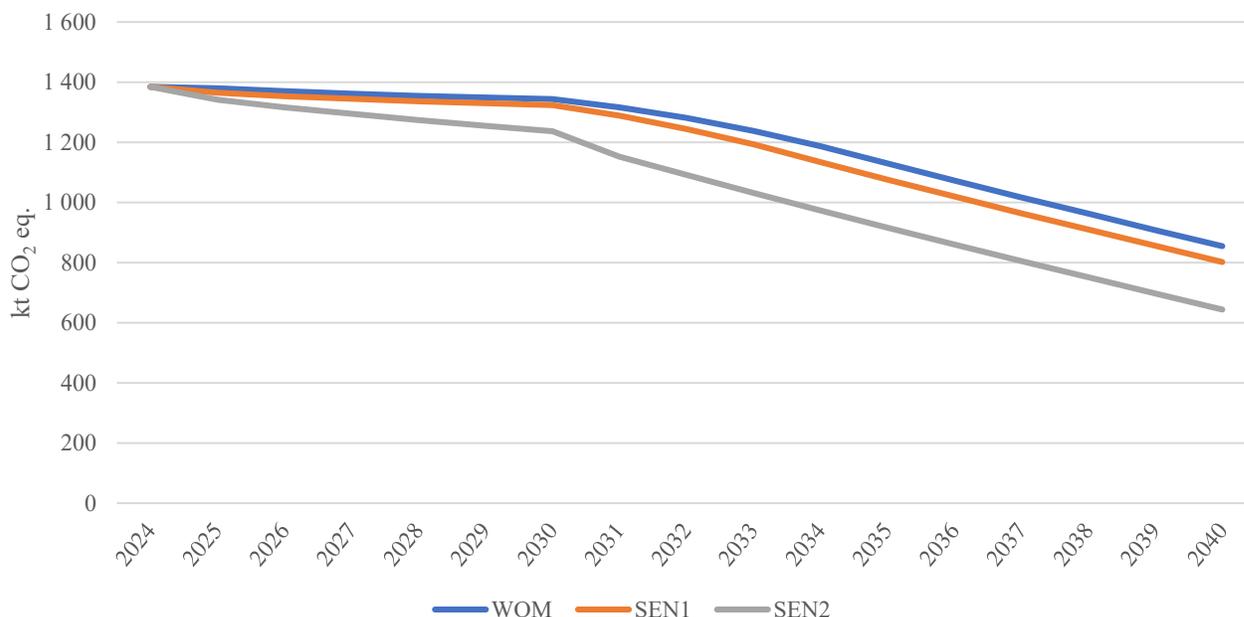


Figure 3.28 Comparison of total GHG emissions of the Transport sector WOM (30 thousand electric passenger cars), SEN1 (40 thousand electric passenger cars) and SEN2 (80 thousand electric passenger cars) scenarios, kt CO₂ eq.

(2) IPPU

Sensitivity analysis for IPPU sector emissions is based on the alternative population and annual real GDP growth rate harmonised values provided by the European Commission (see [Table 3.6](#)).

Table 3.6 Harmonised parameters given by the European Commission

Indicator	2025	2030	2035	2040
GDP (growth rate), %	3.18	1.4	1.74	2.03
Population in Estonia, million	1.3759	1.3568	1.3441	1.3423

Under the SEN scenario population and GDP growth rate values provided by the EC are used in the calculations of the IPPU categories 2.D Non-energy products from fuels and solvent use (GDP

and population) and 2.G Other product manufacture and use (GDP and population) according to the methodology of the WEM scenario.

When comparing GHG emissions between the WEM and SEN scenarios, the emissions are projected to increase by 1.7% in 2040 in the SEN scenario compared to the WEM scenario. The results of the SEN scenario are presented in [Figure 3.29](#).

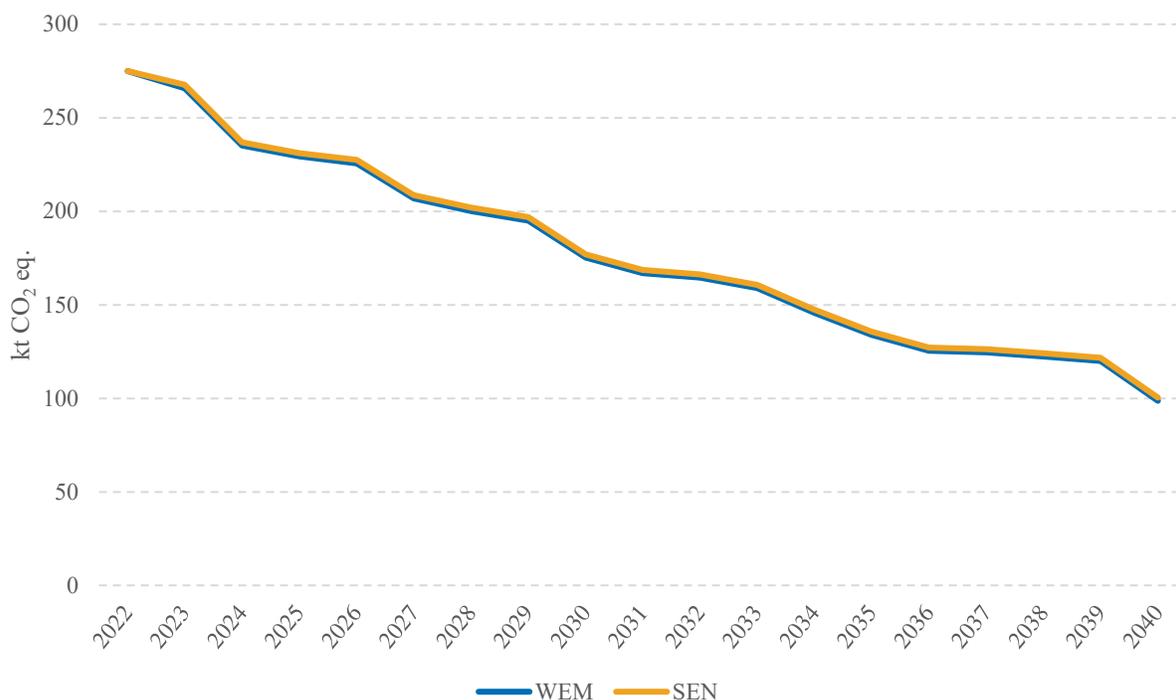


Figure 3.29 Comparison of total GHG emissions of the IPPU sector WEM and SEN scenarios, kt CO₂ eq.

(3) LULUCF

Forest is the prevailing land-use category in Estonia and has the largest influence on the whole LULUCF sector's total carbon balance. The felling scenarios try to predict the future changes in Forest land and HWP carbon stocks under different felling intensities. Sensitivity analysis for LULUCF sector emissions is based on the scenarios, where total felling volume has been projected at 8 million m³ (SEN1), 10 million m³ (SEN2) and 12 million m³ (SEN3) levels. For other land use categories, no additional SEN analysis is carried out.

Under the SEN1 scenario ([Figure 3.30](#)) the LULUCF sector is expected to become a CO₂ sink in the whole period (except in 2023). The LULUCF sector will reach the maximum removals (-89.59 kt CO₂ eq.) in 2030 and then decline to -635.67 kt CO₂ eq. in 2040. The total forest growing stock will increase rapidly (total forest growing stock will be approximately 8% higher in 2043 than it is 2023) and therefore carbon sequestration in tree biomass increases. Net removal from Forest

land is projected to increase significantly, reaching -3,060.07 kt CO₂ eq. in 2032 and then will decrease slightly to -2,708.47 kt CO₂ eq. in 2040. HWP net removal will decrease significantly due to the lower felling volume from -641.58 kt CO₂ in the base year to -166.40 kt CO₂ in 2040.

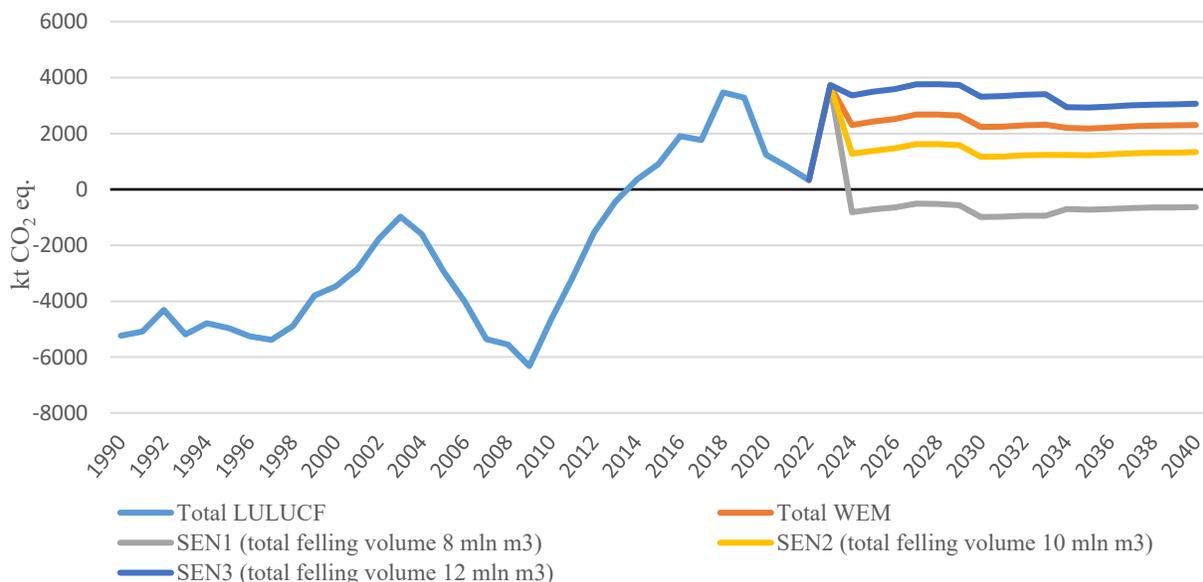


Figure 3.30. Comparison of total GHG emissions of the LULUCF sector WEM (total felling volume 11 million m³), SEN1 (total felling volume 8 million m³), SEN2 (total felling volume 10 million m³) and SEN3 (total felling volume 12 million m³) scenarios, kt CO₂ eq.

In the SEN2 scenario, the LULUCF sector is expected to become a CO₂ source side throughout the considered period. Forest land will sequester carbon (except in 2023), as the total forest growing stock will remain quite stable. HWP net removal will decrease compared to the base year to -364.84 kt CO₂ in 2040. Net emissions in the LULUCF sector are projected to increase from 339.29 kt CO₂ eq. in 2022 to 1,332.29 kt CO₂ eq. in 2040.

The SEN3 scenario shows that during the period of 2023–2040, the LULUCF sector remains a GHG source. From 2023 to 2033, the net emissions from Forest land are projected to increase the most (an average 1,780.98 kt CO₂ eq. per year). and then decline to 1,389.22 kt CO₂ eq. by 2040. HWP net removal will increase in the first decade (an average -701.07 kt CO₂ per year) and then decline to -563.28 kt CO₂. by 2040. The projected overall emissions from the LULUCF sector under the SEN3 scenario will increase in the first decade, reaching the maximum value (of 3,765.22 kt CO₂ eq.) in 2028 and then decline to 3,065.14 kt CO₂ eq. in 2040.

(4) Waste

Sensitivity analysis for Waste sector emissions is based on the population and annual real GDP growth rate harmonized values provided by the European Commission (see Table 3.6). All

categories in the Waste sector are either affected by the change of population projections, fluctuations in GDP, or both.

The SEN scenario projections are quite similar to the WEM scenario projections, projecting only 0.70% lower emissions for the year 2040. On [Figure 3.31](#) the comparison of the two scenarios in regard to the projected total emissions in the Waste sector can be seen.

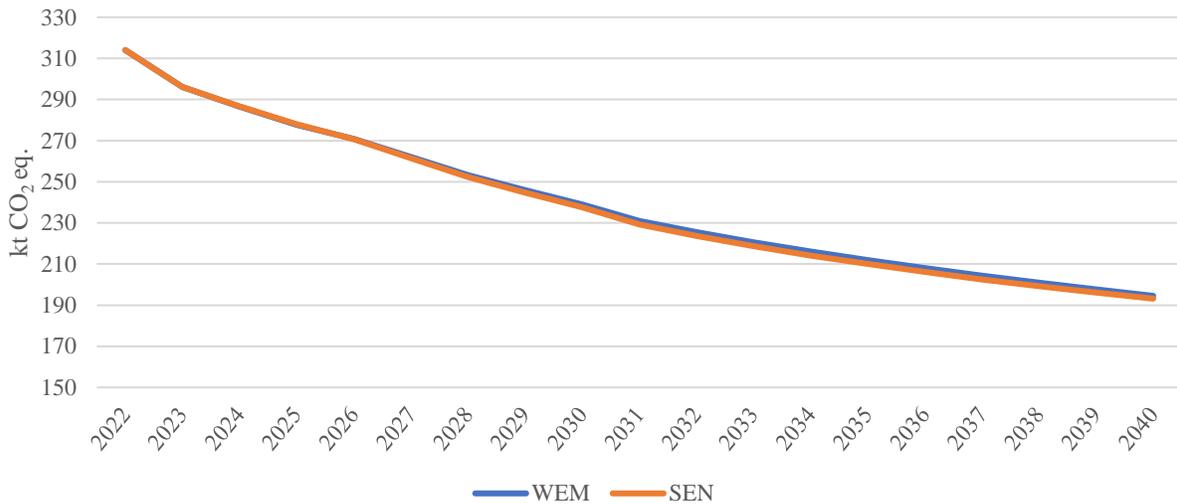


Figure 3.31 Comparison of total GHG emissions of the Waste sector WEM and SEN scenarios, kt CO₂ eq.

3.8 Other information

According to paragraph 103 of the annex to decision 18/CMA.1, ‘each Party may provide any other information relevant to tracking progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement’. All relevant information can be found in sections 3.1 to 3.6, above. Hence, no additional information is provided here.

4 Climate change impacts and adaptation

4.1 National circumstances, institutional arrangements and legal frameworks

4.1.1 National circumstances relevant to its adaptation actions, including biogeophysical characteristics, demographics, economy, infrastructure and information on adaptive capacity

The main factor influencing Estonia's climate is the country's geographical position. Local climatic differences are mainly caused by the neighbouring Baltic Sea, which warms up the coastal zone in winter and has a cooling effect in spring. Estonia lies in the transition zone between maritime and continental climates. Topography plays an important role in the distribution and duration of snow cover, especially in the highlands of south-eastern Estonia.¹⁵²

The average annual temperature has increased slightly faster in Estonia compared to the world as a whole since the middle of the last century^{153,154}. The global increase in the ground level temperature since 1951 has been 0.12 °C per decade, for Estonia it has been 0.2–0.3 °C per decade¹⁵³. In the last 60 years, the average temperature in Estonia has risen by 1.2 °C. Climate warming has not occurred evenly throughout the year. The temperature has risen the most in winter (from December to February) and spring (from March to May). Climate warming is also reflected in changes in nature's seasonality. As a general tendency, spring climatic seasons have started to arrive earlier and the autumn ones later, as a result of which the warmer half-year has become longer and the winter has become shorter.¹⁵⁵

The increase in the average annual precipitation in the second half of the 20th century has been significant in Estonia, remaining between 5% and 15%, taking into consideration a correction for wetting. A higher trend can be observed in the period from October to March¹⁵³. In 1866 – 1995, only a weak and statistically insignificant growth trend has been observed in the case of Estonia, which is stronger in autumn and winter, weaker in spring and summer. Regular cycles have also been observed in the total amount of precipitation, which are of the lengths 50–60, 25–33, and 5–

¹⁵² Estonian Environment Agency. (2015). Estonian future climate scenarios until 2100. (In Estonian) [www] https://www.klab.ee/wp-content/uploads/sites/4/2016/04/2016-04-07-KAUR_Lopparuanne.pdf (15.07.2024).

¹⁵³ Jaagus, J. (2006). Climatic changes in Estonia during the second half of the 20th century in relationship with changes in large-scale atmospheric circulation. *Theoretical and Applied Climatology*, 83 (1–4), 77–78.

¹⁵⁴ BACC. (2008). Assessment of climate change for the Baltic Sea basin. Springer-Verlag, Berlin Heidelberg.

¹⁵⁵ Nõges, P., Jaagus, J., Järvet, J., Laas, A., Nõges, T. (2012). The impact of climate change on water ecosystems and groundwater in Estonia and the resulting possible development directions of the water monitoring program. (In Estonian) [www] <https://kliimaministeerium.ee/sites/default/files/documents/2021-12/Kliimamuutuste%20m%C3%B5ju%20vee%C3%B6kos%C3%BCsteemidele%20ning%20p%C3%B5hjaveele%20Eestis%20ja%20sellest%20tulenevad%20vee%20vee%20vee%20v%C3%B5imalikud%20arengusuunad.pdf> (15.07.2024).

7 years. The average annual precipitation in a specific region may differ by more than twice, for example, 400 mm in 1965 and 850 mm in 1990.^{156,157,158}

A periodicity similar to that of precipitation is generally also characteristic of the runoff of Estonian rivers. Short-term variability can most often be observed in periods of 3–4 years and long-term variability in periods of 26–27 years, which reflect the regularity of the water-rich and water-hungry periods in the 20th century. No one-way increases or decreases in runoff have been observed in Estonia in the last 150 years and the impacts of climate change on runoff are not as clear or clearly targeted as the observed long-term increase in precipitation¹⁵⁵. The data on the water temperature of the two biggest lakes of Estonia Lake Peipus and Lake Võrtsjärv show an increasing trend^{159,160} similarly to other lakes in the Baltic Sea basin¹⁵⁴. The end of winter in the Estonian inland waterbodies moved to a month earlier in the period of 1946–1998¹⁵⁵. The ice cover period of Estonian rivers and lakes has shortened¹⁶¹. The runoff maximum of the rivers has moved to an earlier time and the peak runoffs are less steep¹⁶². The likelihood of high runoffs in spring ($\leq 10\%$, i.e. runoff, which occurs once in ten years) decreased in the period of 1922–2010¹⁶³. Sea water surface temperature is one of the main parameters characterising the climate of the surface layer of the Baltic Sea and its variability. The research, based on the analysis of infrared channel data from satellites, found a warming of the average annual surface temperature of the Baltic Sea. Around the coast of Estonia, the temperature change has been 0.6 to 1.0 °C per decade in the period of 1990–2008¹⁶⁴. The time series of the Baltic Sea ice cover shows that, during the last 50 years, the maximum ice cover extent of the Baltic Sea has fluctuated between 50,000 km² and 400,000 km². In earlier years, it reached up to 420,000 km². A sharp decrease in the maximum extent of ice cover after 1990 is preceded by predominantly ice-rich years and followed by ice-poor years¹⁵⁵. Decreasing sea ice cover has also been accompanied by a shorter duration of ice cover in the coastal areas of Estonia – ice formation is taking place later and the melting earlier.¹⁶⁵

The descriptions on biogeophysical characteristics, demographics, economy and infrastructure are under Chapter 3.1.1 National circumstances.

¹⁵⁶ Jaagus, J. (1992). Periodicity of precipitation in Estonia. *Man and Nature*. Ed. by Kaare, T. Estonian Geographical Society, 43–53.

¹⁵⁷ Jaagus, J. (1998). Climatic fluctuations and trends in Estonia in the 20th century and possible climate change scenarios. *Climate Change Studies in Estonia*. Ed. by Kallaste, T., Kuldna, P. Tallinn, Stockholm Environment Institute Tallinn Centre.

¹⁵⁸ Jaagus, J., Tarand, A. (1998). Precipitation. Periodical fluctuations and a seasonal shift. Country case study on climate change impacts and adaptation assessments in the Republic of Estonia. Report to the UNEP/GEF project No GF/2200-96-45, 43–53.

¹⁵⁹ Nöges, P., Järvet, A. (2005). Climate driven changes in the spawning of roach (*rutilus rutilus* (L.)) and bream (*abramis brama* (L.)) in the Estonian part of the Narva river basin. *Boreal Environment Research*, 10 (1), 45–55.

¹⁶⁰ Nöges, T. (2009). Trends in air temperature in Estonia and in water temperature of Estonian large lakes in 1961–2004, possible consequences on water quality. *Verh. Internat. Verein. Limnol.*

¹⁶¹ Jaagus, J. (1997). The impact of climate change on the snow cover pattern in Estonia. *Climatic Change*, 36 (1–2), 65–77.

¹⁶² Reihan, A., Kriaciuniene, J., Meilutyte-Barauskiene, D., Kolcova, T. (2012). Temporal variation of spring flood in rivers of the Baltic states. *Hydrology Research* 43 (4), 301–314.

¹⁶³ Sarauskiene, D., Kriaciuniene, J., Reihan, A., Klavins, M. (2015). Flood pattern changes in the rivers of the Baltic countries. *Journal of Environmental Engineering and Landscape Management*, 23 (1), 28–38.

¹⁶⁴ Lehmann, A., Getzlaff, K., Harlaß, J. (2011). Detailed assessment of climate variability in the Baltic Sea area for the period 1958 to 2009. *Climate Research* 46, 185–196.

¹⁶⁵ Jaagus, J. (2003). Changes in the ice conditions of the Estonian coastal sea in the second half of the 20th century. *Publicationes instituti Geographici Universitatis Tartuensis* 93, 143–152.

4.1.2 Institutional arrangements and governance, including for assessing impacts, addressing climate change at the sectoral level, decision-making, planning, coordination, addressing cross-cutting issues, adjusting priorities and activities, consultation, participation, implementation, data governance, monitoring and evaluation, and reporting

In 2014, the Republic of Estonia commenced drafting of the National Adaptation Strategy (NAS) called the Climate Change Adaptation Development Plan until 2030 (Kliimamuutustega kohanemise arengukava aastani 2030). The NAS and the accompanying implementation plan (NAP) for the period of 2017–2020 were adopted by the Government of the Republic of Estonia on March 2, 2017. The overall goal of the NAS is to decrease the vulnerability of Estonia to climate change and achieve the preparedness and capability to cope with the impacts of climate change at the local, regional, and national level with the help of a framework of activities.

The NAS is based on the EC Guidelines on developing adaptation strategies, the EU strategy on adaptation to climate change, the methodology of other EU countries, the 5th IPCC assessment report, the analyses of climate change scenarios drawn up by the Estonian Environment Agency (ESTE), the knowledge base of Estonia, other national cohesion policies, and the measures and practices being implemented. The NAS describes the most important problems in the area of adaptation to climate change and analysed vulnerability, the impacts of climate change until 2100, and the potential adaptation measures, based on the future climate change scenarios in Estonia in eight priority areas¹⁶⁶:

9. health and rescue capability;
10. land use and planning;
11. natural environment;
12. bioeconomy;
13. economy;
14. society, awareness, and cooperation;
15. infrastructure and buildings;
16. energy and security of supply.

The Ministry of the Climate is responsible for the implementation of the NAS. Responsible authorities also include the Ministry of Regional Affairs and Agriculture, the Ministry of Social Affairs, the Ministry of Economic Affairs and Communications, the Ministry of the Interior, the Ministry of Finance, the Ministry of Education and Research and other ministries.¹⁶⁶

The NAS is implemented based on the NAP. The NAP includes specific activities and their costs for four years, presented based on the years and the responsible authorities. The NAP is prepared based on the state budget strategy. The draft implementation plan together with the development plan will be presented for approval to the Government of the Republic by the Minister of the Climate and on each following year the implementation plan will be presented within the

¹⁶⁶ Ministry of Environment. (2017). Climate Change Adaptation Development Plan until 2030. [www] <https://envir.ee/media/912/download> (15.07.2024).

framework of planning the state budget strategy. The working group of the NAS discusses the NAP before presenting it to the government for approval. After the approval of the state budget strategy and the state budget, the NAP will be specified if necessary. The working group of the NAS with the chair of the Ministry of the Environment discusses the NAP once a year before presenting it to the Government of the Republic for approval, monitors the implementation of the NAS, gives recommendations for changing the NAS and if necessary, solves the open issues related to the NAS.¹⁶⁶

In 2022, a report on the implementation of the NAP for the period of 2017–2020 was presented to the Government of the Republic. The report provides a good overview of the achievement of the goals and effectiveness of the NAS.

The MoE (now Ministry of Climate) prepared an action plan for the period of 2021–2025 by the spring of 2021, in cooperation with other ministries and NAS steering committee members. The implementation of the activities of this action plan is planned through other sectoral action programmes. The NAS for the period of 2021–2025 does not need to be approved by the Government of the Republic¹⁶⁷. Almost half of the planned adaptation activities in this period are activities under the responsibility of the MoE (mainly in the fields of natural environment and bioeconomy). Greater emphasis is placed on more efficient use of primary energy and increasing the share of renewable energy in the final consumption in the field of energy and security of supply.

4.1.3 Legal and policy frameworks and regulations

The role of the national level (incl. regional agencies of ministries – the Rescue Board, the Health Board, the Environmental Board) is to shape the common understanding with respect to the important adaptation goals (strategies and policies), to support (training, technical and financial support) and monitor the implementation of the policies (general and detailed spatial plans, inspection of the existence of evacuation and local crises management plans).

According to the NAS, the main legislation that deals with climate change adaptation is the Emergency Act. Based on the Act, the Rescue Board has prepared a risk analysis for various emergency events: floods in densely populated areas, extreme cold weather, extreme hot weather and extensive forest and landscape fires.¹⁶⁸

The Water Act lays down the basis for regulating the use and protection of water. According to paragraph 31 of the Act, one of the six objectives of water conservation is to help mitigate the effects of floods and droughts.¹⁶⁹

The Planning Act lays down requirements for general and detailed plans. The Planning Act guides development in space by setting out the procedure for drawing up plans for development, construction and land use and the substantive requirements to be met by plans. According to Article

¹⁶⁷ Ministry of Environment. (2022). „Climate Change Adaptation Development Plan until 2030” Execution report 2017-2020. [www] <https://envir.ee/kliimamuutustega-kohanemise-arengukava> (25.10.2024).

¹⁶⁸ Emergency Act. (2017). RT I, 08.10.2024, 27. [www] [Emergency Act–Riigi Teataja](https://www.riigiteataja.ee/en/eli/530062022002/consolide) (25.10.2024).

¹⁶⁹ Water Act. (2019). RT I, 11.06.2024, 17. [www] <https://www.riigiteataja.ee/en/eli/530062022002/consolide> (25.10.2024).

75 of the Act, the general plan shall, inter alia, address the following tasks: 1) define the boundaries of areas of repeated flooding on the coastline and to set the high water marks of internal bodies of water with an extensive flooding area; 2) extend or reduce the building exclusion zone of the shore or bank.¹⁷⁰

Estonia is in the process of drafting its first Climate Resilient Economy Act. The aim of the Act is to contribute to climate change mitigation and adaptation by contributing to a more resilient society, increasing the climate resilience of the economic and business environment and creating conditions for the growth of a clean economy. These actions will provide protection for people and nature from the impacts of global climate change. The Act gives the Estonian people, entrepreneurs, organisations and the public sector the assurance that we can clearly and co-ordinately implement steps to slow down climate change. The Climate Resilient Economy Act creates the prerequisites for shaping a more sustainable economic model in Estonia. The end result will give Estonian society a more clear and reliable environmental goals, which help make long-term decisions and investments.⁸¹

In 2017 the Government of the Republic adopted the NAS called the Climate Change Adaptation Development Plan until 2030 (Kliimamuutustega kohanemise arengukava). The main goal of the NAS is to decrease the vulnerability of Estonia to climate change, achieve better preparedness and capability to cope with the impacts of climate change at the local, regional, and national level with the help of a framework of activities. Furthermore, the NAS includes eight sub-goals according to the division of prioritised sectors.¹⁶⁶

4.2 Impacts, risks and vulnerabilities, as appropriate

4.2.1 Current and projected climate trends and hazards

In 2015 “Future climate change scenarios in Estonia until 2100” was drawn up by the Estonian Environment Agency (ESTE A)¹⁵². This report forms the basis for the assessment of the sectors that are influenced by atmosphere and ground conditions. A climate scenario provides information on the spatio-temporal variability of the climate, taking into account both the relationships between the physical processes of the entire atmospheric, terrestrial and aquatic system, as well as emission scenarios.

Where possible, the report was drawn up on the basis of the CMIP5 (CMIP – Coupled Model Intercomparison Project) regional fine-scaling compiled for the latest report of the Intergovernmental Panel on Climate Change (IPCC), AR5. The period of 1971–2000 was used as the base climate period (reference period), if possible, and the periods of 2041–2070 and 2071–2100 as future comparison periods. The climate forecasts were drawn up based on the global

¹⁷⁰ Planning Act (2015). RT I, 30.06.2023, 57. [www] <https://www.riigiteataja.ee/en/eli/ee/510062024003/consolide/current>

climate change scenarios RCP4.5 and RCP8.5. Both also form the basis for the CMIP5 experiment.¹⁵²

New climate projections and updating of the future climate scenarios are in the process at the moment. This is done under the LIFE-SIP AdaptEst project. In cooperation with the ESTEA, the University of Tartu and Tallinn University of Technology it is planned to prepare high-resolution climate models for Estonia until the end of this century. Preparation of Estonian climate projections is planned for the project period of 2023–2027.¹⁷¹

Air temperature

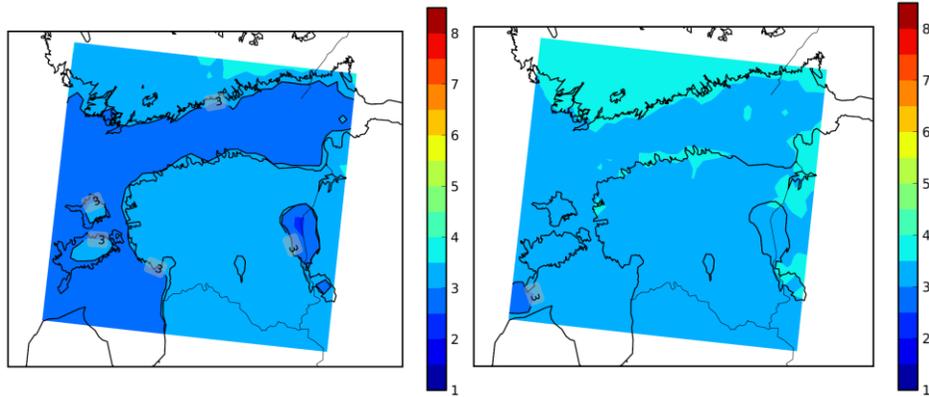
The average annual increases in air temperature provided in **Table 4.1** and **Figure 4.1** are higher than the global average values forecasted in AR5. This matches the distribution of the increase in the average temperature in the CMIP5 forecasts, which shows that the increase in temperature is high in the northern hemisphere, especially at higher latitudes.¹⁵²

Table 4.1. Absolute seasonal change in air temperature based on the EURO-CORDEX ensemble at the height of 2 m at the end of the 21st century compared to the control period of 1971–2000, °C¹⁵²

Period	2041–2070		2071–2100	
	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Winter (DJV)	2,3	2,9	3,1	4,9
Spring (MAM)	2,4	3,1	3,4	4,9
Summer (JJA)	1,6	2,2	2,2	3,8
Autumn (SON)	1,7	2,2	2,2	3,6
Annual average	2,0	2,6	2,7	4,3

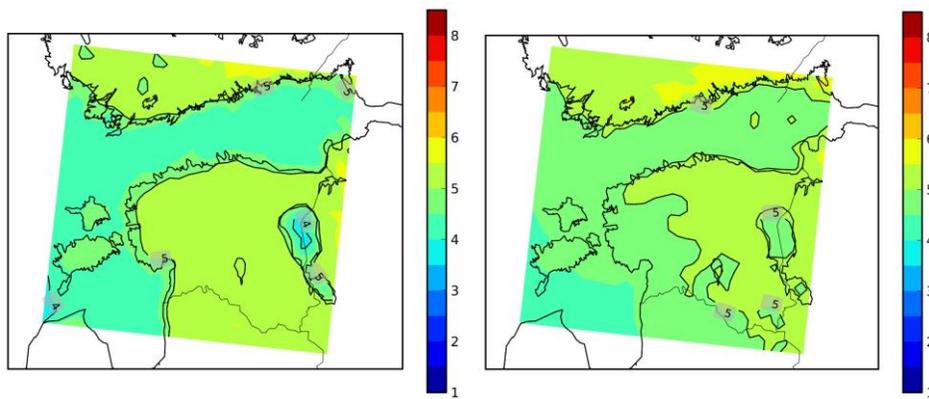
The highest average increase in the temperature by month is observed in March in the case of both scenarios. This may be explained by the faster warming of the ground due to springs with less snow. Higher increases in the temperature are also observed in other winter (December, January, February, i.e. DJF) and spring (March, April, May, i.e. MAM) months. The absolute seasonal changes in air temperature are provided in **Table 4.1** and **Figure 4.1**. In the period of 2041–2070, the increase in the temperature will be lowest in the summer months (June, July, August, i.e. JJA), and, in the period of 2071–2100, in the autumn months (September, October, November, i.e. SON).¹⁵²

¹⁷¹ LIFE-SIP AdaptEst. (2023). [www] [LIFE-SIP AdaptEST | LIFE envir](#) (25.10.2024)



(a) RCP4.5, DJV

(b) RCP4.5, MAM



(c) RCP8.5, DJV

(d) RCP8.5, MAM

Figure 4.1. Absolute seasonal change in the average temperature by the end of the 21st century compared to the control period of 1971–2000; top row (a, b): scenario RCP4.5, bottom row (c, d): scenario RCP8.5; left to right: winter (DJF), spring (MAM), °C ¹⁵²

Shortwave radiative forcing of the Sun affecting the surface of the Earth

Table 4.2 presents an overview of the relative change in the shortwave radiative forcing affecting the surface of the Earth found by the EURO-CORDEX high-resolution model. The main outcome of the calculations performed by using the model ensemble was a decrease in the shortwave radiative forcing affecting the surface of the Earth. The decrease is more obvious in the colder part of the year with the change in the radiative forcing remaining insignificant in the summer months. This result matches the expected strengthening of the western flow, which will result in cloudier weather in the colder half of the year.¹⁵²

Table 4.2. Relative seasonal change in the average shortwave radiative forcing affecting the surface of the Earth by the end of the 21st century compared to the control period of 1971–2000, %¹⁵²

Period	2071–2100	
	RCP4.5	RCP8.5
Winter (DJV)	-6	-11
Spring (MAM)	-3	-6
Summer (JJA)	0	-1
Autumn (SON)	-4	-3
Annual average	-3	-5

Wind

The majority of the sources are referring to an increase in the average wind velocity in winter and partly in spring. The increase is likely to range between 3% and 18% and is related to the increase in the number of cyclones moving to our territories from the Atlantic Ocean. The average wind velocity in the summer season will increase less or will not increase at all. The forecasts concerning extreme wind velocities are not deemed reliable enough to be used.¹⁵²

Precipitation

Table 4.3 and **Figure 4.2** summarise the modelled relative change in average precipitation. By the end of the century, higher precipitation will be experienced in the spring months; however, in the period of 2041–2070, primarily in the summer months. The change in the precipitation is lowest in the autumn months. The geographical distribution presented in **Figure 4.2** clearly shows that, irrespective of the scenario, an increase in the precipitation in the winter and spring months can be expected on land and in the summer and autumn months over the sea.¹⁵²

The average annual increase in precipitation of 19% in the RCP8.5 scenario accurately matches the precipitation forecast provided in AR5, based on which the changes in the territory of Estonia will remain between 10% and 20%. Examining the forecasted increases in precipitation for all seasons in the case of both scenarios and combinations of the period, the highest increase in precipitation in the RCP8.5 scenario can be observed in spring, and in the RCP4.5 scenario however, in summer.¹⁵²

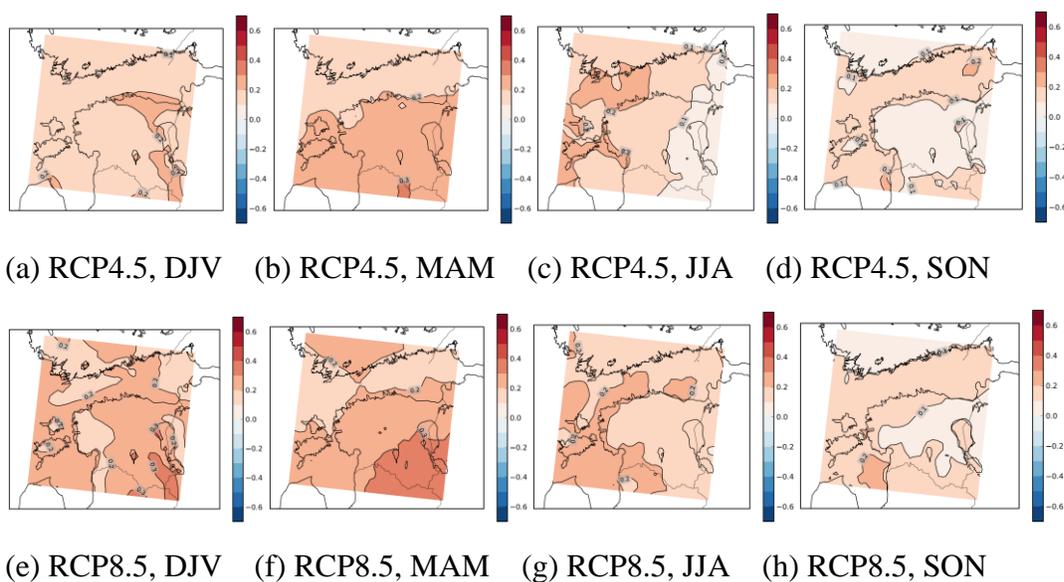


Figure 4.2. Relative seasonal change in the average precipitation by the end of the 21st century compared to the control period of 1971–2000; top row (a, b, c, d): scenario RCP4.5, bottom row (e, f, g, h): scenario RCP8.5; left to right: winter (DJF), spring (MAM), summer (JJA), autumn (SON), the scale division value 0.1 = 10, % ¹⁵²

Table 4.3. Average seasonal change in precipitation in the periods of 2041–2070 and 2071–2100 compared to the control period of 1971–2000, % ¹⁵²

Period	2041–2070		2071–2100	
	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Winter (DJF)	9	15	16	22
Spring (MAM)	10	16	21	24
Summer (JJA)	11	18	15	19
Autumn (SON)	10	8	11	12
Annual average	10	14	16	19

Extreme values of precipitation

Table 4.4 presents the likelihood of the occurrence of more than 30 mm of precipitation over 24 hours by seasons and scenarios as analysed with the EURO-CORDEX model. The last column of the table provides the likelihood of the occurrence of more than 30 mm of precipitation at a certain point on a certain day as an average of the entire area included in the model ensemble. Based on the models, an increase in the number of occurrences of extreme precipitation is forecast, but taking into consideration the very low likelihood thereof in the majority of the year, these occurrences are only significant in summer.¹⁵²

Table 4.4. Relative changes in the occurrences of more than 30 mm of precipitation over 24 hours by seasons, scenarios, and periods compared to the likelihood of the event at a certain point in a certain day in the control period of 1971–2000, %¹⁵²

Period	2041–2070		2071–2100		1971–2000
	RCP4.5	RCP8.5	RCP4.5	RCP8.5	Control
Autumn (SON)	188	174	184	245	16
Winter (DJV)	201	231	141	435	1
Spring (MAM)	158	209	207	244	8
Summer (JJA)	124	139	137	165	54

Snow cover

Projections show a significant decrease in snow cover by the end of the 21st century. In the control period of 1971–2000, there were 1–6 days of snow, on average, in April. Based on both scenarios, RCP4.5 and RCP8.5, the likelihood of snow in April is very low. According to the RCP4.5 scenario, the number of days of snow in March will decrease by more than 10 days compared to the control period and, according to the RCP8.5 scenario, by up to 15 days, rarely exceeding 5 days. In January-February, according to the RCP4.5 scenario, snow cover will also decrease by at least 10 days, reaching the average of 15 days, which means that permanent snow cover will not form. In more than half of the days, snow can only be found in rare areas in North-Eastern Estonia. According to RCP8.5, the duration of snow cover in January and February remains under 10 days as a rule.¹⁵²

Sea level

The local change in the sea level of the Baltic Sea is the highest in the Gulf of Finland and in the Gulf of Riga, with the relative increases of 6–8 cm¹⁷². This study disregards the land uplift, which equals approximately 1 mm in Pärnu, over 2 mm in Hiiu County, and even more towards the northwest, reaching the maximum level of approximately 9 mm at the bottom of the Gulf of Bothnia near the coast of Sweden¹⁷³. In Estonia, studies of the time series of the sea level in the period of 1924–2004 have shown that the slight rising of the sea level in summer is balanced by the land uplift in Pärnu. In the winter period, however, an average increase of 15 cm in the sea level has been observed. In Ristna, where the land uplift is higher, lowering of the average sea level in summer has been observed, while there are no changes in winter. As the relative local change and the land uplift have a balancing effect with respect to one another on the western coast of Estonia, it is mostly necessary to consider the average global rising of the sea level here, which may mean an average rise of the sea level on the coasts of Estonia by 20–40 cm based on the

¹⁷² Meier, H.E.M., Höglund, A., Ralf, D., Andersson, H., Löptien, U., Kjellström, E. (2011). Quality assessment of atmospheric surface fields over the baltic sea from an ensemble of regional climate model simulations with respect to ocean dynamics. *Oceanologia* 53, 193-227.

¹⁷³ Ekman, M. (1996). A consistent map of the postglacial uplift of Fennoscandia. *Terra Nova* 8 (2), 158- 165.

RCP4.5 future scenario and by approximately 40–60 cm based on the RCP8.5 future scenario by the end of the 21st century.¹⁷²

Seawater surface temperature

According to the estimations of BACC¹⁵⁴, the seawater surface temperature will rise by 2.9 °C as an average of the model ensemble by 2071–2100 compared to the period of 1961–1990. The increase in the seawater surface temperature will be the highest in May and June and will be expressed most in the southern and central areas of the Baltic Sea. Meier et al. (2011) observed the largest sea surface temperature increase in the Gulf of Bothnia and the Gulf of Finland for the SRES-A1B scenario (similar to the RCP6 scenario, which lies between the RCP4.5 and RCP8.5 scenarios). Based on the same modelling results, the seawater surface temperatures in the Estonian coastal waters will be 2.1–2.8 °C higher in winter and spring and 1.0–2.0 °C higher in summer and autumn in the period of 2061–2090 compared to the period of 1970–1999.¹⁷²

Sea ice

Modelling based on the AR5 scenarios shows that according to the RCP4.5 scenario, the coverage of the Baltic Sea with ice in a typical winter in the 2040s has decreased. The coastal areas of the Gulf of Finland, the Väinameri Sea, and the Gulf of Riga are still covered with ice, but the thickness of the ice layer has decreased by half or up to three times. By the 2080s, the ice cover of the Baltic Sea will have decreased further – the Väinameri Sea and the Gulf of Riga are almost completely ice-free, but the coastal areas of the Gulf of Finland are still covered with ice. In the RCP8.5 scenario, the ice cover in the 2040s will be slightly less extensive than in the RCP4.5 scenario, but still quite similar to the more optimistic scenario. In a typical winter of the 2080s, however, most of the Baltic Sea is ice-free. Only a 30–40 cm ice layer forms on the Gulf of Bothnia and a 0–10 cm ice layer in the north-eastern part of the Gulf of Finland. The estimated extent of the ice cover on the Baltic Sea by 2085 is 75,000 km² (30,000 km² to 140,000 km²) in the case of the RCP4.5 and 45,000 km² (23,000 km² to 70,000 km²) in the case of the RCP8.5 compared to the current average of 115,000 km².¹⁷⁴

Inland water

According to the IPCC SRES-A2 emission model scenario (similar to the RCP8.5, but with a slightly lower radiative forcing), the water temperature of the lakes in Europe, incl. in Estonia, will rise by 2–7 °C by 2100.¹⁵²

Due to the increasing winter temperatures, the ice cover period of Estonian rivers is shortening, or no ice cover will form on most of the rivers^{154,155}. This will result in runoff in the winter period, as the precipitation will no longer accumulate in the form of snow.¹⁷⁵

Due to the forecasted decreasing of the snow cover, the maximum runoffs modelled for the future are smaller than the current runoffs and distributed more evenly over the year, thus the maximum

¹⁷⁴ Luomaranta, A., Ruosteenoja, K., Jylhä, K., Gregow, H., Haapala, J., Laaksonen, A. (2014). Multimodel estimates of the changes in the baltic sea ice cover during the present century. *Tellus A: Dynamic Meteorology and Oceanography* 66, 22617.

¹⁷⁵ Bates, B. C., Kundzewicz, Z.W., Wu, S., Palutikof, J.P., eds. (2008). *Climate Change and Water*. IPCC Secretariat, Geneva.

water levels are also lower. The significant decrease in the runoff in the maximum period (typically in April and May) will result in the lengthening of the minimum period in the summer towards spring, which will cause the decreasing of the water supply during the first half of the vegetation period and the risk of small streams and rivers becoming vulnerable to decreasing runoff during the first half of the summer. The seasonal distribution of the runoff of the rivers in Southern and Eastern Estonia will remain relatively unchanged compared to the base period. In Northern Estonia, where the rivers are influenced by karst, the autumn runoff will increase significantly. The impact of climate change on the seasonality of runoff is the greatest in Western Estonia and on the islands, where the autumn runoff will increase and even exceed the spring runoff. There will be two main hydrological seasons instead of the current four. Thus, the increase of precipitation in autumn will increase the autumn runoff and autumn may become the most water-rich period in Northern and Western Estonia and on the islands.¹⁵²

4.2.2 Observed and potential impacts of climate change, including sectoral, economic, social and/or environmental vulnerabilities

Based on the future climate change scenarios the most important problems in the area of adaptation to climate change in Estonia were divided into eight priority areas in the NAS¹⁵²:

- 1) health and rescue capability;
- 2) land use and planning;
- 3) natural environment;
- 4) bioeconomy;
- 5) economy;
- 6) society, awareness, and cooperation;
- 7) infrastructure and buildings;
- 8) energy and security of supply.

1. Health and rescue capability

Health

The most serious impact on people's health is the increase in air temperature and the increasing rate of heat waves, together with the impact of the heat island effect. The impact of higher temperatures on hot days and the increased number of heat waves have been already manifested, as mortality was quite high during hot weather periods (with the maximum temperature of the day exceeding 27 °C) in the period of 1996–2013.¹⁵²

The summer of 2021 was the warmest in the 155-year history of Estonian weather observations. In June 2021, 15 absolute air temperature records were recorded at 25 stations of the National Weather Service. On average, they exceeded the absolute air temperature norms calculated for the period of 1991–2020 by 2–3 °C (Estonian Weather Service, 2022). Although the number of deaths

in July 2021 was 7% higher than in 2020 (by almost 80 people)¹⁷⁶, unfortunately the statistics collected in Estonia do not reflect deaths caused by heat waves, because it is not a medical diagnosis. It is possible to make a correlation with the occurrence of a heat wave, but in recent years, due to COVID-19, it is difficult to draw firm conclusions about specific causes.¹⁷⁷

Before that, an extremely warm summer affecting the health of the population of Estonia was seen in 2010, when the mortality in the summer months apparently increased by almost 30%. As heat waves are becoming more frequent due to climate change, depending on the climate change scenario used (RCP4.5 or RCP8.5), 506 or 679, or almost 655 or 1,068 excessive deaths per year, on average, can be expected in the periods of 2030–2050 and 2050–2100, respectively. In spite of the general warming of the climate, the health risks arising from very low temperatures or formation of glare ice on roads should also not be underestimated in Estonia in the future. Further extreme weather conditions, which may endanger human health, include storms and heavy rain (the resulting floods), which may also make vital medical assistance less accessible or even completely inaccessible.¹⁵²

Air quality also has an important effect on health. Poor air quality is considered one of the biggest environmental health risks, as air pollution has a significant impact on public health. The most important primary pollutants that degrade air quality are particulate matter (PM₁₀), fine particles (PM_{2.5}) and nitrogen dioxide (NO₂). The main sources of fine particle air pollution are car traffic (both exhaust gases and particles from road surface and tire wear), local heating (mainly stove heating) and industrial enterprises. In addition to local pollution, there is also the long-range transmission of air pollutants, which is especially important in rural areas. Fine particles can also have natural sources such as forest fires.¹⁷⁸

In 2020, air pollution fine particles and nitrogen dioxide in the ambient air caused an average of 1,179 early deaths in Estonia. Among the various sources of air pollution, local heating had the highest negative health impact (a total of 571 early deaths in 2020), followed by traffic (433 early deaths, of which 87% are caused by exhaust gases and 13% by health effects resulting from road dust). Life expectancy is reduced by almost 10 months on average due to air pollution. The highest drop in life expectancy was seen in bigger cities such as Tallinn, Tartu, Narva, Pärnu, Viljandi and Kohtla-Järve, and was somewhat higher in Ida-Virumaa.¹⁷⁸

Although the pollutant content of the air may increase (formation of ground-level ozone intensifies during heat waves, the conditions for the diffusion of fine particles may deteriorate in certain periods, and forest fires may become more frequent), the most direct impact of climate change related to air quality is the increased spread of pollen. In the RCP8.5 scenario, the duration of the pollen season will increase by the end of the century and new allergenic plant species will spread to the territory of Estonia, which will increase the health risk.¹⁵²

¹⁷⁶ Euromomo. (2022). Excess mortality. [www] <https://www.euromomo.eu/graphs-and-maps/#excess-mortality> (25.10.2024).

¹⁷⁷ Health Board. (2022). Health care risk analysis. [www] <https://www.terviseamet.ee/en/health-care-risk-analysis> (10.01.2024).

¹⁷⁸ Orru, H., Teinmaa, E., Maasikmets, M., Keernik, H., Paju, M., Sikk, A., Tamm, T., Lainjärv, H-M., Kriit, H., Lõhmus Sundström, M. (2022). Comparison of the Impact of Ambient Air Quality on Human Health in Estonia in 2010 and 2020 and Forecast of the Health Effects of Air Pollution by 2030. [www] <https://envir.ee/keskkonnakasutus/valisohk/uuringud-ja-aruanded> (25.10.2024)

Changing climate impacts the spread of vector-borne diseases of animals and plants (e.g. spread by fleas, ticks, mosquitos), which may pass on dangerous infections. Changes in the spreading areas of vector-borne diseases will result in more frequent occurrences of both the diseases already prevalent in Estonia, such as tick-borne encephalitis and Lyme disease, as well as diseases that are currently relatively rare in Estonia, such as leishmaniasis, hantavirus, tularaemia, dengue fever, etc. Therefore, the impacts of various climate components are conflicting – milder winters and periods of higher humidity (but not heavy rain) generally support, while drought periods prevent, the spread of diseases. Heavy rain may cause the carrying of hazardous substances or excessive nutrients (the former of which may present a direct hazard to human health and the latter may cause more intensive eutrophication) and many parasites (which may end up in drinking water in the case of insufficient treatment processes) from the environment into the water. Long drought periods, however, may leave shallow drinking water wells dry. A higher frequency of hot summers may also increase the frequency of algal blooming, which deteriorates the quality of bathing water. The wider spread of plant diseases and mycotoxins presents a hazard related to food safety, which, according to the RCP8.5 scenario, may increase in the period of 2050–2100.¹⁵²

Rescue capability

The main factors to be taken into consideration from the aspect of rescue capability are floods in densely populated areas and extensive forest and landscape fires. As 60% of forest fires occur in May and June, the higher frequency of drought periods in spring and summer also increases the forest fire hazard. These emergencies do not present a very high risk to human life and health in Estonian conditions, but may cause huge proprietary damage and interruptions in operative rescue works or the processing of emergency calls. Forest fires are also generally accompanied by extensive damage to the natural environment.¹⁵²

It is remarkable that human activity may still be deemed to be the main cause of forest fires, but climate change increases the risk of fire outbreaks (heat and dryness). Sharpening of the impacts of climate change calls for a need for more extensive involvement of volunteers as well as defence structures and the private sector in responding to emergencies, while the amount of human assets and money spent will also increase.¹⁵²

2. Land use and planning

Coastal areas

Due to changes in the trajectories of cyclones and the resulting higher frequency of western storms, Estonian coastal areas may be at a risk of increasingly frequent rises in the water level and floods, the extent of which in the future will probably exceed what has been experienced so far. Rising of the global sea level, more frequent western storms, and the decreasing extent of ice cover in winter together will probably bring forth more intensive erosion processes in the Estonian coastal areas in the next few decades, which may also endanger objects in the direct vicinity of the coastal zone, incl. cultural heritage, and coastal tourism may suffer. It should also be taken into account that, in the future, the isolines of the area with a risk of flooding will be located further inland due to the

rise of the sea level. For a more accurate and operative assessment of the floods caused by storm surges, management of risks, and operative responding to the consequences, methods and systems for monitoring coastal areas must be applied, significant endangered objects must be identified and the protection of such objects planned, which will be accompanied by higher financial costs.¹⁵²

Other areas affected by flood risk

There are 13 areas exposed to floods in densely populated areas in the Western Estonian hydrographic basin and 3 in the Eastern Estonian hydrographic basin. Floods, which are likely to occur once every 10 years, endanger approximately 1,000 people in coastal settlements, those likely to occur once in 100 years approximately 6,600, and those likely to occur once in 1,000 years approximately 15,000 people. Floods which are likely to occur once in 10 years, endanger 843 residential buildings, those likely to occur once in 100 years, approximately 3,200, and those likely to occur once in 1,000 years, approximately 6,400 residential buildings. The flood risk in inland waters is assessed as considerably lower compared to that in coastal areas.¹⁵²

Land improvement

The forecasted increase in the ground water level as a result of climate change is not high, but may cause significant changes in the quality of the ground water as well as in the hydrography of the ground level water table. The latter determines the water regime of the soils and the use of drained land. In low, level areas, especially in the case of heavy-textured soils and organic soils, the level of the ground level ground water table may rise so much that the total area of wetlands will expand. Climate change together with deterioration (amortisation) of the condition of drainage systems will in turn bring forth changes in land use – excessively wet areas will expand and may be left out of use as the yield or harvestability of the areas decrease. The selection of the cultivated cultures will depend on the resistance of the cultures to excessively wet conditions or droughts. The decreasing of the amount of agricultural land available for crops, which provide higher added value, may, for example, result in less land for cultivating potatoes, rapeseed, and cereals, and thus in the expansion of the areas of grasslands.¹⁵²

High-intensity rain with a high amount of precipitation may start to cause local floods. An increase in the amount of precipitation will increase the risk of the flushing out of nutrients from the soil into the surface or ground water. Milder winters will decrease the water supply in the soil in the first half of the vegetation period, which will in turn bring forth a need for more irrigation.¹⁵²

Renovation of many land improvement objects established in previous decades is highly resource-exhaustive, the need for renovation, however, is several times higher than the investment capability. Thus, in order to ensure the operability of the land improvement systems in the near future, decisions must be made on which drainage systems are important for the Estonian economy and which should be abandoned.¹⁵²

Cities

Both direct as well as indirect impacts of climate change above all affect the larger cities, Tallinn, Tartu and Pärnu, where the majority of the population, economic activity, assets, capital, and cultural objects have accumulated. The technogenic city environment of a high population density and complex city planning interdependencies is unable to buffer the impacts quickly enough – new structures often even amplify the risks.¹⁵²

Taking into consideration the geographical location of Estonia and the sparse settlement system, the risks related to climate change here are relatively low and, as a rule, the area of influence is local (specific streets or districts). On the other hand, however, the planning practice used here does not consider climate change. The main risks which Estonian towns face according to the future climate forecasts arise from a higher frequency of exceptional weather conditions, incl. storms, floods, and heat waves. Of the above, the negative impact of the flooding of the coastal sea is the highest and endangers the cities of Kuressaare, Haapsalu, Pärnu, and Tallinn as well as eight smaller towns. The impact is the most extensive in Virtsu, Nasva, Uuemõisa, Võiste and Paralepa. The flooding risk of Estonian rivers is the likeliest and potentially most extensive on the shores of River Emajõgi in Tartu and the flooding risk of the lakes is the highest on the shores of Lake Tamula in Võru. The risks of storm damage affecting settlements are higher in Western Estonia, islands and coastal areas, where winds blowing over 21 m/s occur more often.¹⁵²

Heat waves, which have already presented themselves as climate-related risks in the summers of the last few decades in Estonia, are amplified in the cities due to the heat island effect, which most significantly affects the chronically ill, small children, and the elderly. The abovementioned population groups are more vulnerable to the risks of morbidity and mortality. A study of the heat wave of July 2014 revealed that all densely populated areas are affected by the heat island effect, not only larger cities. The negative impact of heat waves is amplified by the ageing of the population and urbanisation, which can already be observed in Estonia today and will accelerate in the future.¹⁵²

3. Natural environment

Biological diversity

Based on the current knowledge, the species that have adapted to specific environmental conditions and those in the peripheral areas of their habitats are the most vulnerable to climate change. Climate change may exacerbate the spread of invasive foreign species and reduce the efficiency of the control measures applied so far. Invasive foreign species anchor themselves outside of their natural habitats and endanger ecosystems, habitats, and ingenious species, thereby causing economic losses.¹⁵²

Terrestrial ecosystems

Warmer winters prevent the freezing of the soil, which, above all, increases the extent of storm damage in excessively wet forest areas with a superficial root system and makes the performance

of forestry works more difficult, thereby increasing the risk of damaging the soil. Higher frequency of spring and summer drought periods increases the prevalence of forest fires and facilitates the reproduction and spread of forest pests. Climate change impacts the spread and coherence of forest habitats, biological diversity, interspecies relationships, and forest habitat types.¹⁵²

Climate change increases the frequency of droughts in wetland areas and causes a higher risk of floods and fires. Increasing air temperature and a higher amount of precipitation causes a rise in the greenhouse gas (GHG) emissions from natural and drained peat areas, consequently the areas which are affected by human activity can be expected to generate significantly (up to two times) higher GHG emissions. Climate warming and changes in the precipitation regime also cause long-term shifts in the species composition of the vegetation of wetlands, changing the ratios of peat moss species and increasing the competitive advantage of shrubs compared to peat mosses.¹⁵²

Higher temperatures accelerate the decomposition of the organic matter in agricultural land and grasslands, which in turn impacts the fertility of the soil. Higher precipitation increases the production of grasslands and may also somewhat accelerate the decomposition of organic matter. It is very difficult to distinguish the changes in the grasslands which have occurred as a result of climate change so far from those arising from human activity. It is clear that more frequent, deeper, and more extensive cultivation of the soil increases the carbon dioxide (CO₂) emission from the soils of agricultural land and grasslands, thereby reducing the fertility of the soil, and extensive tillage helps to preserve the humus content and fertility of the soils.¹⁵²

Ecosystem services

Until 2030, ecosystem services will be most heavily impacted by the increasing frequency of extreme weather phenomena. Although various climate risks will manifest to a significant extent in the case of both climate change scenarios by 2050 and 2100, bringing along changes in provision of the supply and adjustment as well as cultural services, the higher frequency of extreme weather phenomena is likely to be the main force behind the changes in the quantities and qualities of ecosystem services. The impacts of climate change on ecosystem services may differ, i.e. may be simultaneously positive as well as negative. The effect of the negative impacts will presumably be highest in the case of the ecosystem services for sea and freshwater communities and somewhat lower in the case of services for terrestrial ecosystems; urban ecosystems, on the other hand, will show most positive effects.¹⁵²

4. Bioeconomy

Agriculture

In agriculture, climate change mainly impacts the selection of cultures and species, the yield thereof, the efficiency and productivity of animal husbandry, and the spread of plant pests and infectious animal diseases. The conditions for growing the traditional cultures, e.g. for the wintering of winter crops, may deteriorate. Nutrients are flushed out of unfrozen soil in winter and may be washed into the ground water or waterbodies. Earlier spring has enabled the earlier sowing of cultures while later autumn allows for later harvesting. Later harvesting may however be

complicated due to excessive water content of the soil in some areas. Extreme weather phenomena increase the risk of crop failures and may result in the deaths of agricultural animals due to power cuts or floods. Heat waves and drought periods in the summer endanger the welfare, productivity, and feed supplies of animals. Longer cultivation periods increase the mass of forage plants, while longer grazing periods reduce the animal upkeep costs in winter. Higher temperatures allow for the growing of frost-sensitive cultures. In gardening, the increase in the outside temperature will bring forth significant changes in the profitability of glasshouse agriculture and in the selection of open area plants.¹⁵²

Forestry

The higher frequency and longer duration of drought periods in spring and summer will facilitate the development of root rot and the reproduction of bark beetles and increase the fire hazard in the forests. The increase in summer temperature and milder winters will potentially create favorable living conditions for various pests, which can usually be found in masses south from the territory of Estonia, in addition to our local pests.¹⁵²

In the excessively wet habitat types in Estonia, forests have been traditionally cut when the ground is frozen. Due to the reduced number of winter periods of lower temperatures the soils in Estonian forests fail to freeze deeply, which may result in more extensive damage to the soils during felling work.¹⁵²

Pine and fir trees are also growing well in habitats where the temperature is 5 °C higher than in Estonia, if there are no drought periods. Thus, the potential increase in temperature will not be accompanied by considerable changes in the species composition of Estonian forests; changes in the percentage of certain species are, however, possible. Due to changes in the natural conditions, the conditions will improve for the forest species which have been rarely found in Estonia so far and are on the northern border of their habitat, while the conditions will deteriorate or become unsuitable for the species on the southern borders of their habitats.¹⁵²

Fisheries

The forecasted climatic changes could mainly impact the size and species composition of the fisheries resources, which directly influence the opportunities for industrial and hobby fishing. The signs of climate change (changes in the water level and temperature, extreme weather phenomena, unstable ice cover or no ice cover, inflow of saline water into the Baltic Sea or the lack thereof) may directly impact the abundance of fisheries resources, which are important from a fisheries management perspective and are less resistant (more vulnerable) to climate change, and the amount of fisheries resources in the Baltic Sea as well as in Estonian inland waters. The increasing temperature should increase the general productivity of these water ecosystems and accelerate the growth of the fish, but this is also dependent on many other factors (e.g. the eutrophication, pollution arising from human activity, overfishing). There are fish species of quite different ecological needs living side-by-side in Estonian waterbodies and the forecasted climatic changes may have conflicting impacts on the size of the resources of these species: the numbers of

freshwater and cold-water fish (e.g. the Salmonidae, European whitefish, Peipsi whitefish, burbot, smelt) may decrease further in the future and their habitat may become narrower compared to warm-water fish species (e.g. Cyprinidae, pike perch), which prefer more nutrient-rich habitats. Gradual changes in the water temperature may have a smaller impact on the fisheries resources than sudden changes in the regime (e.g. heat waves, inflow of saline water into the Baltic Sea), which may cause drastic changes in the living environment of the fish within a short period of time (even hours).¹⁵²

The status of the fisheries resources may be strongly impacted by the ice conditions and changes in the water temperature within one year (seasonal changes), which determine the successful reproduction of the fish, the strength of the generation, and the size of the progeny. For example, shortening of the ice cover period may have conflicting effects on the fisheries resources: 1) it may decrease the mortality risk of fish in shallow lakes in winter due to a lack of oxygen; 2) it may negatively affect the success of the reproduction of the fish, which spawn in late autumn or in winter, such as the European whitefish, powan, and burbot; 3) it may damage the opportunities for hobby fishing in winter. Climate change also facilitates the spread of invasive foreign species and new fish parasites and diseases, which have a negative impact on the fisheries resources.¹⁵²

Peat production

Peatlands cover 1.2 million ha of the territory of Estonia, or more than a fifth of the land¹⁷⁹. Currently, the annual rate of peat extraction is 2.85 million tons (Annual rate of peat extraction and size of critical and usable reserves, 2017). The increase in the average air temperature arising from climate change will presumably bring forth more extensive mineralisation of the peat in the extraction areas and thereby up to twice as high CO₂ emissions. Furthermore, it may be significantly impacted by the amount of precipitation and the humidity of the soil.¹⁵²

5. Economy

Estonia as a small country with open economy is more vulnerable to the impacts of climate change to the global economy than to the local processes related to climate change. The global need for technological progress, more sustainable management, and environmentally friendlier manufacturing arising from climate change have above all placed the issues of climate change in the sector of opportunities for entrepreneurship in Estonia. The success of the sector of technology companies is showing a growing trend in Estonia, and the availability of natural resources (timber and other natural materials), which enable sustainable production, and the traditions of using such materials provide a developmental advantage.¹⁵²

Estonian companies must take into consideration the environmental safety requirements and restrictions applicable to the use of the environment which have formed in time. For example, the impacts of climate change on the industrial sector mainly manifest through alleviation measures – adjustment of the building, availability and prices of raw material, changes in the supply chain and

¹⁷⁹ Ministry of Environment. (2022). Peat. (In Estonian) [www] <https://envir.ee/ringmajandus/maapou/turvas> (25.10.2024).

transportation. The pressure from consumers arising from the threats of climate change has, however, remained rather modest in Estonia so far.¹⁵²

6. Society, awareness, and cooperation

More frequent extreme weather phenomena are accompanied by a need for the assistance of social workers, especially for servicing vulnerable groups, who are in danger of social isolation. The need for cooperation between the (civil and military) institutions, organisations, and individuals who are involved in rescue work also increases.¹⁵²

An increase in extreme weather events can increase unforeseen property damage. The hazards accompanying extreme weather phenomena impact different groups of society differently – the impacts vary locally (e.g. floods in seaside or lowland areas) and by members of society (e.g. the elderly are more vulnerable to extreme cold and heat). Climate change endangers the most disadvantaged people, i.e., those in a poorer socio-economic situation and those with less social capital, who may not have the resources or networks for buffering the impacts of climate change that affect them directly, or for the management of climate-related risks. The impacts on health are mainly prevalent in children, the elderly, and in chronically ill people or those affected by multiple health conditions. Thus, extreme weather phenomena may further deepen inequality in society.¹⁵²

From the aspect of climate change, Estonia is most influenced by EU climate policies in international communication. Estonia is also one of the parties of main international treaties and participates in the developmental cooperation oriented to third countries as a member of the EU and the Organisation for Economic Co-operation and Development (OECD). At the global level, Estonia is principally a party that provides assistance and thus global agreements as well as any agreements in the area of adaptation to climate change, which are reached within the EU, primarily impacting the Estonian policies of cooperation for development. Increased immigration pressure arising from climate change is also possible.¹⁵²

7. Infrastructure and buildings

Transport system

In this century, significant changes can be seen in the need for upkeep and maintenance of the transport infrastructure (both road and street network, railway network, bridges, ports and airports). For example, there is a need for more frequent removal of storm or flood debris from roads, ports and airports. Overhead transmission lines must be maintained due to the increased number of days of glaze. Some circumstances arising from the climate, which may damage the transport infrastructure, can also be foreseen, such as the softening of road surfaces, deformation of railroads, or destruction of roads or bridges as a result of floods.¹⁵² For example, in 2021 and 2022, high temperatures caused technical problems for several trains; the trains' cooling and hydraulic systems overheated, causing the temperature of the engines to rise. For this reason, the

trains had to reduce their speed, and there were delays in train traffic both for departures and arrivals.^{180,181}

In comparing various types of transport, the most vulnerable are the entire means of transport on the roads and streets as well as the safety of people related to the infrastructure arising from changes due to interruptions in traffic, slipping hazards, reduced load-bearing capability of unpaved side roads, and safety of cycle and pedestrian tracks. Small Estonian ports are also vulnerable due to the rising sea level and more frequent storms.¹⁵²

In order to ensure climate resilience, the European Commission came up with technical guidelines in the autumn of 2021 regarding the methodology for assessing climate resilience of infrastructure. When using European Union Cohesion Policy funds for the period of 2021–2027, it is a condition to ensure climate resilience in the case of infrastructure investments based on the Common Provisions Regulation (EU) 2021/1060. The infrastructure object can be new or the renewal or expansion of an existing one. Ensuring climate resilience includes both mitigating and adapting to climate change, and, among other things, it requires that a climate change adaptation risk assessment has been carried out for infrastructure projects and possible climate impacts and mitigation solutions have been taken into account.¹⁸² The MoC, in cooperation with the State Support Center and implementing agencies, ensures that when applying for infrastructure investments, various climate risks affecting the infrastructure are assessed and, if necessary, mitigated.

Water and sewerage infrastructure

Increased average amount of precipitation, less extensive snow cover and decreased amount of flooding in spring due to a rise in temperature as well as more frequent climate events, such as droughts or heavy rains, all have a direct impact on the functioning of the water and sewerage system. Shorter snow cover periods and faster vaporisation of the water supplies from the soil due to higher temperatures in summer will result in reduced productivity of the upper ground water layer over a longer period of time, which may cause drying of the wells in sparsely populated or karst areas. On the other hand, isolated and very intensive rain periods accompanying southern cyclones may be expected in the conditions of higher temperature in summer, which may produce local floods in lower parts of cities due to the limited capacities of the storm drains.¹⁵²

The causes of water shortages and droughts can be the result of global warming and the decrease in the amount of precipitation during certain seasons. If the snow cover and the ice period of the rivers decrease, it will lead to a significant change in the hydrological regime. Autumn and winter runoff increase, springtime high water remains smaller and shifts to an earlier time, which is directly accompanied by a decrease in spring floods, but also lengthens the summer minimum

¹⁸⁰ Raudmäe, E. (2021). Trains may be delayed due to the heat wave. Estonian Public Broadcasting. (25.10.2024). (In Estonian) [www] <https://www.err.ee/1608254025/kuumalaine-tottu-voivad-rongid-hilineda>

¹⁸¹ Koch, M. (2022). Elron trains delayed due to heat wave. Estonian Public Broadcasting. (27.06.2022). (In Estonian) [www] <https://www.err.ee/1608640798/elroni-rongid-hilinevad-kuumalaine-tottu> (25.10.2024).

¹⁸² European Commission. (2021). Technical guidance on the climate proofing of infrastructure in the period 2021-2027. Notice 2021/C 373/01. [www] <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:C:2021:373:FULL&from=EN> (25.10.2024).

runoff period. In the big picture, the issue of water shortage in Estonia is not yet serious, but there is a high probability that it will worsen in certain areas over time.¹⁵⁵

Initially, groundwater is available for drinking in Estonia, but this valuable resource is unfortunately used for many other purposes: irrigation, industrial water, firefighting –groundwater is also lowered to enable mining, and if there are several dry summers in a row, the security of water supply is already at risk. A common example is also the use of groundwater table level water in sparsely populated areas or in former summerhouse areas near bigger cities, where wells have traditionally not been built very deep to meet only seasonal needs. Thus, in such regions, during the drought period, it may be the case that the existing borehole is no longer able to provide a sufficient amount of water, or the water obtained from it is polluted. However, it can become especially difficult in the so-called former polluted groundwater areas (Tapa) or in the Ida-Viru region, where there is often no alternative option when quality water decreases as available water may be polluted. Estonia's islands and densely populated areas by the sea are also risk areas for water shortages and droughts, where a lower groundwater level can be accompanied by seawater seeping into the aquifers and deterioration of water quality. Fortunately, there have been no cases of water shortage or droughts with serious consequences in Estonia as yet.¹⁵²

Buildings and energy efficiency

The higher the efficiency of buildings and the equipment in the buildings, the lower the vulnerability thereof to the impacts of climate change. Estonian buildings, however, are characterised by low energy efficiency and quality compared to other EU Member States and the Estonian building stock is old and the construction quality of the new developments unstable. The thermal insulation of the poorly built building structures is low and higher springtime wind velocity increases the heat losses of the buildings. On the other hand, the need for air conditioning in the indoor premises increases as the summer temperatures grow. The steeply increasing power consumption due to heating or cooling in the case of very cold or very hot weather may overload the system and cause power cuts.¹⁵²

8. Energy and security of supply

Energy resources

The changes in the climate factors forecasted have relatively little impact on the availability of energy resources up to 2100. In 2020, the largest primary energy consumption energy resource in Estonia was oil shale, while renewable energy resources, such as biomass, wind and solar energy, are of the highest consumption potential. The forecasted changes will have positive as well as negative impacts on the availability and quality of energy resources.¹⁵² During the transition to a climate-neutral economy, the use of fossil fuels (including oil shale) is gradually decreasing. In 2022, renewable energy sources accounted for approximately 25% (including biomass 21%) of fuel use in energy production and consumption (including transport fuels).¹⁰² According to the Energy Sector Organisation Act by the year 2030, renewable energy accounts for at least 65 per cent of gross domestic final consumption of energy. Renewable energy accounts for at least 100

per cent of gross final consumption of electricity and for at least 63 per cent of gross final consumption of thermal energy. Renewable energy used in road and rail transport accounts for at least 14 per cent of total energy consumed in the transport sector.¹⁰¹ The compliance of the technology used, the timing, and the infrastructure with the weather conditions is of increasing importance in the collection of bioenergy resources. For example, the collection of timber, herbaceous biomass, or peat is a highly seasonal activity. These fuels require interim storage, which increases vulnerability if the storage conditions are not protected from the weather conditions. By 2100, the ongoing climatic changes can be expected to bring a positive total impact on the wind energy resource, while a small negative impact can be presumed in the case of solar energy (due to an increase in the number of cloudy days), and on the consumption of timber as an energy resource. The impact of weather conditions and the changes thereof are the lowest on using the energy source of oil shale. The changes forecasted have no impact on the extent of the oil shale resource to be used.¹⁵²

Heat production and cooling

Centralised heat production is more susceptible to climate change than local heating, as the lower heat consumption as a result of climate change may turn the operating of district heating networks unfeasible from an economic perspective. Shortening of the heating period will increase the percentage of the losses in the transmission of the heat, which is used for heating centralised domestic water outside of the heating period.¹⁵²

In Estonia, the remaining of the maximum air temperature during 24 hours at ≥ 30 °C for at least five days is deemed especially hazardous to human health. Currently, the air conditioning systems of buildings are not designed to take into consideration the heating solar radiation permeating through the windows which makes it difficult to maintain a specific temperature (e.g. the estimated temperature range in offices during a cooling period is 22–27 °C). Climate change has a dual impact on the energy sector. On the one hand, increasing the temperature in winter will decrease the thermal energy consumption in the cold half of the year. On the other hand, the increase in the average temperature, the higher temperature in summer and more frequent short heat waves (7–10 days, on average) increase the need for cooling buildings, which is mainly fuelled by electricity. Therefore, the decrease in the demand for thermal energy is not proportional to the increase in the winter temperatures, as the higher winter temperatures are primarily related to windy weather and the inflow of a warmer, humid air mass over Estonia. Due to the higher humidity and wind velocity, additional energy is needed to maintain a comfortable temperature. The higher amount of precipitation raises the level of the upper level of ground water. The higher level of ground water and higher humidity of the soil cause large heat losses, especially in old, uninsulated heating pipelines, as the heat conductivity of the soil increases.¹⁵²

A warmer climate in our region leads to a decrease in the energy consumption required for heat production, which is however replaced by cooling demand. This is why it is important to plan economical cooling solutions such as district- and exhaust cooling and smart planning of buildings (shading, etc.) to proactively ensure the most economical use of energy.

4.2.3 Approaches, methodologies and tools, and associated uncertainties and challenges, in relation to paragraph 107(a) and (b) above.

The scientific basis used for compiling the NAS is “Future climate change scenarios in Estonia until 2100”, drawn up by the Estonian Environment Agency (ESTE A). The report was finalized in 2015, therefore is almost a decade old. With the help of the LIFE-SIP AdaptEst project, new climate projections are being prepared¹⁷¹.

In cooperation with the ESTEA, the University of Tartu and Tallinn University of Technology it is planned to prepare high-resolution climate models for Estonia until the end of this century. Preparation of Estonian climate projections is planned for the project period of 2023–2027. Climate projections are also impacting the development of other areas (e.g. creating a model of the water bodies that are most affected by climate change, developing construction standards taking extreme weather events into account, etc.).¹⁷¹ The climate projections are an important input for the new period of adaptation policy planning, but also for the planning of climate change adaptation activities in other sectoral development plans.

4.3 Adaptation priorities and barriers

4.3.1 Domestic priorities and progress towards those priorities

Based on the future climate change scenarios the most important problems in the area of adaptation to climate change in Estonia were divided into eight priority areas in the NAS¹⁶⁶:

- 1) health and rescue capability;
- 2) land use and planning;
- 3) natural environment;
- 4) bioeconomy;
- 5) economy;
- 6) society, awareness, and cooperation;
- 7) infrastructure and buildings;
- 8) energy and security of supply.

1. Measures and developments of the health and rescue capability sector

In order to get closer to the goals given in the NAS in 2019–2020, as part of the health measure, probability scenarios and map layers of coastal flood areas were prepared by the ESTEA, and the beach monitoring methodology was updated. During the same period (2019–2020), the study ‘Use and development of remote sensing data in the public services’ was carried out within the research programme RITA. As part of the study, a flood mapping methodology suitable for Estonia was developed based on remote monitoring data, which enables operationally occurring floods to be mapped and the state’s operational institutions to deliver the necessary warnings and evacuate residents. In addition, the information about floods that occurred can be used for planning in the

future. As a follow-up activity, the development of the ESTEA's service based on this methodology started in 2021.¹⁶⁷

Updating the sea level forecast model and introducing the new sea modelling environment, NEMO-Est, started in 2020. NEMO-Est can be used for operational forecasts of the Estonian sea area, climate studies and assessment of various marine processes. By updating the model, operational forecasts of sea level, water temperature, salinity, currents and ice conditions will become more accurate. To date, the NEMO-Est operational model has been implemented in the ESTEA.¹⁶⁷

In order to increase the rescue capacity, the Rescue Board has developed the ability to monitor and extinguish forest fires from the air and has acquired and deployed 15 drones (including 7 with a thermal camera). In order to effectively respond to emergency situations arising from climate change (floods, wildfires, extreme weather conditions), the Rescue Board has acquired modern rescue equipment and technology in the past years. In the case of extraordinary weather phenomena, the Rescue Committee has the possibility of direct communication with the ESTEA weather forecaster (on call) to obtain information in addition to the transmitted warnings.¹⁶⁷

2. Measures and developments of the land use and planning sector

In 2018, recommendations and guidance materials for rainwater solutions in the planning process and an overview of engineering-technical solutions for rainwater were prepared in cooperation between the MoE and the Ministry of Finance¹⁶⁷. Also, in 2019, the MoE, in cooperation with the Estonian Rescue Board, developed information brochures with guidelines for areas with a flood risk.¹⁸³

In order to prevent possible damage caused by heat islands and to mitigate risks, the ESTEA prepared a heat island analysis for the largest cities in Estonia in 2020 (Tallinn, Tartu, Pärnu, Kohtla-Järve, Narva, Rakvere and Viljandi) based on Landsat-8 satellite data. Developers of residential areas and urban planners can use the maps when making spatial planning decisions. Map layers are also available on the Geoportal of the Land Administration in the map application Heat Islands.¹⁸⁴ Estonia's largest city, Tallinn, also conducted a study on the location of its heat islands and changes in temporal and spatial dynamics.¹⁸⁵

In 2018, the MoE updated and made public the assessment of flood-related risks and determined risk areas in order to mitigate flood risks¹⁸⁶. In 2019, maps of the flood hazard areas and the flood-related risk areas were updated and made public, as they are intended for use by the general public, as well as planning and environmental experts and local governments for spatial planning

¹⁸³ Ministry of Environment. (2019). Guidelines for floods. [www] [Käitumisjuhised ja videod võimaliku üleujutuse tasemete kohta riskipiirkondades | Kliimaministeerium](#) (25.10.2024).

¹⁸⁴ Estonian Environment Agency. (2020). Map „Heat islands“ (In Estonian) [www] <https://xgis.maaamet.ee/xgis2/page/app/soojussaared> (25.10.2024).

¹⁸⁵ Tallinn Strategy Centre. (2021). Mapping of Tallinn's heat islands in 2021. (In Estonian) [www] <https://uuritud.tallinn.ee/uuring/vaata/2021/2021-aasta-soojussaarte-analuis> (25.10.2024).

¹⁸⁶ Ministry of Environment. (2018). Updated version of flood risk assessment. (In Estonian) [www] <https://envir.ee/ajakohastatud-uleujutusega-seotud-riskide-hinnang> (25.10.2024).

decisions¹⁸⁷. In addition, the ESTEA also mapped the probability scenarios of coastal floods outside the flood risk areas in 2020¹⁸⁸. Also several mitigation plans have been made to mitigate flood risks including technical solutions of the flood risk mitigation plan in the city of Tartu and technical solutions of the flood risk mitigation plan in the city of Kärdla¹⁸⁹.

In the course of the Environment Agency's project "Tools necessary for assessing, forecasting and ensuring the availability to assess the socio-economic and climate change-related environmental condition of biodiversity" a green network planning guide was prepared, in which special attention was placed on areas with urban institutions and the planning of green areas in the urban environment. It is a helpful guidance material for local governments for green area planning.¹⁹⁰

3. Measures and developments of the natural environment sector

In 2017–2020, conservation management works for rare and endangered species were ordered, inventories of habitats of protected plant species were carried out and protection management recommendations were given, alien species were mapped and a study of migratory movements was carried out.¹⁶⁷

In 2020, the Minister of the Environment's directive approved the National Action Plan on Invasive Alien Species 2020–2025¹⁹¹, and in 2021, the ESTEA prepared a monitoring plan for alien species of EU-level importance to improve the monitoring of invasive alien species. In addition, as part of the coastal sea monitoring of the national environmental monitoring programme, already known alien species are monitored in the sea, and the presence of alien species is monitored at regular monitoring stations. In order to control the introduction of alien species in ballast water, studies were carried out in the water areas of major ports with the funding of the Environmental Investment Center (EIC). Within the framework of the RITA project "Study of micro-organisms and viruses in ship ballast water" the species found in ship ballast water were studied¹⁹². Moreover, within the framework of the mereRITA project, monitoring methodologies were further developed to detect alien species early with the eDNA method¹⁹³. In order to raise general awareness, the Environmental Board and the ESTEA have published several articles on alien species in recent years.¹⁶⁷

In order to ensure the favourable condition of communities and the diversity of landscapes, a green network planning guide was prepared, which is primarily intended for planning a green network

¹⁸⁷ Ministry of Environment. (2019). Maps of the flood hazard areas and the flood-related risk areas. (In Estonian) [www] <https://envir.ee/uleujutusohupiirkonna-ja-uleujutusohuga-seotud-riskipiirkonna-kaardid>. (25.10.2024).

¹⁸⁸ Estonian Environment Agency (2020). Preparation and mapping of flood probability scenarios for coastal areas. (In Estonian) [www] <https://keskkonnaagentuur.ee/media/939/download> (25.10.2024).

¹⁸⁹ Ministry of Environment. (2021). Technical solutions of the flood risk mitigation plan in the city of Tartu. (In Estonian) [www] [Uuringud ja aruanded | Kliimaministeerium](https://keskkonnaagentuur.ee/elme#rohevorgustik) (25.10.2024).

¹⁹⁰ Estonian Environment Agency. (2022). ELME – Green Network. (In Estonian) [www] <https://keskkonnaagentuur.ee/elme#rohevorgustik> (25.10.2024).

¹⁹¹ Ministry of Environment. (2019). National action plan on invasive alien species 2020-2025. (In Estonian) [www] https://envir.ee/EL_voorliigid (25.10.2025).

¹⁹² Ministry of Environment. (2020). Study of micro-organisms and viruses in ship ballast water. [www] <https://envir.ee/keskkonnakasutus/merekeskkonna-kaitse/uuringud#patogeenide-ja-mikro> (25.10.2024).

¹⁹³ Ministry of Environment. (2021). Applicability of eDNA based methodology for early detection of alien (cryptic) species. (In Estonian) [www] <https://datadoi.ee/handle/33/461> (25.10.2024).

at the level of general planning. The preparation of the guidance was preceded by an analysis of the functioning of the existing green network, and it can also be used at the level of detailed plans.¹⁹⁴

In order to ensure socio-economically important ecosystem services, the RITA ForBee project “Possibilities to reduce the death of pollinators, including honeybees” was implemented in 2019–2021 under the leadership of the Estonian University of Life Sciences Institute of Agriculture and Environment. Selected ecosystem services have been mapped and evaluated as part of the ELME project “Tools necessary for assessment, projecting and ensuring the availability of data of the socio-economic and environmental state of biodiversity associated with climate change” led by the ESTEA.¹⁶⁷

4. Measures and developments of the bioeconomy sector

As part of the Rural Development Plan 2014–2020, support measures were developed for the development of land improvement systems for landowners and companies to improve sustainability, energy and resource efficiency, taking into account climate risks, land fund, soil and other regional and local conditions. In addition, support measures for product development were developed to encourage agricultural resource management and use the positive effects of climate change.¹⁶⁷

In 2019, the report Forest and Climate Change was prepared to ensure the productivity, vitality and diversity of forests. The work is based on existing and available scientific research, and it describes the role of Estonian forests in mitigating climate change (including energy and carbon storage) and adapting to it, keeping in mind European and global climate change policies.¹⁹⁵ In 2019–2020, the Estonian University of Life Sciences conducted a study on the nature and need of genetic reserve forests in Estonia. The paper outlines from which tree species it is possible to create a gene reserve forest, the number of areas and what size is optimal for Estonian conditions, and how to manage them.¹⁶⁷

In order to ensure the sustainability of fish stocks, in 2019–2020, on the order of the MoE, the dynamics of the food spectrum of the growth period of young fish were studied in Lake Kuremaa.¹⁶⁷ In 2020, the Estonian University of Life Sciences prepared the “Study of the Impact of Climate Change on Estonian Small Lakes”, which contains recommendations for maintaining and improving the ecological condition of the studied lakes¹⁹⁶.

5. Measures and developments of the economy sector

In order to better ensure mitigation of household risks associated with climate change, the Ministry of Finance is conducting a study ‘Analysis of insurance coverage of climate risks affecting

¹⁹⁴ Ministry of Finance. (2018). Green Network Planning Guide. (In Estonian) [www] <https://planeerimine.ee/juhendid-ja-uuringud/rohevorgustik/> (25.10.2024).

¹⁹⁵ Ministry of Environment. (2020). Forest and climate change. (In Estonian) [www] <https://envir.ee/elusloodus-looduskaitse/metsandus/uuringud-ja-lisamaterjalid> (25.10.2024).

¹⁹⁶ Estonian University of Life Sciences. (2020). Study of the impact of climate change in Estonian small lakes. (In Estonian) [www] <https://envir.ee/elusloodus-looduskaitse/kalandus/uuringud-ja-aruanded> (25.10.2024).

Estonian households that can be mitigated with insurance services’, which should be completed by 2025.¹⁶⁷

6. Measures and developments of the society, awareness, and cooperation sector

In order to make risk management more effective, a list of the emergency situations in which risk communication is organised and the authorities responsible for the organisation was prepared on the basis of § 10 of the Emergency Act. Behavioural guidelines for crisis situation were prepared in 2018 together with the concept of population protection (updated in 2022).¹⁹⁷ A website and an app “Be prepared” (“Ole valmis”) are also available to residents. In relation to climate change, extraordinary weather situations (storms, excessively hot weather) and floods have been presented as crisis situations, and guidelines for behaviour in these situations have been provided. In 2024 the Hazard Notification booklet was released. This leaflet gives an overview of how the country informs people of an emergency and specifies when to shelter or evacuate. At a critical moment, it is essential that relevant information reaches people quickly, because timely threat alerts and action save lives, health, and property.¹⁹⁸

In March 2020, in order to meet the information needs of the population in emergency situation caused by COVID-19, the state helpline information number 1247 was opened, which also provides environmental information from the beginning of 2021.¹⁶⁷

7. Measures and developments of the infrastructure and building sector

The LIFE-IP BuildEst project deals with the development of technical solutions, pilot solutions for different building types and methods, activities related to climate risks and the circular economy, the development of digital tools and, more broadly, the raising of renovation-related awareness, in order to ultimately increase the ability of owners to renovate their buildings. During the project, among other things, climate risks are modelled and solutions for adapting to a changing climate are tested. These results are the basis for changes in design standards and regulations. The aim is to ensure better climate resistance of buildings in various extreme weather conditions throughout their life span, in order to avoid repeated renovation works. The project will last until 2028 and includes the activities of 18 institutions leading innovation in the construction field all over Estonia. Among them are municipalities, NGOs, ministries, universities, professional associations and state institutions.¹⁹⁹

8. Measures and developments of the energy and security of supply sector

¹⁹⁷ Rescue Board. (2022). What to do in a crisis situation. [www] <https://www.olevalmis.ee/files/2022-12/ole-valmis-2022-eng.pdf?61d9cef5d8> (25.10.2024).

¹⁹⁸ Rescue Board. (2024). Hazard Notification. [www] [augpa-ohuteavituse-manual-veeb-eng.pdf](http://www.augpa-ohuteavituse-manual-veeb-eng.pdf) (25.10.2014)

¹⁹⁹ Ministry of Economic Affairs and Communications. (2022). Research Development Program LIFE IP BuildEST. (In Estonian) [www] Teadusarendusprogramm LIFE IP BuildEST – hooandja hoonete renoveerimisele | Kliimaministeerium (25.10.2024).

In the Estonian Recovery and Resilience Plan (RRF), a programme to strengthen the electricity grid is planned to increase the production capacity of renewable energy and to continue with the construction of a weatherproof electricity grid necessary for adaptation to climate change. Making electricity networks weather-proof (mainly by replacing bare-wire overhead lines with weather-proof solutions in the distribution network, e.g. underground cables) helps to reduce breakdowns and ensure the supply of consumers even in extreme weather conditions (e.g. significant storms). The total investment until 2026 is nearly 68.5 million euros, of which the support part from the RRF is 30 million euros.¹⁶⁷

4.3.2 Adaptation challenges and gaps, and barriers to adaptation.

The potential impacts of climate change and vulnerability vary greatly by regions, but adaptation must be based on the location and territorial risk assessments. An assessment of vulnerability and climate change impacts is drawn up based on the assumption that exposure, sensitivity, and ability to adapt are phenomena that vary spatially. In addition to climatic changes moving in different directions in different regions and since some regions are more exposed than others, all regions have their own distinguishable environmental, social, and economic features, which are sensitive to climate change to a larger or smaller extent. To assess vulnerability, the impacts of change and the regional ability to adapt are integrated. This is based on the principle that a region with high impacts of climate change may still be moderately vulnerable if it is well-adapted to the presumed climate change. On the other hand, high impacts may be expected to result in higher vulnerability if the ability of the region to adapt is low.

There is yet no comprehensive monitoring, reporting and evaluation methodology in place to systematically and periodically assess climate impacts, vulnerabilities, risks and adaptive capacity. This has been identified as an issue and a systemic solution is being sought.

Estonia is in the process of drafting its first Climate Resilient Economy Act. According to the Act the Ministry of Climate will coordinate and organize the reporting, monitoring, forecasting and assessment of climate change mitigation and adaptation in the Climate Report. This report will be prepared once a year and include data from the national inventory of greenhouse gas emissions, assessment of the fulfillment of climate goals and overviews of greenhouse gas footprint assessments and measures. Every second year the report will include the projections of greenhouse gas emissions and once in five years assessment of competitiveness, an overview of the relevance and adequacy of climate goals, assessment of technological readiness, including carbon capture technologies, analysis of subsidies, tax differences and environmental fees, which are in conflict with climate and with environmental goals and assessment of climate risks.⁸¹

4.4 Adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies

4.4.1 Implementation of adaptation actions in accordance with the global goal on adaptation as set out in Article 7, paragraph 1, of the Paris Agreement

The general objective of the NAS is to increase the readiness and capacity of the regional and local level of the state of Estonia to adapt to the effects of climate change¹⁶⁶.

It has been identified and taken into consideration by the Ministry of Environment (now the Ministry of Climate) that adaptation measures need to be directed to increase the awareness and resilience as well as to the implementation at sub-national level on the principle of caution based on the following guiding principles¹⁶⁶:

- awareness: increasing the awareness of the general public (the society as a whole, people, officials, etc.) and reducing the knowledge gaps related to climate change and the uncertainty due to them (scientific measures);
- readiness and resilience: ensuring the capacity to mitigate climate risks and increasing strategic and operative readiness;
- caution: acknowledging long-term changes and preventive action in the long perspective.

According to the division of prioritised sectors in the NAS, it has eight subgoals, the performance of which is supported by the measures for adaptation to the effects of climate change, which are presented in the draft implementation plan together with the activities, results and costs. Each sector has a subgoal with a metric, initial level and target level 2030. For example, in land use and planning sector the subgoal is – Storm, flood and erosion risk has been managed, the heat island effect has been mitigated, the climate security of settlements has been increased by choosing the best solutions in land use and planning thereof. The metric in this sector is the number of residents on flood risk areas (1% probability). The initial level for it is 9,171 (2014) and target level 2030 is <11,000. There are 2 measures in this sector¹⁶⁶:

Measure 2.1. Increasing awareness about the effects of climate change and risks in land use, urban arrangement and planning, development of planning methods of risk areas and organisation of the legal framework;

Measure 2.2. Management of flood risks and the development of green areas and urban landscapes for managing climate risks.

4.4.2 Adaptation goals, actions, objectives, undertakings, efforts, plans (e.g. national adaptation plans and subnational plans), strategies, policies, priorities (e.g. priority sectors, priority regions or integrated plans for coastal management, water and agriculture), programmes and efforts to build resilience

The area of adaptation to climate change is planned and managed comprehensively through the NAS, which is also used to assemble and harmonise the approaches of adaptation to the effects of climate change used in different national development documents and accounts for the sectors that are most vulnerable to the effects of climate change. This ensures better coherence between the different sectors related to the adaptation to the effects of climate change.¹⁶⁶

The strategic development documents of Estonia include direct and indirect measures, which may help society in adapting to the impacts of climate change.

Climate change has already been included as a horizontal topic in several sectoral development documents and development plans, as well as in the long-term strategy **Estonia 2035**. The goal is the comprehensive introduction of solutions that contribute to the green transition and to achieve this the following activities are planned: supporting planning in cooperation with local governments to mitigate climate change, reducing the impact of climate change and adapting to it, increasing and preserving biodiversity, diversifying the living environment, and promoting environmentally friendly living and visiting environments.⁹⁰

Adaptation to climate change is also integrated into the climate policy vision document **General Principles of Climate Policy until 2050** (GPCP), where the long-term vision of Estonian climate policy, along with sectoral and economy-wide policy directions, will set a clear path towards 2050 for mitigating climate change, i.e. reducing GHG emissions and also adapting to climate change effects.⁷⁹

Estonia's long-term goal in terms of earth's crust written in the **General principles of Earth's crust policy until 2050** is to ensure the science-based management and use of extractable land resources, which is directed at national economic growth and resource efficiency, is eco-friendly, and maintains human health. At the same time, it is important to reduce dependence on non-renewable resources.²⁰⁰

The **National Security Concept of Estonia** emphasized the importance of having a consistent, trouble-free and reliable supply of vital services and food and drinking water as well the ability of society and individuals in the event of disruption of these services over a period of time to manage independently. The effects of climate change (climate refugees, natural disasters, pollution) are a threat to the country's security.²⁰¹

In the **Development Plan for Internal Security 2020–2030**, climate change is considered as one of the important trends affecting the field of internal security. According to this, it is more

²⁰⁰ Ministry of Environment. (2017). General principles of Earth's crust policy until 2050. [www] [Maapõuepoliitika põhialused aastani 2050 | Kliimaministeerium](#) (25.10.2024).

²⁰¹ Ministry of Defence. (2023). National Security Concept of Estonia. [www] [eesti_julgeolekupoliitika_alused_eng_22.02.2023.pdf](#) (25.10.2024).

necessary than before to pay attention to the prevention of widespread fires, monitoring their occurrence, and extinguishing fires that have broken out as economically and quickly as possible. As climate change causes an increase in extreme weather conditions (including floods and storms) and can also lead to widespread crises, then preparing for such crises becomes more important than before for both residents and the country.²⁰²

One of the sub-goals of the **Population Health Development Plan 2020–2030** is a health-supporting environment. Readiness and flexibility to consider the impact of climate change on health is stated as one of the prerequisites for achieving it. According to the development plan, it must be taken into account that poor people are most vulnerable to climate change (e.g. more frequent storms and floods or hot periods in summer), as they may lack the means and network to buffer against the impact of climate change or to mitigate climate risks. Therefore, extreme weather events can increase inequality in society. In addition, outdoor and indoor air, noise, drinking and bathing water from the environment have a significant impact on peoples' health quality.²⁰³

The **Youth Sector Development Plan 2021–2035** considers raising awareness and readiness of young people to solve future challenges, including problems associated with climate change, as an important challenge. It is proven that climate and environmental topics are important for young people all over the world, including in Estonia, where there are already civic youth movements on climate change. The topic of climate change is dealt with in various forms of education, including non-formal education and youth work activities. When planning policies or changes, it is also important to analyse their economic, social and value-related impact on the youth.²⁰⁴

In the **Estonian Research and Development, Innovation and Entrepreneurship Strategy 2021—2035** the most important objectives in the field of research, development, innovation and entrepreneurship for the EU are in line with the priorities of Estonia's EU policy. In particular, the strategy is closely linked to the priorities related to the development of the economic base and the construction of a climate-neutral, digital, green, fair and social Europe. The focus is on valorisation of local resources and introduction of smart and sustainable energy solutions. Knowledge transfer facilitates the application and development of different technologies, ideas and knowledge, also improving society's adaptability to cope with global changes (including climate change).²⁰⁵

The goals and directions in the **Agriculture and Fisheries Strategy 2030** take into account the needs for sustainable development as well as for the mitigation of climate change and adaptation. The development plan states that according to climate projections, our region may be one of the few where production conditions tend to improve over time, although it is assumed that weather

²⁰² Ministry of the Interior. (2021). Development Plan for Internal Security 2020-2030 (In Estonian) [www] <https://www.siseministeerium.ee/et/STAK2030> (25.10.2024).

²⁰³ Ministry of Social Affairs. (2020). Population health development plan 2020-2030. (In Estonian) [www] [Rahvastiku tervise arengukava 2020-2030 | Sotsiaalministeerium](https://www.sotsiaalministeerium.ee/et/rahvastiku-tervise-arengukava-2020-2030) (25.10.2024).

²⁰⁴ Ministry of Education and Research. (2021). Youth Sector Development Plan 2021-2035 (In Estonian) [www] <https://www.hm.ee/ministeerium-uu-dised-ja-kontakt/ministeerium/strateegilised-alusdokumendid-ja-programmid#noortevaldkonna-aren> (25.10.2024).

²⁰⁵ Ministry of Education and Research. (2021). Estonian Research and Development, Innovation and Entrepreneurship Strategy 2021—2035. [www] [TAIE arengukava tutvustus | TAIE](https://www.taie.ee/taie-arengukava-tutvustus) (25.10.2024).

may become more extreme and unpredictable than before. At the same time, the globalisation of trade and climate change encourage the spread of new plant pests and animal diseases.²⁰⁶

The main focus of the **Transport and Mobility Development Plan 2021–2035** is the reduction of the environmental footprint of the means and system of transportation and the development of a climate-resistant infrastructure, with the aim of helping to achieve the climate goals for 2030 and 2050.²⁰⁷

The main goals connected to climate issues in **The Estonian Energy Policy Development Plan 2030** (ENMAK 2030) are to reduce CO₂ emissions, increase the production and use of renewable energy sources for electricity and heat, increase energy efficiency and security, improve the efficiency of the internal energy market and promote research, innovation and competitiveness in this field.¹⁰⁰

The Government of Estonia is currently updating the ENMAK 2030 document. The renewed **Energy Development Plan until 2035** aims to update the trends, goals and activities of the energy economy included in the ENMAK 2030. It will also include the development vision, goals, bottlenecks and policy instruments of the Estonian energy economy in moving towards a climate-neutral energy production and consumption and ensuring energy security. The deadline for approving the renewed Energy Development Plan until 2035 is set for 2025.¹⁰²

Estonian Foreign Policy Development Plan 2030 draws attention to the fact that climate change affects the integrity of the ecosystem, which in turn affects all areas of life and activity. Security can be threatened by emergencies caused by natural disasters or environmental pollution in Estonia or in the vicinity, as well as by biological threats (cross-border infections and pandemics, diseases, pests and poisons). The goal is to advance Estonia's reputation as a country with pure natural environment and high-quality and safe food. To this end, Estonia will engage in international cooperation to preserve biodiversity and combat harmful climate change.²⁰⁸

In the **Estonia's Digital Agenda 2030** it is stated that digital solutions enhance environmental monitoring. In addition, they create faster analysis capabilities to cope with and respond to extreme weather conditions. Enhanced protection of information systems is important in securing environmental information. Although the environmental footprint of the use of digital solutions is constantly increasing in Estonia and elsewhere in the world, the better availability and usability of public digital services reduces the number of people forced to move from their homes reducing their environmental and climate impact.²⁰⁹

²⁰⁶ Ministry of Rural Affairs. (2021). Agriculture and Fisheries Strategy 2030. [www] <https://www.agri.ee/en/ministry-news-and-contact/ministry-rural-affairs/agriculture-and-fisheries-strategy-2030> (25.10.2024).

²⁰⁷ Ministry of Economic Affairs and Communications. (2021). Transport and Mobility Development Plan 2021–2035. [www] <https://www.mkm.ee/transport-ja-liikuvus/transpordi-tulevik> (25.10.2024).

²⁰⁸ Ministry of Foreign Affairs. (2020). Foreign Policy Development Plan 2030. [www] [Vabariigi Valitsuse Välispoliitika arengukava 2030 | Välisministeerium](http://vabariigi.valitsuse.valispoliitika.arengukava.2030.valisministeerium) (25.10.2024).

²⁰⁹ Ministry of Economic Affairs and Communications. (2021). Estonia's Digital Agenda 2030. [www] [Digiühiskonna arengukava 2030 | Majandus- ja Kommunikatsiooniministeerium](http://digiuhiskonna.arengukava.2030.majandus-ja-kommunikatsiooniministeerium) (25.10.2024).

4.4.3 How best available science, gender perspectives and indigenous, traditional and local knowledge are integrated into adaptation

A large part of climate change adaptation measures can be implemented through public awareness, as the decisive and often primary factor is human behaviour. One of the strongest influencing factors in the development of environmental awareness is education – the views of people with higher education are more environmentally friendly than average, the understanding of the functioning of ecosystems is more comprehensive, and the self-esteem behaviour is more environmentally sustainable than in people with lower education. Also, people with higher education express a more responsible and more active attitude in terms of preventing and solving environmental problems than people with lower education. Climate change mitigation is also considered a higher priority by people with higher education.²¹⁰

Education strategy 2021–2035 puts emphasis to environmental awareness and introducing topics related to the environment through general education. The field of education affects training of future specialists and experts who support nature conservation and the reduction of negative impacts of climate change, as well as promote the introduction of new technologies. The development plan promotes practical learning of subjects in the field of natural and exact sciences and technology in general education.²¹¹

“Eesti elanike keskkonnateadlikkuse uuring” (“The environmental awareness survey of Estonian residents”) is a study that has been done every 2 years since 2010. The purpose of the survey is to provide an overview of the environmental awareness and attitudes of Estonian residents. The last study was carried out in August 2024. The study has been used to make temporal comparisons of the results of previous similar population surveys (from 2010-2022).

The study highlighted the importance of education in the development of environmental awareness: compared to people with lower education, the behavior of people with higher education is more environmentally friendly, their will to live more environmentally friendly is greater, and they feel the benefits of environmentally friendly behavior more clearly for themselves.²¹⁰

The study revealed a connection between awareness and attitudes to behavior – people who are aware of the importance of environmental problems generally behave more environmentally friendly than those who do not understand the importance of the problems. Environmentally friendly behavior is also encouraged if a person perceives the importance of his contribution (i.e. feels that his behavior also has a wider impact) and feels the benefit of environmentally friendly behavior for himself.²¹⁰

Similarly to previous studies, higher environmental awareness of women was confirmed. Compared to men, women behave more environmentally friendly and are more interested in living

²¹⁰ MoC. (2024). Study on the environmental awareness in Estonia. (In Estonian) [www] <https://envir.ee/kaasamine-keskkonnateadlikkus/keskkonnateadlikkus/uuringud> (06.12.2024).

²¹¹ Ministry of Education and Research. (2021). Education strategy 2021–2035 [www] https://www.hm.ee/sites/default/files/documents/2022-09/1._haridusvaldkonna_arengukava_2035_kinnitatud_11.11.21.pdf (25.10.2024).

even more environmentally friendly. Also, women perceive more clearly than men the importance of their own contribution to environmental protection and the benefit of environmental protection (for themselves).²¹⁰

Awareness of the consequences of climate change is also higher among women, younger people, people with higher education or who are better off financially.²¹⁰

According to the survey, environmental issues often matter more to people who are doing better in financial terms. People with economic difficulties are more indifferent to environmental protection, which proves that everyday problems relegate concerns about the environment to the background.²¹⁰

Nonetheless, 83% of the population consider themselves environmentally conscious, with 15% very environmentally conscious (81% and 10% respectively in 2022, i.e. the proportion of those who consider themselves very environmentally conscious has increased slightly). The proportion of people who do not consider themselves environmentally conscious is 13% and of those who cannot assess their environmental awareness is 4%.²¹⁰

The term "indigenous people" cannot be found in Estonian laws. Indigenous people are those who have been discriminated against, whose land has been occupied and who have not had the opportunity to create schools or other institutions for their own development. Therefore, the Ministry of Culture has not declared any groups of people in Estonia as indigenous people.²¹²

Climate change does not affect different social groups equally. The risks are highest for disadvantaged people – those in a poorer socio-economic situation, with less social capital or people with chronic illnesses. Thus, extreme weather conditions may deepen the inequality in society and put the cohesion of society at risk. The economies which are able to adjust to the changed conditions more rapidly and effectively achieve a significant competitive advantage.

It is already stated in the NAS that equal opportunities are the key topic of the society when adapting to the effects of climate change, since the focus point of adaptation is to reduce the vulnerability of the groups in less favourable positions. Different groups of residents are differently affected by climate change and the target of the adaptation measures must be to level these inequalities. The NAS broadens the possibilities of the general public and the stakeholders to have a say in making the decisions and helps to better understand climate risks and the measures implemented for managing them.¹⁶⁶

More frequent extreme weather phenomena are accompanied by a need for the assistance of social workers, especially for servicing vulnerable groups, who are in danger of social isolation. The hazards accompanying extreme weather phenomena impact different groups of society differently – the impacts vary locally (e.g. floods in seaside or lowland areas) and by members of society (e.g.

²¹² Põlendik, K. (2023). The law does not provide an opportunity for Võrokesed to be recognised as indigenous people Elron trains delayed due to heat wave. Estonian Public Broadcasting. (24.04.2023). (In Estonian) [www] <https://www.err.ee/1608957767/seadus-vorokeste-polisrahvana-tunnustamiseks-voimalust-ei-paku> (25.10.2024).

the elderly are more vulnerable to extreme cold and heat). Climate change endangers the most disadvantaged people, i.e., those in a poorer socio-economic situation and those with less social capital, who may not have the resources or networks for buffering the impacts of climate change that affect them directly, or for the management of climate-related risks. The impacts on health are mainly prevalent in children, the elderly, and in chronically ill people or those affected by multiple health conditions. Thus, extreme weather phenomena may further deepen inequality in society. In the Health and rescue capability sector one of the vulnerabilities arises from the capability and preparedness of healthcare systems to adapt to the changing climate and extreme weather phenomena (availability of medical care may be interrupted), from the sensitivity and inequality of the population, from the share of more vulnerable people (the elderly, children, chronically ill), and from the existence and functioning of warning systems.¹⁶⁶

According to the Gender Equality Act¹ § 9 upon planning, implementation and assessment of national, regional and institutional strategies, policies and action plans, the state and local government authorities shall take into account the different needs and social status of men and women and consider how the measures applied and to be applied will affect the situation of men and women in society. In doing so the state and local government authorities shall, if necessary, consult the relevant interest groups and non-profit organisations that have a legitimate interest in helping to combat discrimination based on sex in order to support compliance with the principle of equal treatment.²¹³

Equality between women and men and the creation of equal opportunities for minority groups is one of the important basic principles that must be taken into account when moving towards the goals of long-term strategy Estonia 2035: “Everyone must have equal opportunities for self-fulfillment and participation in society, regardless of their individual characteristics and needs, belonging to different social groups, their socio-economic capacity, or place of residence.” Compliance with this basic principle is monitored using the gender equality index (EIGE (European Institute for Gender Equality) Gender Equality Index). The initial level is 60.7 value points out of 100 (2018). By 2035, it is expected to reach the level of 70.7 value points out of 100.⁹⁰

4.4.4 Development priorities related to climate change adaptation and impacts

The priorities of Estonia in terms of climate change have been divided into 8 categories in the NAS¹⁶⁶:

1. Health and rescue capability. The main goal of this sector is improved rescue capability and the ability of people to protect their health and property has decreased the negative impacts of climate change on health and living environment;

²¹³ Gender Equality Act¹. (2004). RT I, 30.06.2023, 72. [www] <https://www.riigiteataja.ee/en/eli/ee/516012019002/consolide/current> (04.12.2024).

2. Land use and planning, including coastal areas, other areas with a risk of flooding, areas with a risk of landslides, land improvement, towns. The main goal of this sector is that the risk of storms, floods, and erosion has been managed, the heat island effect has been managed, the climate resistance of settlements has been increased by selecting the best land use and planning solutions;
3. Natural environment, including biodiversity, land ecosystems, freshwater ecosystems and environment, marine ecosystems and environment, ecosystem services. The main goal of this sector is to ensure a variety of certain species, habitats, and landscapes, the favourable condition and completeness of terrestrial and aquatic ecosystems, and provision of socio-economically significant ecosystem services in a sufficient extent and with a sufficient quality in the changing climate conditions;
4. Bioeconomy, including agriculture, forestry, fishing industry, hunting, tourism, peat production. The main goal of this sector is to ensure the sustainability of the bioeconomic sectors, which are important to Estonia through planning the agriculture, forestry, water management, fisheries and the leisure industry as well as peat extraction by taking into consideration the climate;
5. Economy, including insurance, banking, employment, entrepreneurship and industry. The main goal of this sector is to see to it that participants in the economy are using the opportunities which accompany climate change, in the best possible manner and manage the risks related thereto;
6. Society, awareness and cooperation, including awareness, education and science, international relations and cooperation. The goal is to make sure people understand the hazards and opportunities accompanying climate change;
7. Infrastructure and buildings, including transport and infrastructure of transport, technical support systems, buildings. The main goal is to ensure the impacts of climate change will not result in decreased availability of vital services or decreased energy-efficiency of buildings;
8. Energy and security of supply, including energy independence, security, resources, efficiency, and heat and electricity production. The main goal of this sector is to secure that climate change will not result in decreased energy independence, energy security, security of supply or usability of renewable energy resources or in the increase of the volume of the final consumption of primary energy.

4.4.5 Any adaptation actions and/or economic diversification plans leading to mitigation co-benefits

Reclamations and restoration of bogs regulate the water regime in the landscape and thereby alleviate drought and floods, increase water capacity of the landscape and ensure quality and volume of regional water supply, decrease fire hazard in the nearby forests, clean and store fresh water, create conditions for the recovery of the habitats of endangered and rare species. In addition, reclamation of residual bogs (wetland restoration or afforestation) makes it possible to significantly reduce GHG emissions – bogs bind carbon well with the help of peat that is

continuously created there and, in this way, softens human-caused climate change. With climate goals in mind, reclamation of residual bogs is a cost-effective activity that has quick impact.

In order to ensure the stability, functions and diversity of terrestrial ecosystems and habitats, the 2014-2020 Cohesion Fund funds have been implemented by the EIC water protection program project "Adjustment of drained, exhausted and abandoned peatlands". In the course of the project, up to 2000 ha of residual bogs were restored by 2023. As of 2023, the natural water regime has been restored on a total of approximately 20 000 hectares in various marsh communities (including the 2000 hectares in residual bogs).²¹⁴

Pärnumaa is a demo region in the Regions4Climate project where the overall goal is to contribute to a faster and more efficient adaptation to climate change in Europe. The 5-year project (2023–2027) is funded by the European Commission's research and innovation program "Horizon Europe". During the project they will map heat island in the City of Pärnu and its surrounding to study the possibilities of mitigating and preventing heat islands. Also a study will be carried out, to update knowledge regarding landslide-prone areas in the City of Pärnu. The aim is to determine landslide-prone and potential landslide-prone areas. This data can be used in the future to make decisions in developing the region – where, how and under which conditions to build in order to prevent future landslides. The City of Pärnu will also start developing a digital tool with the aim of making (planning) decision-making faster, easier and more science-based.²¹⁵

LIFE IP BuildEst (until 2028) is an R&D programme to support the energy-efficient renovation and climate-proofing of buildings. In this framework the Department of Marine Systems of Tallinn University of Technology carried out the project “Pursuing national climate ambition through renovation of Estonian building stock and developing its long-term resilience in 2022–2023”. During the project also climate scenarios are analysed and the most suitable scenario for Estonia is selected and downscaled.¹⁹⁹

In 2022, the Department of Energy Technology of Tallinn University of Technology carried out the project “Finding more cost-effective solutions to use CO₂ captured from Enefit-280 plants as a raw material” funded by Eesti Energia AS.²¹⁶

4.4.6 Efforts to integrate climate change into development efforts, plans, policies and programming, including related capacity-building activities

The general goal of the NAS emphasises that in addition to the national level, the local and regional level play an important role in adapting to climate change.

The Ministry of Climate cooperates with the Association of Estonian Cities and Municipalities (AECM) to promote climate issues, e.g. cooperation in the local government’s round tables and in

²¹⁴ Ministry of Climate. (2024). Estonia continues restoration work on wetlands that are valuable for nature conservation. (02.02.2024). (In Estonian) [www] [Eesti jätkab looduskaitsekselisel väärtuslike märgalade taastamistööd | Kliimaministeerium](#) (25.10.2024).

²¹⁵ Regions4Climate (2023). [www] <https://regions4climate.eu/resilient-region/parnumaa/> (25.10.2024).

²¹⁶ Tallinn University of Technology. (2022). Finding more cost-effective solutions to use CO₂ captured from Enefit-280 plants as a raw material. [www] <https://ws.lib.ttu.ee/publikatsioonid/et/isik/item/10eac990-7330-40ff-89ee-87aaacedc698> (25.10.2024).

environmental working groups. Various support measures have been initiated to promote climate and energy topics in local governments (for the preparation of local government climate and energy plans) with the aim of contributing to the conceptualisation, setting and achievement of climate and energy goals at the local level.¹⁶⁷

Local governments' awareness and ability to adapt to climate change is different. Local governments have an important role in adapting to climate change through spatial planning and design, through which they can either mitigate or amplify climate risks. The consistent activity of municipalities in planning for climate change and preparing for extreme weather conditions is supported by the development of information systems for environmental and weather monitoring and the existence of climate plans. A number of local governments have taken the hazards arising from climate change into consideration in their development plans as well as in the renovation of water and sewerage or other lines, and in the drawing up of detailed and comprehensive plans. Water undertakings are regularly monitoring the conditions of water pipelines in order to ensure the quick outflow of storm water from the city in the case of heavy rain.

Local governments have prepared and some are preparing climate and energy plans in order for local governments to make long-term strategic decisions maintaining and improving their living environment and contributing to the fulfilment of General Principles of Climate Policy until 2050, the Estonian National Energy and Climate Plan 2030 and the NAS. The purpose of climate and energy plans is to help identify the areas related to climate change adaptation and mitigation in a specific region and to find the necessary developments and measures to deal with them. Possible risks and opportunities associated with the impact of climate change are thoroughly considered, thereby helping local governments to adopt knowledge-based long-term strategic decisions. By December 2024, local energy and climate plans exist in 61 out of 79 local governments. In addition, some larger cities, for example two of Estonia's largest cities Tallinn and Tartu also have their separate action plans, which focus on mitigating climate impacts and clearly outline the needs and actions to adapt to climate change.

In 2023 the municipal green reform network was launched. The network will support activities of municipalities in achieving the goals of the green reform. The Ministry of Climate will explain, mediate, nationally coordinate and enhance cooperation on the green reform and climate issues. The municipalities will contribute to the implementation of the green reform action plan at the local level to local opportunities and priorities. They will also contribute in cooperation with other local municipalities in submitting proposals and views to the steering committee of the green reform to take into account the needs of municipalities.²¹⁷

In the spring of 2023, the Environmental Investment Centre and the Association of Estonian Cities and Municipalities created a knowledge network for municipalities. The network is called R-Club and focuses on environmental and climate issues to link the green turnaround to the day-to-day management of local governments and their investments. It is seen by the Estonian authorities as

²¹⁷ Municipal Green Reform Network. [www] <https://kliimaministeerium.ee/rohereform-kov> (25.10.2024).

a local alternative to the Covenant of Mayors. The aim of the club is to be a development engine and a platform for joint projects in maintaining the living environment, and also to offer development models for managing the green revolution.²¹⁸

Behavioural guidelines for crisis situations were prepared in 2018 together with the concept of population protection (updated in 2022). A website and an app "Be prepared" ("Ole valmis") are also available to residents. In relation to climate change, extraordinary weather situations (storms, excessively hot weather) and floods have been presented as crisis situations, and guidelines for behaviour in these situations have been provided.¹⁹⁷

In the 2021-2027 funding period of the European Union's structural funds and recovery and resilience funding, there is greater emphasis put on achieving environmental goals and meeting the requirements related to them. The most important concepts that need to be understood in the context of the distribution of grants for the new funding period is the "do no significant harm" principle and, in the case of infrastructure projects, also ensuring climate resilience. This means that planning and implementation of all projects must take into account climate change, its mitigation and adaptation options, as well as the preservation of biodiversity, the sustainable use of resources and the transition to a circular economy, and the prevention and reduction of environmental pollution. Therefore, as a whole, a good environmental condition must be ensured and the effects of economic activity must be taken into account more comprehensively.²¹⁹

Estonia is in the process of drafting its first Climate Resilient Economy Act. It is planned to oblige the public sector to take into account mitigation of climate change provided for in the Act when preparing plans, strategic development documents, drawing up and implementing action plans and as much as possible in making administrative decisions and in the procurement procedures. The aim of the Act is to integrate climate change adaptation into strategic development documents and planning, so that climate change impacts are taken into account in decision-making processes at all levels of governance. In particular, local authorities or associations of local authorities will be required by the Act to draw up climate and energy plans setting quantified greenhouse gas emission reduction targets that contribute to the achievement of national greenhouse gas emission reduction targets and climate change adaptation targets, together with an action plan to achieve these targets.⁸¹

4.4.7 Nature-based solutions to climate change adaptation

Annual precipitation in Estonia will increase by 19% whereas the highest growth is expected in spring (24%) and winter (22%). At the same time, higher frequency of rainfall exceeding 30 mm per day (increase by 99% in 2021–2030, by as much as 231% in 2031–2050 and by 435% in 2051–2100) as well as higher frequency and severity of torrential rains in the summer are to be expected.

²¹⁸ R-club. [www] [Omavalitsusjuhtide roheklubi R-klubi | Keskkonnainvesteeringute keskus](#) (25.10.2024).

²¹⁹ State Shared Service Center.

Investments in the new support period of the European Union must take climate and environmental goals into account. [www] <https://rtk.ee/euroopa-liidu-uue-toetusperioodi-investeeringud-peavad-arvestama-kliima-ja-keskkonnaeesmarkidega> (25.10.2024)

It is already now that the existing rainwater systems cannot cope with torrential rain, and floods in cities occur due to insufficient storm water drainage.²²⁰

An extremely important share of responsibility in this respect rests with local governments, which organise the construction and maintenance of storm water management systems in the territory of their municipalities. This is why it is reasonable to start increasing their resilience to climate changes now, especially their capability to manage floods caused by torrential rains, including the development of rainwater harvesting solutions (SUDS).

The project LIFE UrbanStorm project (taking place 2018–2023) was funded by the European Union’s LIFE + program and the Environmental Investment Center of Estonia. The aim of the UrbanStorm project was to reduce the vulnerability of Estonian cities to the effects of climate change and to increase the capacity of cities to mitigate floods caused by torrential rains. It was also important to increase the capacity of Estonian local government water management specialists and engineers and to multiply the results of the project in other local governments.²²⁰

During the project²²⁰:

- they established SUDS pilot areas in Viimsi Municipality: Viimsi Manor Park and parking lot in Haabneeme, Karulaugu tee 16, as well as a smart stormwater monitoring and management system for Viimsi Municipality;
- published a handbook „Sustainable stormwater solutions suitable for the Estonian climate”;
- designed a project for building SUDS in Trummi area in Tallinn and a reconstruction project with SUDS for a parking lot in Viimsi Municipality, Randvere tee 18 (construction work was done outside the project);
- held seminars and trainings on SUDS for local government specialists, engineers, designers and planners;
- they did analysis of the strategies and legal acts related to the stormwater management; development of a proposal for methodology for stormwater management fee for Tallinn City.

LIFE-SIP AdaptEST integrated project’s “Implementation of national climate change adaptation activities in Estonia” main objective is to increase the resilience of different ecosystems in a changing climate, to improve society's readiness to adapt to climate change and to ensure a positive socio-economic impact through the sustainable use of resources, using a number of good practices, demonstration and pilot projects and capacity building measures.¹⁹⁹

During the project one activity is to find and implement more environmentally friendly solutions for the maintenance of semi-natural communities (grazing, the most suitable maintenance regimes and techniques, biomass transport and composting) and for the use of biomass there. In addition, aquatic habitats and the living conditions of aquatic life will be restored and improved, and the water regime of wetlands will be made more natural.¹⁹⁹

²²⁰ LIFE UrbanStorm. (2018). [www] <https://life.envir.ee/et/life-urbanstorm> (25.10.2024)

The project will also test the establishment of geographical experimental cultures of less common forest tree species in search of trees species that are more resistant to weather conditions and diseases, as well as grow faster and have higher quality of wood. In Estonia forest planting material of domestic origin is mostly used in forest renewal. The actual effect of the origin of the planting material from outside Estonia on the growth characteristics of the stands is not well-known at the moment. The test results make it possible to assess whether and which species from different regions of origin could be used by forest owners in reforestation. Also they will test the possibilities of growing different tree species together across Estonia, contributing to the increase of forest diversity.¹⁹⁹

Five cities from Estonia (Haapsalu, Narva, Rakvere, Viimsi and Võru) take part in the Life LATESTadapt project. During the project nature-based solutions will be developed and tested at demonstration sites that will protect, sustainably manage, and restore natural or modified ecosystems in local governments. More specifically, the project will develop and test a set of measures that will help to prevent and respond in case of pluvial flooding, i.e., flooding generated locally by an overload of the urban drainage system by extreme rainfall. New high-potential plant communities will be composed, pluvial flood simulation model and integrated decision support system for measures will be developed and nature-based solutions will be designed. These tools and solutions will be tested in 8 urban demonstration sites of Estonian and Latvian local governments. Green infrastructure and nature-based solutions will be operationalised in local urban municipal planning by co-creation of policy and management options, adoption of nature-based solutions' maintenance rules and urban greening plans. In addition, capacity of local governments (planners, project managers and politicians) will be strengthened on developing and managing nature-based solutions and urban planning of green infrastructure. Also, awareness will be raised on adaptation to climate change effects and thriving cocreation of nature-based solutions with the local communities.²²¹

Two Estonian cities (Rakvere and Haapsalu) took part in the NOAH project, which aim was to protect the Baltic Sea from untreated wastewater spillages during flood events in urban areas. In the process of creating the NOAH concept, the methods of storm water management, spatial planning and real-time control of urban drainage systems were tested as a holistic entity in selected NOAH pilot areas. In Rakvere the stormwater systems were mapped, and water samples were taken from stormwater outflows. The Extreme Weather Layer was created for the area as a planning tool for more flood resilient urban space. This layer can be used to simulate the stormwater system's response to extreme weather events based on different climate change scenarios (current situation, RCP 4.5 and RCP 8.5). Also a movable weir with Real-Time Control was installed in the Süsta pond (section of Soolikaoja creek) to reduce flooding in the downstream city. As a result, the risk of flooding in the center of Rakvere decreases. The system has proven its expected efficiency and functionality during showers.²²²

²²¹ LIFE LATESTadapt. (2022). [www] <https://lifelatestadapt.viimsivald.ee/> (25.10.2024)

²²² Interreg Baltic Sea Region NOAH – Protecting the Baltic Sea from untreated wastewater spillages during flood events in urban areas. (2019). [www] [BSR NOAH | Protecting the Baltic Sea](#) - (25.10.2024)

In Haapsalu the existing poor-quality dam of the wetland, which is the buffer for stormwater outflow before the Baltic Sea, was replaced with a new automatic weirwall. The new system consists of a moveable gate and two sensors. The position of the weirwall is adjusted automatically based on the wetland and seawater level sensors. The system helps with flood protection by using Real-Time Control to prevent seawater backflow in case the sea level rises higher than the water level in the wetland. It also allows sufficient retention time for the urban stormwater to be purified in the wetland before releasing the water to the sea. The system has proven its operation and efficiency during storms, when the sea level was temporarily above average.²²²

Keila City's new singing square project is also a good example of using sustainable solutions that are close to nature in the construction of Keila's new singing field and to contribute to mitigating climate change and adapting to the effects of climate change. The project combines water-permeable surfaces, green roofs on buildings, collection and recirculation of rainwater as domestic water (in the toilets of the singing field, for watering) and diverse landscaping: various grasses, including areas of white clover and meadows that are mowed 1-2 times a year, and impregnation of rainwater with plants that tolerate wet conditions as a comprehensive solution in the project area or rain bed.²²³

4.4.8 Stakeholder involvement, including subnational, community-level and private sector plans, priorities, actions and programmes

The Government Office of the Republic of Estonia has published the good practice of inclusion, which is a set of recommendations for all public institutions, especially for those who prepare draft government decisions. Local governments are also welcome to base their decisions on the good practice of inclusion. To develop inclusion, the Government Office finances various inclusion projects.²²⁴

Various groups have been included in the preparation of development plans that are already in place. The involvement of stakeholders is becoming more important with every new strategy, legal document and programme that is prepared.

During the process of drafting the first Climate Resilient Economy Act the private and non-profit sector, as well as the public sector, including local governments, were mainly involved through working groups. The task of the working groups was to advise sectors on the preparation of the draft climate act. The results of the discussions of the working groups have been published on Ministry of Climate webpage and were also submitted to the Climate Council for validation.²²⁵

Opinion journey is a participatory governance initiative as well as a civic education project to better understand the challenges facing our country and sets common goals for Estonia. The opinion journey format has been developed as one of the activities within the framework of the

²²³ Close-to-nature solutions at Keila Song Festival Grounds. [www] [Esileht - Keila Lauluväljak](#) (25.10.2024)

²²⁴ Involvement and participation. [www] <https://www.riigikantselei.ee/valitsuse-too-planeerimine-ja-korraldamine/kaasamine-ja-osalemine> (25.10.2024)

²²⁵ Involvement in the creation of the Climate Resilient Economy Act. [www] <https://kliimaministeerium.ee/rohereform-kliima/kliimakindlamajanduse-seadus/kaasamine> (25.10.2024)

Estonian Open Government Partnership action plan in 2021, and it has been carried out during updating of the Estonia 2035 action plan (in 2021) and in the collection of proposals for the Climate Resilient Economy Act (in 2024).²²⁶

In the first half of 2024, employees of the Ministry of Climate visited schools all over Estonia. In total, almost 50 climate lessons were conducted, where climate change, its causes and associated effects were discussed. In addition, young people were asked what is important for them regarding climate issues and what the ministry should definitely do in the field of climate.²²⁵

Green Tiger, a multidisciplinary cooperation platform which purpose is to create, teach and implement a balanced economic model, is also helpful in improving cooperation between the state, local governments and local communities. Green Tiger's mission is to create and implement environmentally friendly practices in all sectors and develop a balanced economy. Green Tiger initiates and contributes to generating innovations inside companies and in society more broadly by involving entrepreneurs, individuals, the public sector and the civic sector. Green Tiger gathers knowledge and skills from companies and researchers and maps regulations that prevent companies, municipalities and organisations from operating in an environmentally friendly manner and offers input and suggestions for policy making.²²⁷

In 2021, with the help of Green Tiger, Estonia's first Climate Assembly for the youth of Ida-Virumaa was held. The format of the Climate Assembly, i.e. the people's assembly on environmental issues, is intended for making complex and long-term climate-related environmental decisions. The Climate Assembly is made up of participants summoned on the basis of a random sample, who form a so-called mini-public. After listening to experts and related interest groups, the Climate Assembly makes informed and considered decisions on a given topic. In 2022, a larger climate assembly was held in the City of Tartu.²²⁷

4.5 Progress on implementation of adaptation

4.5.1 Implementation of the actions identified in chapter IV.D above

Alongside with the NAS the Action Plan (NAP) on climate change adaptation was adopted by the Government of Estonia. The NAP includes specific activities and their costs for four years, presented based on the years and the responsible authorities. Examples of different activities done under the NAP can be found in section 4.3.1.

In 2022, a report on the implementation of the NAP for the period of 2017–2020 was presented to the Government of the Republic. According to the report, the most successfully implemented measures addressed increasing awareness of the general public, reducing knowledge gaps related to climate change and the uncertainties due to them, acknowledging long-term changes, and

²²⁶ Opinion journey. [www] <https://arvamusrannak.ee/et> (25.10.2024)

²²⁷ Green Tiger. [www] Rohetiiger.ee (10.10.2022).

ensuring the capacity to mitigate climate risks and increasing the strategic and operative readiness. While the initial estimate on implementation of the adaptation programme in the first period was ca 6.7 million euros (which did not take into account funding planned under other relevant strategic plans), it was identified, that actual disbursement of cross-sectoral funding reached ca 186 million euros, of which Governmental level spending earmarked to increase climate resilience of human and non-human systems (including risk prevention) reached up to 155 million euros in the period 2017–2020.¹⁶⁷

4.5.2 Steps taken to formulate, implement, publish and update national and regional programmes, strategies and measures, policy frameworks (e.g. national adaptation plans) and other relevant information

Estonia is in the process of drafting its first Climate Resilient Economy Act. The Climate Resilient Economy Act gives the Estonian people, entrepreneurs, organisations and the public sector the assurance that we can clearly and co-ordinately implement steps to slow down climate change. A Climate Council independently supervises the development of the Climate Act. The Climate Resilient Economy Act creates the prerequisites for shaping a more sustainable economic model in Estonia. The end result will give Estonian society a more clear and reliable environmental goals, which help make long-term decisions and investments.⁸¹

With the Climate Resilient Economy Act⁸¹:

- specific climate goals are set by and across sectors for the years 2030, 2035, 2040 and 2050;
- principles are agreed upon to slow down climate change or adapt to its effects;
- legal certainty is ensured for meeting climate goals, shaping the strategies of companies and organisations;
- the financial resources necessary to achieve the goals of the climate policy are brought together under unified management;
- a schedule is defined at which pace to move, giving time to adapt to the climate resilient economy act and the accompanying activities, as well as to get used to the reporting from the European Union;
- it is ensured that both the development and implementation of the act takes into consideration all parties and includes all target groups;
- the basis for a more environmentally friendly economy and a stronger competitive advantage is created.

Estonia's 2030 National Energy and Climate Plan (NECP 2030) is updated so that is in accordance with the Climate Resilient Economy Act. The NECP states that adaptation to climate change is a horizontal topic included in several sectoral development documents and development plans and in the national long-term development strategy "Estonia 2035".⁹⁴ In the NAS Estonia has described the most important problems in the field of climate change adaptation, Estonia's vulnerabilities

based on future climate scenarios, the predicted impacts of climate change until the year 2100 and possible adaptation measures in eight priority sectors.¹⁶⁶ In 2022, a report on the implementation of the NAS for the period of 2017–2020 was presented to the Government of the Republic, which provides a good overview of the achievements of the goals and performance of the development plan.¹⁶⁷

4.5.3 Implementation of adaptation actions identified in current and past adaptation communications, including efforts towards meeting adaptation needs, as appropriate

Estonia reports its adaptation communications in the national communication chapter 6.5.

4.5.4 Implementation of adaptation actions identified in the adaptation component of NDCs, as applicable

Not applicable.

4.5.5 Coordination activities and changes in regulations, policies and planning

Estonia is in the process of drafting its first Climate Resilient Economy Act as described in point 3.5.2. Under the Act a Climate Council will be established. It will act as an advisory body to the Government of the Republic on science-based climate policy. The Climate Council will be composed of experts with extensive and high-level academic expertise. The first composition of the Climate Council shall be approved by the Government of the Republic by order on the proposal of the Minister of Climate. The Climate Council is independent in performing its functions and will not take instructions from the Ministry of Climate, the Government of the Republic or any other public or private body, organisation or person. The Climate Council will monitor the implementation of climate change mitigation and adaptation objectives, their science-based nature and assesses reports on the implementation of the objectives. The Climate Council will also make proposals to the Government of the Republic for achieving climate change mitigation and adaptation objectives and the implementation of the necessary measures.⁸¹

4.6 Monitoring and evaluation of adaptation actions and processes

Climate change has already been included as a horizontal topic in several sectoral development documents, development plans and strategies, which are monitored by the responsible authorities of the documents/plans/strategies.

There is yet no comprehensive monitoring, reporting and evaluation methodology in place to systematically and periodically assess climate impacts, vulnerabilities, risks and adaptive capacity. This has been identified as an issue and a systemic solution is being sought.

In the Environmental Protection and Use Programme 2024–2027 under climate change mitigation and climate change adaptation activities the goal is to develop and implement policies, activities and measures, that support climate change mitigation and adaptation at all levels. In order to fulfill the goal, the design and implementation of climate policy should be ensured in accordance with the country's development strategies and international requirements. Also the population's awareness in the field of climate should be increased. Performance metrics include implementing the EU Emissions Trading System, number of organized information days and seminars and the share of people (%) that are aware of climate risks and have taken appropriate measures.²²⁸ The most important activities in achieving the goals include the development of the Climate Resilient Economy Act.

4.6.1 Establishment or use of domestic systems to monitor and evaluate the implementation of adaptation actions. Approaches and systems for monitoring and evaluation, including those in place or under development.

Efforts have mainly focused on monitoring and evaluating processes set by adaptation policies by looking at what is being done. These also include monitoring the use of different funds allocated to adaptation measures, different communication activities, but also involvement of stakeholders in adaptation processes. As engagement of stakeholders in policy development and planning process is likely to improve the outcomes of the process, more emphasis has been put to stakeholder involvement. Stakeholders are informative in assessing the viability of adaptation options and in ensuring that measures are appropriate and can be implemented.

In 2020 Performance-Based Budgeting (official name Activity-Based Budgeting in Estonia), was fully adopted in Estonia as an integral part of the State Reform, which aims to achieve more effective and efficient implementation of public functions, higher quality of public services, reduction of general government expenditure and staff costs, and more flexible and less bureaucratic management of the government sector. More effective governance requires the ability to use the available resources as optimally as possible, which often means the implementation of strategic goals beyond the boundaries of ministries and organizations.²²⁹

Performance area (outcome area) development plan identifies the overall long-term objective, sub-goals, performance indicators, and the policy instruments by which the goals are to be achieved. The development plan of the field is approved by the Government. Budget programs are based on the sub-goals set in the development plan of a performance area. There is a linear connection between program and performance area, whereas the performance areas are determined in the

²²⁸ Ministry of Environment. (2024). Environmental Protection and Use Programme 2024–2027. [www] <https://kliimaministeerium.ee/sites/default/files/documents/2024-02/Keskkonnakaitse%20ja%20kasutuse%20programm%202024-2027.pdf> (25.10.2024).

²²⁹ Performance Based Budgeting. [www] <https://www.fin.ee/en/public-finances-and-taxes/state-budget-and-economy/performance-based-budgeting> (02.12.2024)

National State Budget Strategy. Currently there are 24 Performance Areas set in the Budget Strategy and about 60 programs in the making.²²⁹

The program is a development document for achieving the sub-goals of the field of performance area. The program defines measures, activities and services, including their objectives, indicators, and financial plan. The program also sets management and accountability structure for managing the resources and achieving the results. The program is approved by the minister.²²⁹

4.6.2 Effectiveness and sustainability of adaptation actions

In order to ensure the sustainability of fish stocks, in 2019–2020, on the order of the MoE, the dynamics of the food spectrum of the growth period of young fish were studied in Lake Kuremaa.¹⁶⁷

In 2020, the Estonian University of Life Sciences prepared the “Study of the Impact of Climate Change on Estonian Small Lakes”, which contains recommendations for maintaining and improving the ecological condition of the studied lakes¹⁹⁶.

Raising awareness about excess rainwater and sustainable rainwater solutions was performed through the LIFE UrbanStorm project, which aimed to develop sustainable urban rainwater systems that are resistant to climate change. The goal of the project was to increase the capacity of Estonian municipalities in adapting to climate change, especially in mitigating floods caused by torrential rains, thereby increasing the capacity of municipal water management specialists and engineers in local governments. In the course of the project, climate change adaptation strategies and action plans for Tallinn and Viimsi were prepared.²²⁰ Reusing water is seen as a perspective of the future, and in the coming years there are plans to study reusing water and to develop a corresponding regulation in Estonia.

LIFE-SIP AdaptEST integrated project’s “Implementation of national climate change adaptation activities in Estonia” main objective is to increase the resilience of different ecosystems in a changing climate, to improve society's readiness to adapt to climate change and to ensure a positive socio-economic impact through the sustainable use of resources, using a number of good practices, demonstration and pilot projects and capacity building measures. During the project they will among other things support the bioeconomy sectors that are important for Estonia from the point of view of sustainability: forestry, water and fisheries are planned in a climate-conscious manner. They will also prepare authorities and citizens to deal with the threats and opportunities associated with climate change.²²¹

4.7 Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

4.7.1 Observed and potential climate change impacts, including those related to extreme weather events and slow onset events, drawing upon the best available science

Extreme weather conditions likely to take place in the future include heavy storms and rain (increasing the probability of floods and landslides), heat waves, drought, forest fires. These events influence human health and welfare, infrastructure, functioning of ecosystems etc.¹⁶⁶

Estonia is in the 83rd position among all countries in the world in the Global Climate Risk Index. This index takes into account extreme weather events (e.g. storms, floods, heat waves) but not slow changes (e.g. sea level rise, melting of glaciers, acidification). The ranking is based on the number of deaths and the amount of economic damage, and the countries that rank higher are the most affected by extreme weather events.²³⁰ In past years, Estonia has increased its position in the Global Climate Risk Index^{231,232,230}, i.e. Estonia's situation has worsened based on this index, taking into account the consequences of the occurrence of more extreme weather events.

4.7.2 Activities related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change

Better preparations for changes related to climate change help mitigate and avoid loss and damage associated to climate change. Nature-based solutions are becoming more popular in dealing with climate change and its effects. Nature-based solutions increase biodiversity and landscape value while improving ecosystem services such as anti-erosion protection, forest fire, drought and flood prevention, carbon sequestration and cooling.

4.7.3 Institutional arrangements to facilitate the implementation of the activities referred to in paragraph 115(b) above.

The Estonian authorities have directed European Economic Area (EEA) grants for the preparation of local governments' climate and energy plans.

Several measures were supported in Estonia from the EEA and Norway Grants Estonia (from the Norwegian Financial Mechanisms) support program "Mitigation and adaptation to climate change, 2014–2021" (implementation period was until April 2024). The purpose of the program was to help mitigate climate change and reduce susceptibility to climate change in Estonia. The program was implemented through projects funded under four open application rounds and one small

²³⁰ Eckstein, D., Künzel, V., Schäfer, L. (2021). Global Climate Risk Index 2021. Who suffers most from extreme weather events? Weather-related loss events in 2019 and 2000-2019. Briefing Paper. Germanwatch e.V.

²³¹ Eckstein, D., Hutfils, M-L., Wings M. (2019). Global Climate Risk Index 2019. Who suffers most from extreme weather events? Weather-related loss events in 2017 and 2000-2017. Briefing Paper. Germanwatch e.V.

²³² Eckstein, D., Künzel, V., Schäfer, L., Wings M. (2020). Global Climate Risk Index 2020. Who suffers most from extreme weather events? Weather-related loss events in 2018 and 2000-2018. Briefing Paper. Germanwatch e.V.

project grant scheme. The preparation of climate and energy plans at the local level was supported within the support scheme for small projects. As part of the open application rounds, support was provided for helping to control non-native species, marine environment activities, preparation of a complete circular economy package, improving awareness of climate change and the circular economy.^{233,234,235}

The State Shared Service Centre supports the measure “Empowerment of local governments in making green investments”. The purpose of the support is to empower local governments in higher-quality preparation and faster processing of plans, design conditions, construction and use permits in the wind energy sector, which are necessary for the operation of onshore or offshore wind farms. The strategic goal is to significantly speed up the construction of wind farms, so that by 2030 it would be possible to produce 100% of all electricity consumption in Estonia from renewable energy sources. In order for local governments to be able to make faster and more meaningful decisions when planning wind energy, it is necessary to provide them with the financial means to hire competent specialists or to purchase the service.²³⁶

4.8 Cooperation, good practices, experience and lessons learned

4.8.1 Efforts to share information, good practices, experience and lessons learned, including as they relate to

In 2023 the municipal green reform network was launched. The network will support activities of municipalities in achieving the goals of the green reform. The Ministry of Climate will explain, mediate, nationally coordinate and enhance cooperation on the green reform and climate issues. The municipalities will contribute to the implementation of the green reform action plan at the local level to local opportunities and priorities. They will also contribute in cooperation with other local municipalities in submitting proposals and views to the steering committee of the green reform to take into account the needs of municipalities.²¹⁷

In the spring of 2023, the Environmental Investment Centre and the Association of Estonian Cities and Municipalities created a knowledge network for municipalities. The network is called R-Club and focuses on environmental and climate issues to link the green turnaround to the day-to-day management of local governments and their investments. It is seen by the Estonian authorities as a local alternative to the Covenant of Mayors. The aim of the club is to be a development engine and a platform for joint projects in maintaining the living environment, and also to offer development models for managing the green revolution.²¹⁸

²³³ Support measures. [www] <https://kliimaministeerium.ee/euroopa-majanduspiirkonna-toetused-2014-2021#vaikeprojektide-taot> (25.10.2024)

²³⁴ Climate change adaption activities. [www] <https://kik.ee/et/toetavad-tegevused/kliimamuutustega-kohanemise-tegevused> (02.12.2024)

²³⁵ Increasing the resilience of ecosystems. [www] <https://www.kik.ee/et/toetatavad-tegevused/okosusteemide-vastupanuvoime-suurendamine> (02.12.2024)

²³⁶ Empowerment of local governments in making green investments. [www] [Meede: Kohalike omavalitsuste võimestamine roheliste investeringute tegemisel | Riigi Tugiteenuste keskus](https://www.kik.ee/et/toetatavad-tegevused/okosusteemide-vastupanuvoime-suurendamine) (02.12.2024)

4.8.1.1 Helping developing countries to identify effective adaptation practices, needs, priorities, and challenges and gaps in a way that is consistent with encouraging good practices;

In terms of international climate cooperation, in the period of 2015–2020, Estonia contributed 1 million euros annually to climate-change-related activities in developing countries on a voluntary basis, contributing in a cross-border fashion to mitigating climate change and adapting to its effects within the framework of development cooperation, involving Estonia’s best know-how. From 2018, Estonian companies and NGOs started to transfer climate-related technologies and knowledge to developing countries. The sub-institution of the MoE involved is the EIC, which supports various activities within the framework of the state budget strategy measure ‘Estonia’s contribution to international climate cooperation’ and the related regulation of the MoE, the purpose of which is to transfer solutions, knowledge, services and products developed in Estonia to developing countries that would help achieve climate goals. As part of the measure developed for this purpose, three open application rounds have been conducted. Projects have been started in different countries (Bangladesh, South Africa, Costa Rica, Kenya) and cooperation with international organisations (UNEP) is underway. Contributions to various international climate funds will also continue. From 2021, the allocation of funding for activities related to climate change will take place in pace with the planning of the state budget strategy. The allocation of support has currently been increased to 1.5 million euros per year.¹⁶⁷ See also chapter 5 of this BTR.

4.8.2 Strengthening scientific research and knowledge related to:

4.8.2.1 Climate, including research and systematic observation and early warning systems, to inform climate services and decision-making

The general alert system EE-ALARM allows sending a text message to the phones of people in a danger area in the event of a threat to their life, health or national security, or other major dangerous events (e.g. major fires, mass riots, large-scale natural disasters).²³⁷

ILM+ is an application to warn the public about extreme weather events. It has been operational since 2021. The response at national level is the responsibility of the Estonian Environment Agency (ESTE), which transmits the warnings to the Rescue Board and other authorities who decide on further action. ESTEA transmits hydrological monitoring data to EFAS system. In the framework of the LIFE-SIP Adapt project, the Estonian authorities plan to update the fire risk map application and to use it for operational work of the National Weather Service. In addition, the project aims at updating the whole warning system.²³⁸

In 2014–2022, the ESTEA carried out the project “Development of the monitoring of meteorological and hydrological indicators for evaluating or forecasting climate change” (SEME

²³⁷ Threat alert. [www] <https://kriis.ee/kriisideks-valmistumine-estis/kriisideks-valmistumine-estis/ohuteavitus> (25.10.2024)

²³⁸ The national weather app ILM+. [www] <https://www.keskkonnaagentuur.ee/ilmpluss> (02.12.2024)

and SEME2). Within the framework of the projects, hydrometeorological stations were improved and the necessary infrastructures were developed. In addition, the calibration laboratory of meteorological and hydrological sensors was renewed, and a new automatic radiosonde station was purchased for observations and research in the troposphere and higher atmospheres.^{239,240}

Another project carried out by the ESTEA in partnership with the University of Tartu Landscape Biodiversity Group in 2014–2020 was the “National Assessment and Mapping of Ecosystems and Ecosystem Services (ELME)”, which included the topic area of ecosystem services, the application of new monitoring methods in the monitoring of biodiversity and developing the work tools to assess the socio-economic status of biodiversity and climate-change-related conditions, and to forecast and ensure the availability of data.²⁴¹

The Air Quality and Climate Department of the Estonian Environmental Research Centre (EERC) is responsible for air quality monitoring in Estonia pursuant with European Directives and international conventions. The EERC is carrying out national ambient air quality monitoring in cities and rural areas. The regular monitoring network includes one street station, two urban background stations, three urban-industrial stations and four rural stations, one of them in cooperation with Institute of Physics at the University of Tartu. Since 2016, the network includes five stations for allergenic pollen monitoring. An important task is the development and management of the Estonian Air Quality and Climate System. The system combines the continuous air quality monitoring (data collection from national monitoring stations and from industrial monitoring stations), air pollution modelling, emission databases, calculation of the air quality index and other data related to air. In addition to the ESTEA and the EERC, the Tartu Observatory of the University of Tartu, the Estonian Marine Institute and Institute of Physics of the University of Tartu and the Estonian Agricultural Research Centre also engaged in environmental monitoring.

In 2024 a project started, during which monitoring, forecasting and warning systems for water level and sudden rainfall will be created to prevent and mitigate the risk of flooding, which in the long run will help increase resilience to climate change. The project includes research on the selection of the best preventive measures in risk areas and information activities to prevent the risk of flooding. The expected duration of the project is six years and the cost is 10 million euros, of which 70% is a grant from the European Regional Development Fund and 30% is state co-financed.²⁴²

Estonia is a member of MeteoAlarm, which is an Early Warning Dissemination System that visualises, aggregates, and accessibly provides awareness information from 38 European National

²³⁹ Development of the monitoring of meteorological and hydrological indicators for evaluating or forecasting climate change (SEME). [www] <https://keskkonnaagentuur.ee/meteoroloogiliste-ja-hydrooloogiliste-naitajate-seire-arendamine-kliimamuutuste-hindamiseks-voi> (02.12.2024)

²⁴⁰ Development of the monitoring of meteorological and hydrological indicators for evaluating or forecasting climate change (SEME2). [www] <https://keskkonnaagentuur.ee/meteoroloogiliste-ja-hydrooloogiliste-naitajate-seire-arendamine-kliimamuutuste-hindamiseks-voi-0> (02.12.2024)

²⁴¹ University of Tartu. (2022). National Assessment and Mapping of Ecosystems and Ecosystem Services (ELME). [www] <https://landscape.ut.ee/the-final-report-of-elme-project-is-now-published/?lang=en> (02.12.2024)

²⁴² Flood hazard prevention and mitigation systems. [www] [Keskkonnaagentuur alustab projektiga „Ülejuutusohu ennetamine ja levendamine, hoiatussüsteemid“](https://keskkonnaagentuur.ee/ulejutusohu-ennetamine-ja-levendamine-hoiatussisteemid) | Keskkonnaagentuur (25.10.2024)

Meteorological and Hydrological Services. MeteoAlarm aggregates and accessibly provides warnings from the MeteoAlarm Members through the MeteoAlarm Feeds, facilitating the dissemination of awareness information through both national and international redistributors, further empowering individuals to take early action. MeteoAlarm has been developed for EUMETNET, the European Network of National Meteorological Services. MeteoAlarm is purposefully designed to consistently visualise awareness information from the MeteoAlarm Members, following an easily understandable colour code of yellow, orange, and red, to ensure coherent interpretation throughout Europe.²⁴³

Estonia is also a member of the Early Warnings for All initiative, which aims to ensure universal protection from hazardous hydrometeorological, climatological and related environmental events through life-saving multi-hazard early warning systems, anticipatory action and resilience efforts by the end of 2027. Through coordination and collaboration, the initiative aims to build on and scale up existing efforts and capacities, promoting synergies among initiatives and partnerships across sectors to protect lives and livelihoods from natural hazards such as floods, heatwaves, storms and tsunamis. The use of mobile phones to communicate alerts is also linked to this initiative. The Early Warnings for All initiative is built on four pillars to support countries in building and operating effective and inclusive multi-hazard early warning systems: disaster risk knowledge; detection, observation, monitoring, analysis, and forecasting, warning dissemination and communication; preparedness and response capabilities.²⁴⁴

In Europe, there is also the European Flood Awareness System, to which Estonian Environment Agency transmits hydrological monitoring data and receives warnings from.²⁴⁵

4.8.2.2 Vulnerability and adaptation;

In 2019, the report Forest and Climate Change was prepared to ensure the productivity, vitality and diversity of forests. The work is based on existing and available scientific research, and it describes the role of Estonian forests in mitigating climate change (including energy and carbon storage) and adapting to it, keeping in mind European and global climate change policies.¹⁹⁵ In 2019–2020, the EULS conducted a study on the nature and need of genetic reserve forests in Estonia. The paper outlines from which tree species it is possible to create a gene reserve forest, the number of areas and what size is optimal for Estonian conditions, and how to manage them.¹⁶⁷

In order to ensure the sustainability of fish stocks, in 2019–2020, on the order of the MoE, the dynamics of the food spectrum of the growth period of young fish were studied in Lake Kuremaa. In 2020, the Estonian University of Life Sciences prepared the “Study of the Impact of Climate Change on Estonian Small Lakes”, which contains recommendations for maintaining and improving the ecological condition of the studied lakes.¹⁹⁶ The European Maritime and Fisheries Fund financed the projects carried out on behalf of the MoE in 2018–2020²⁴⁶:

²⁴³ Meteoalarm. [www] <https://www.meteoalarm.org/en/live/page/about-meteoalarm#list> (25.10.2024)

²⁴⁴ Early Warnings for All. [www] <https://earlywarningsforall.org/site/early-warnings-all> (02.12.2024)

²⁴⁵ European Flood Awareness System. [www] [Home | Copernicus EMS - European Flood Awareness System](https://www.eufas.eu/) (02.12.2024)

²⁴⁶ Marine environment studies. [www] [Merekeskkonna uuringud | Kliimaministeerium](https://www.merekeskkonna.uuringud.ee/) (02.12.2024)

- 1) 'Preparation of regional aquaculture plans to manage possible environmental pressure', within the framework regional aquaculture plans were prepared for the Estonian coastal sea, containing recommendations based on the regional specificities of aquaculture species and forms and limitations, taking into account the possibilities of improving the state of the marine environment;
- 2) 'Adjustment of the fishing load to meet the conditions of a good environmental condition', the purpose was to reduce the impact of pressure resulting from fishing on commercially used fish populations in Estonian sea areas;
- 3) 'Modernization of regional fishing restrictions and limit sizes of fish', the purpose was to reduce the pressure from fishing and the impact of the impact of fishing on commercially used fish populations in Estonian marine areas.

In 2020, the Minister of the Environment's directive approved the National Action Plan on Invasive Alien Species 2020–2025¹⁹¹, and in 2021, the ESTEA prepared a monitoring plan for alien species of EU-level importance to improve the monitoring of invasive alien species. In addition, as part of the coastal sea monitoring of the national environmental monitoring programme, already known alien species are monitored in the sea, and the presence of alien species is monitored at regular monitoring stations. In order to control the introduction of alien species in ballast water, studies were carried out in the water areas of major ports with the funding of the Environmental Investment Center (EIC).

4.9 Any other information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

Not applicable

5 Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

5.1 National circumstances and institutional arrangements

Estonia is not among the countries listed in Annex II of the United Nations Framework Convention on Climate Change (UNFCCC) and is therefore not obliged to fulfill the commitments arising from Articles 4.3, 4.4, and 4.5 of the Convention. Nevertheless, Estonia has voluntarily contributed to climate finance. The Estonian government is committed to combating global climate change, placing particular importance on assisting countries that are most vulnerable to its impacts, including least developed countries and small island developing states.

Estonia recognizes that the financial needs for achieving climate policy objectives are among the many critical factors requiring continuous attention. Investments in programs and policies aimed at reducing greenhouse gas emissions and enhancing resilience to climate change must be supported through both public and private sector funding.

Estonia has decided to focus its climate action financing on the needs of developing countries and aims to continue with this approach in the future. Estonia's goal is to support all activities related to mitigation and adaptation to climate impacts in developing countries, such as fostering the development of renewable energy sources, implementing energy and resource efficiency projects in the transport and industrial sectors, enhancing administrative capacity for climate action, and supporting solutions for climate adaptation.

Climate-related measures aimed at achieving various climate change-related goals are part of the Estonia's national budget strategy, based on national objectives and the goals outlined in sectoral development plans. The Ministry of Climate is responsible for the identification, tracking and reporting on the provision (i.e., public climate finance) and mobilization of (private) climate finance mobilized through public interventions. The recipient countries are put in place in cooperation with the Ministry of Foreign Affairs.

During the period of 2021–2022, Estonia committed EUR 3 million from the revenues of the auctioning of EU ETS allowances for financing international climate cooperation by supporting the environmentally sustainable development of partner countries, through contributing to bilateral and multilateral projects both in mitigation and adaptation actions. Disbursed climate-specific amount in this period was EUR 4,3 million (see [Table 5.1](#) and [Table 5.2](#)). Some bilateral and multilateral finance also came from the Ministry of Foreign Affairs side.

In 2019 the Ministry of Environment adopted a regulation (Terms and conditions of and procedure for providing support for achieving climate policy goals in developing countries)²⁴⁷ aiming to support developing countries' cooperation and stipulating specific conditions and procedures for international climate cooperation through bilateral and multilateral projects. Until 2023 Estonia committed 1,5 million euros worth of support per year. According to State Budget Strategy²⁴⁸, Estonia increased the support to 1.7 million euros in 2024 and plans to further raise the support by 7% until at least 2028 compared to current levels.

In Estonia, the responsibility for conducting, monitoring, and managing annual application rounds for climate cooperation projects with developing countries has been delegated by contract to the Environmental Investment Centre (EIC)²⁴⁹. EIC is also responsible for managing the use of most financial resources, both international and domestic, for environmental projects implemented in Estonia.

In 2021-2022 two open project calls were held to support climate cooperation projects in developing countries under the regulation mentioned previously. 14 projects were financed in total amount of EUR 2,9 million. During this period Estonia supported climate action in the following countries: Georgia, Kenya, Rwanda, Namibia, Azerbaijan, Tanzania, Ukraine and Kazakhstan. Of the total bilateral climate finance provided during the period 2021–2022 EUR 392 564 was marked for mitigation, EUR 388 042 for adaptation, and EUR 2 106 685 as cross-cutting.

Through the open calls for proposals Estonia also mobilizes private finance. The aim of the aid is to give advice, transfer Estonian know-how and technology for adaptation and mitigation measures in developing countries and the aid is provided mostly by Estonian business, non-profit organizations, universities and other (self-sufficient) organizations. The support by the government is up to 90% of eligible costs and minimum self-financing for each project is 10%. The evaluation criteria in the open call are built in a way that the more self-financing provided, the more points the applicant receives. In this way Estonia is seeking to mobilize private finance and plans to do so in the future.

According to the regulation aiming to support developing country cooperation and stipulating specific conditions and procedures for international climate cooperation, international cooperation can also provide support to international climate funds, under a framework agreement or otherwise. During 2021-2022 EUR 1,87 million was committed to support UNEP DEAL, Montreal protocol multilateral fund, IPBES, Intergovernmental Panel on Climate Change, LDC fund, UNFCCC Trust Fund for Supplementary Activities and Estonian Rescue Association who helped firefighters

²⁴⁷ Terms and conditions of and procedure for providing support for achieving climate policy goals in developing countries. (2019). RT I, 12.09.2023, 9. [www] [Areguriikides kliimapoliitika eesmärkide saavutamiseks toetuse andmise tingimused ja kord–Riigi Teataja](#) (20.12.2024).

²⁴⁸ Ministry of Finance. State Budget Strategy 2025-2028. [www] https://www.fin.ee/sites/default/files/documents/2024-12/Riigi%20eelarvestrateegia%202025-2028_eng.pdf (20.12.2024)

²⁴⁹ Environmental Investment Centre (2024). Climate policy objectives for developing countries. [www] <https://kik.ee/et/toetatavad-tegevused/arenguriikide-kliimapoliitika-eesmargid> (20.12.2024)

in Ukraine. Most of the money for these activities in this period came from EU ETS allowances from the period 2013-2020.

Most of the multilateral and bilateral climate-related financial support provided to developing country Parties during the period of 2021–2022 was channeled through the Official Development Assistance (ODA) in accordance with the OECD DAC methodology. Estonia gathers all provided ODA and some membership fees provided as other official flows (OOF) in an Estonian Development Co-operation Database (AKTA)²⁵⁰. All information on disbursed and committed climate finance, also reported under ministries and organisations other than Ministry of Climate, through public interventions is gathered in the same database.

Description of challenges and limitations

Most of Estonia’s climate related finance is provided by the Ministry of Climate and the finance comes from EU ETS revenues. The use of EU ETS revenues is planned as part of the State Budget Strategy for the upcoming four years but confirmed annually at the end of the year for the upcoming year. The strategy can change in case there are changes on the political level or the climate-related or overall priorities of the country change.

On technical level, there is room for improvement on assessing the real impact of the projects (especially regarding the CO₂ emissions and how the project helps to achieve local goals) and if the support ends up in the hands that it is meant to end up in or is it misused. Misuse of the support provided in open calls for projects is usually eliminated by the selection of recipient countries where the countries with very unstable political situations are not supported. The selection of these countries is done by the Ministry of Foreign Affairs. Still there have been doubts regarding some projects that the provided support has been misused.

5.2 Underlying assumptions, definitions and methodologies

Description of the underlying assumptions, methodologies and definitions

Annex III Tables III.1, III.2 and III.3 of the 1st Biennial Transparency Report cover bilateral and multilateral climate financing provided in the calendar years 2021 and 2022. All figures are in Euros and US-Dollars. The conversion is based on OECD reference exchange rates for 2021 and 2022.

2021: 1 USD = 0,85 EUR

2022: 1 USD = 0,95 EUR

The OECD and the UNFCCC allow for reporting Parties to calculate climate finance according to their own methods aligned with the methodologies laid out by the OECD and the UNFCCC. Reporting is done on a project-by-project basis not country-by-country.

²⁵⁰ Estonian Development Co-operation Database (2024). [www] <https://akta.mfa.ee/andmed.php> (20.12.2024)

Estonia reports climate finance status as follows:

- for public climate finance: disbursed (amount provided per year) or committed if the commitment is made but disbursements have not yet been made;
- for mobilized private climate finance: committed (the value is reported in the year the commitments were made).

In reports submitted by Estonia, public finance is finance provided by the Estonian Government from the budgets of the Ministry of Climate and the Ministry of Foreign Affairs. Mobilized private finance reported by Estonia, is in line with the OECD definitions and consists of that proportion of finance from private sources mobilized by mostly bilateral interventions in support of activities in developing countries which can be attributed to Estonia.

Most of the multilateral and bilateral climate-related financial support provided to developing country Parties during the period of 2021–2022 was channeled through the Official Development Assistance (ODA) in accordance with the OECD DAC methodology. Some of Estonia's multilateral finance is also reported as Other Official Flows (mostly membership fees).

In Estonia all climate-related finance is disbursed as grants. Estonia uses Rio markers developed for the OECD Development Assistance Committee's Creditor Reporting System (OECD DAC CRS) to track adaptation, mitigation or cross-cutting related finance based on the data provided in the CRS. The sector classification is performed based on the OECD DAC. The applicants of the open call for proposals must determine whether the project would be mitigation, adaptation or cross-cutting according to the Rio Markers. For multilateral finance it is the reporter who allocates the marker to the project. If several (sub-)sectors apply, Estonia's current practice is to report up to a maximum of two (sub-)sectors.

Capacity building and technology development and transfer are naturally occurring elements in most bilateral projects as both are the objectives of the open calls. In case a project is considerably leaning towards technology or capacity-building, only one of these two is marked. The decision whether the project is contributing towards technology or capacity-building, or both is made by a reporter and based on the nature of the project.

Risks for double counting climate finance provided by Estonia are quite low, as the provided finance comes from single sources. Estonia also only reports public climate finance on the basis of inflows to eliminate the risk of double counting with support provided by other countries. When it comes to private finance mobilized, Annex III Table III.3 (Information on financial support mobilized through public interventions) includes a column to report on the "amount mobilized" (private finance) as well as on the "amount of resources used to mobilize the support" (public finance). As the latter is also included in Annex III Table III.1, a corresponding comment is included in the column "additional information". Estonia does not contribute climate finance that could collide with finance related to Art. 6 of the Paris Agreement.

For attribution of mobilized private finance from public interventions, Estonia is using co-financing. Co-financing helps to mitigate risks for private investors in developing countries, encouraging them to engage more with markets and sectors that need their investment the most. Private finance was mobilized only through open calls for projects where the financial instruments used are standard grants. The reporting is based on the OECD DAC methodology on calculating private finance mobilization to determine the private finance mobilized by public interventions funded by the Ministry of Climate or the Ministry of Foreign Affairs.

The needs and priorities of recipient countries for support provided and mobilized through public interventions is ensured in the open calls for projects by the obligation set for the applicants. The applicant must demonstrate that there is a need for this specific action in the recipient country and that a partnership with a representative of the target country is established. In this light, the applicants often submit recipient countries' NDCs or other country-driven strategies or bring connections between those and the actions set in their application. The need for multilateral and bilateral climate finance to align with Paris Agreement long-term goals is set in the regulation "Terms and conditions of and procedure for providing support for achieving climate policy goals in developing countries"²⁴⁷ and is written out as "The provision of support is based on the needs of the target countries, international climate agreements, and other relevant international strategic documents and climate studies addressing climate issues."

Estonia's support for climate action in developing countries is financed from the budgets of the Ministry of Climate and the Ministry for Foreign Affairs. Estonia has State Budget Strategy, which is annually renewed for the next four years and a certain year's budget is approved by Parliament annually, providing new and additional resources to the budgets approved in previous years, whereby formally the financial support to developing countries for climate action provided from this budget each year is considered new and additional. Estonia defines new and additional climate finance as having been newly committed or disbursed (as applicable) in the respective reporting year. In its climate finance reporting, Estonia provides information only on resources newly committed or disbursed. Thus, all climate finance reported is new and additional and reflects only data for the reporting year in question.

Although Estonia is not obliged to contribute to developing countries climate finance, it recognizes the Art. 9.3 of the Paris Agreement, the reference to global effort and that developed countries should continue to take the lead in mobilizing climate finance from a wide variety of sources, instruments and channels, noting the significant role of public funds. Estonia has been providing support since 2015 and plans to continue doing it while also raising the public funds.

Information on reporting on multilateral finance

According to the regulation aiming to support developing country cooperation and stipulating specific conditions and procedures for international climate cooperation, international cooperation can also provide support to international climate funds, under a framework agreement or otherwise. Estonia supports different global programmes managed by multilateral organisations, including, among others, the UNCCD, UNEP, FAO, and IFAD. Estonia has also provided support to the

operating entities of the financial mechanism of UNFCCC, and the most recent announcement was made at COP28, where Estonia announced a voluntary contribution of EUR 1 million to the Green Climate Fund.²⁵¹

Estonia calculates the climate-specific part of its multilateral support according to the OECD Imputed Multilateral Shares for determining climate-specific part of the core support. Unfortunately, this can be done only for some of the organisations like Multilateral Fund for the Implementation of the Montreal Protocol and Least Developed Countries Fund. For other contributions where the OECD percentages are not available (e.g World Meteorological Organisation contribution, UN Convention to Combat Desertification), Estonia has reported the support only as core.

Multilateral finance has been reported as core, with, indeed, the understanding that the actual climate finance amount it would transfer into depends on the programming choices of the multilateral institutions. Like other Parties, Estonia holds discussions with different organisations and institutions, encouraging them to further enhance the synergies between finance for climate, biodiversity and sustainable land management agendas.

²⁵¹ Green Climate Fund. [www] [Countries | Green Climate Fund](#) (20.12.2024)

Table 5.1 Public finance support provided in 2021

Channels	2021							
	Core total		Climate-specific					
			Mitigation		Adaptation		Cross-cutting	
	EUR	USD	EUR	USD	EUR	USD	EUR	USD
Total public finance provided through multilateral channels	117,281.24	137,977.92	133,000.00	156,470.58	-	-	239,186.05	281,395.35
Multilateral funds	-	-	133,000.00	156,470.58	-	-	-	-
Multilateral finance institutions, development banks	-	-	-	-	-	-	-	-
Specific UNFCCC institutions	99,011.86	116,484.54	-	-	-	-	197,429.05	232,269.47
Other	18,269.38	21,493.38	-	-	-	-	41,757.00	49,125.88*
Total public finance provided through bilateral, regional and other channels	2,887,291.00	3,039,253.68	144,207.00	151,796.84	238,388.00	250,934.73	793,836.00	835,616.84
Total climate-specific			EUR 1,548,617.05 / USD 1,821,902.41					

*IPBES, IUCN, CITES

Table 5.2 Public finance support provided in 2022

Channels	2022							
	Total		Climate-specific					
			Mitigation		Adaptation		Cross-cutting	
	EUR	USD	EUR	USD	EUR	USD	EUR	USD
Total public finance provided through multilateral channels	104,631.35	110,138.26	88,795.00	93,468.42	-	-	1,013,840.00	1,067,199.99
Multilateral funds	-	-	88,795.00	93,468.42	-	-	1,000,000.00	1,052,631.57
Multilateral finance institutions, development banks	-	-	-	-	-	-	-	-
Specific UNFCCC institutions	87,482.68	92,087.03	-	-	-	-	-	-
Other	17,148.67	18,051.23	-	-	-	-	13,840.00	14,568.42*
Total public finance provided through bilateral, regional and other channels	1,710,860.00	1,800,905.00	248,357.00	261,428.42	149,654.00	157 530,52	1 312 849,00	1,381,946.31
Total climate-specific			EUR 2,813,495 / USD 2,961,573.66					

* *IPBES, IUCN, CITES*

Description of the underlying assumptions, definitions and methodologies used to provide information on technology development and transfer and capacity-building support

Technology transfer and/or capacity-building is a vital component of every bilateral project in climate-finance provided by Estonia. Contributions to technology transfer are made, for example, through climate action financing projects with a technological dimension.

Within the framework of annual open calls for proposals, support is considered for activities such as renewable energy production, energy saving, energy storage, and waste management technologies, as well as capacity-building and strengthening in line with Article 11 of the Paris Agreement. This includes implementing adaptation and mitigation actions, facilitating technology development, dissemination, and adoption, improving access to climate financing, and promoting education, training, and public awareness on relevant aspects.

Thus, capacity-building, technology development, and technology transfer are integral components of bilateral projects. Information regarding if the project contributes to capacity building or technology transfer is added while reporting and applicants are not obliged to identify this in their application.

5.3 Information on support for technology development and transfer provided under Article 10 of the Paris Agreement

Technology development and transfer is one of the main objectives while giving bilateral support through open calls for proposals under regulation “Terms and conditions of and procedure for providing support for achieving climate policy goals in developing countries²⁴⁷. Under the open call for applications, support is provided for the transfer of solutions, knowledge, services, and products developed in Estonia or abroad but enhanced with added value in Estonia to developing countries.

Support provided can be ready-to-use of type of technology (equipment) or knowledge of how to use or build any type of technology such as models, software and methodology. The open call for proposals has been built in a way that applicants need to make sure of the real needs and circumstances of the recipient country, the technology is developed and transferred in a way that it matches with local expectations. The cooperation between Estonia and recipient country happens through governmental institutions and private sector and the applicant needs to prove the cooperation by adding a signed contract to the application.

As mentioned above, Estonia mobilizes private sector funding through open calls for proposals. Encouraging the private sector to increase their support is set with evaluation criteria, where bigger self-financing amount receives more points. This approach helps to amplify public sector support.

Below in **Table 5.3** are some specific examples of provided bilateral technology support from 2021 and 2022.

Table 5.3 Examples of projects related to technology development and transfer

Program name: Applying anaerobic technology in wastewater treatment to reduce the impact of methane generation			
Recipient country: Rwanda	Sector: Waste management	Total amount of support: 212,680.00 EUR	Period: 2022–2025
Objective and description: The goal of the project is to develop and construct a nature-based wastewater treatment system with a biogas collection system in Nyamata town, Rwanda, ensuring minimal maintenance and operational costs. The biogas generated will be utilized for cooking purposes. The project significantly contributes to climate change mitigation and the improvement of the local living environment.			
Technology transferred: The core stage of the technology is anaerobic wastewater treatment.			

Program name: A carbon negative construction material - potential implementation in Africa			
Recipient country: Kenya	Sector: Construction	Total amount of support: 199,864.64 EUR	Period: 2021–2023
Objective and description: Researchers in Estonia have developed a high-quality construction material made from peat and oil shale ash. In the project, an analogous material will be developed for construction in developing countries in collaboration with an African partner, using local waste as raw material. The technology enables the rapid and cost-effective construction of affordable buildings with excellent microclimatic conditions, while maintaining a negative environmental footprint (unlike conventional construction, which accounts for 40% of global human-made CO ₂ emissions).			
Technology transferred: Developing a mobile device (on a trailer) for composite material production and deployment directly on-site.			

Program name: Hydrogen-powered back-up generator for developing countries			
Recipient country: Namibia	Sector: Energy	Total amount of support: 187,935.00 EUR	Period: 2021–2024

Objective and description: As part of the project, two hydrogen-powered emission-free UP2.5K generators will be developed and produced and installed at Mushi Bio Power facilities in Namibia. The aim of the project is to transfer green technology to developing countries and enhance the reliability of electricity production.
Technology transferred: UP® generators (UP2.5K)

Estonia also supports technology development and transfer through providing multilateral finance. Some examples of institutions providing support to technology transfer and development are Montreal Protocol Multilateral Fund and Least Developed Countries Fund.

5.4 Information on capacity-building support provided under Article 11 of the Paris Agreement

Similarly to technology development and transfer, capacity-building is one of the objectives of Estonia’s bilateral climate finance as the regulation “Terms and conditions of and procedure for providing support for achieving climate policy goals in developing countries”²⁴⁷ sets that support is provided for transfer of solutions and knowledge. As mentioned above, applicants for the open calls for projects need to prove that their planned actions in developing countries are aligned with the existing and emerging capacity-building needs, priorities and gaps in recipient country. The proof is often submitted as a takeout of developing country’s strategy documents or development plans and the co-operation proof with recipient country’s stakeholder needs to be a signed contract.

Capacity-building actions supported by Estonia have included a lot of educational environment programs in local schools in Africa and educating governments and businesses on energy systems. In recent years, transferring capacity-building elements has become more popular than transferring ready-to-use technology or developing it on-site. See in **Table 5.4** s specific example of provided bilateral support from 2021 and 2022.

Table 5.4 Example of a project related to capacity-building

Program name: Balancing the power system and facilitating the integration of renewable energy into the Kenyan power system			
Recipient country: Kenya	Sector: Energy	Total amount of support: 102,194.63 EUR	Period: 2021–2022
Objective and description: Kenya's energy system is less efficient and less digitalized compared to the EU. More energy is used to supply electricity to fewer customers. At the same time, Kenya is experiencing rapid growth in solar power plant capacity. The project			

will demonstrate a consumption management solution, proven effective in Europe, in Kenya by aggregating four pilot users.

Capacity-building element: The result will be four clients integrated into the Fusebox energy consumption management system. Additionally, energy consumption management will be incorporated into the energy system of the partnering transmission grid company.

Consumption management provides a positive socio-economic impact for Kenyan society by reducing grid service costs. Furthermore, consumers can generate income and achieve savings by participating in the balancing of the electrical system.

6 Improvements in reporting

The current report is Estonia's first BTR under the Paris Agreement's enhanced transparency system and a review has yet to take place. The recommendations from the last review reports of the last biennial report and the National Communication have been taken into account, where relevant. Estonia is consistently working on enhancing the quality of its reporting and plans to further improve its reporting in subsequent BTRs according to the recommendations done by the technical expert review team.

7 ANNEXES

Biennial Transparency Report consist of the report in hand together with the information submitted in tabular format in CRTs and CTF tables and therefore the following annexes are available as separate submissions on the [UNFCCC website](#):

- Common reporting tables for GHG emissions and removals
- Common tabular formats for information necessary to track progress
- Common tabular formats for information on support provided and mobilised

The National Inventory document is submitted as a stand-alone document.

Annex 1 Common tabular formats on information necessary to track progress

Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates^a

	<i>Description</i>
Target(s) and description, including target type(s), as applicable ^{b c}	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term 'domestic' means without the use of international credits. Target type: Economy-wide absolute emission reduction.
Target year(s) or period(s), and whether they are single-year or multi-year target(s), as applicable	Single year target, 2030.
Reference point(s), level(s), baseline(s), base year(s) or starting point(s), and their respective value(s), as applicable	Base year: 1990. Net greenhouse gas emissions level in 1990: 4 699 405 kt CO ₂ eq.
Time frame(s) and/or periods for implementation, as applicable	2021-2030
Scope and coverage, including, as relevant, sectors, categories, activities, sources and sinks, pools and gases, as applicable	Geographical scope: EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)). Sectors covered, as contained in Annex I to decision 5/CMA.3: Energy Industrial processes and product use Agriculture

	<p>Land Use, Land Use Change and Forestry (LULUCF)</p> <p>Waste</p> <p>International Aviation: Emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO₂ emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC these comprise emissions in 2024-26 from flights between the EU Member States and departing flights to Norway, Iceland, Switzerland and United Kingdom.</p> <p>International Navigation: Waterborne navigation is included in respect of CO₂, methane (CH₄) and nitrous Oxide (N₂O) emissions from maritime transport voyages between the EU Member States.</p> <p>Gases:</p> <p>Carbon Dioxide (CO₂)</p> <p>Methane (CH₄)</p> <p>Nitrous Oxide (N₂O)</p> <p>Hydrofluorocarbons (HFCs)</p> <p>Perfluorocarbons (PFCs)</p> <p>Sulphur hexafluoride (SF₆)</p> <p>Nitrogen trifluoride (NF₃)</p> <p>The included LULUCF categories and pools are as defined in decision 5/CMA.3.</p>
Intention to use cooperative approaches that involve the use of ITMOs under Article 6 towards NDCs under Article 4 of the Paris Agreement, as applicable	<p>The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits.</p> <p>The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.</p>
Any updates or clarifications of previously reported information, as applicable ^d	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Note: This table is to be used by Parties on a voluntary basis.

^a Each Party shall provide a description of its NDC under Article 4, against which progress will be tracked. The information provided shall include required information, as applicable, including any updates to information previously provided (para. 64 of the MPGs).

^b For example: economy-wide absolute emission reduction, emission intensity reduction, emission reduction below a projected baseline, mitigation co-benefits of adaptation actions or economic diversification plans, policies and measures, and other (para. 64(a) of the MPGs).

^c Parties with both unconditional and conditional targets in their NDC may add a row to the table to describe conditional targets.

^d For example: recalculation of previously reported inventory data, or greater detail on methodologies or use of cooperative approaches (para. 64(g) of the MPGs).

1. Structured summary: Description of selected indicators

<i>Indicator(s) selected to track progress^a</i>	<i>Description</i>
{Indicator}	Annual total net GHG emissions consistent with the scope of the NDC in CO₂eq.
Information for the reference point(s), level(s), baseline(s), base year(s) or starting point(s), as appropriate ^b	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 699 405 kt CO₂eq.
Updates in accordance with any recalculation of the GHG inventory, as appropriate	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the EU GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope.
Relation to NDC ^c	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.

Notes: (1) Pursuant to para. 79 of the MPGs, each Party shall report the information referred to in paras. 65–78 of the MPGs in a narrative and common tabular format, as applicable. (2) A Party may amend the reporting format (e.g. Excel file) to remove specific rows in this table if the information to be provided in those rows is not applicable to the Party’s NDC under Article 4 of the Paris Agreement, in accordance with the MPGs. (3) The Party could add rows for each additional selected indicator and related information.

^a Each Party shall identify the indicator(s) that it has selected to track progress of its NDC (para. 65 of the MPGs).

^b Each Party shall provide the information for each selected indicator for the reference point(s), level(s), baseline(s), base year(s) or starting point(s) and shall update the information in accordance with any recalculation of the GHG inventory, as appropriate (para. 67 of the MPGs).

^c Each Party shall describe for each indicator identified how it is related to its NDC (para. 76(a) of the MPGs).

2. Structured summary: Definitions needed to understand NDC

<i>Definitions^a</i>	
<i>Definition needed to understand each indicator:</i>	
Annual total net GHG emissions	Total net GHG emissions correspond to the annual total of emissions and removals reported in CO ₂ equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled ‘Reporting format for the description of a Party’s nationally determined contribution under Article 4 of the Paris Agreement, including updates.’ Indirect CO ₂ emissions are included from those Member States that report these emissions.

Any sector or category defined differently than in the national inventory report:

{Sector} **Not applicable**

{Category} **Not applicable**

Definition needed to understand mitigation co-benefits of adaptation actions and/or economic diversification plans:

{Mitigation co-benefit(s)} **Not applicable**

Any other relevant definitions:

Not applicable

Notes: (1) Pursuant to para. 79 of the MPGs, each Party shall report the information referred to in paras. 65–78 of the MPGs in a narrative and common tabular format, as applicable. (2) A Party may amend the reporting format (e.g. Excel file) to remove specific rows in this table if the information to be provided in those rows is not applicable to the Party’s NDC under Article 4 of the Paris Agreement, in accordance with the MPGs. (3) The Party could add rows for each additional sector, category, mitigation co-benefits of adaptation actions and/or economic diversification plans, indicator and any other relevant definitions.

^a Each Party shall provide any definitions needed to understand its NDC under Article 4, including those related to each indicator identified in para. 65 of the MPGs, those related to any sectors or categories defined differently than in the national inventory report, or the mitigation co-benefits of adaptation actions and/or economic diversification plans (para. 73 of the MPGs).

3. Structured summary: Methodologies and accounting approaches – consistency with Article 4, paragraphs 13 and 14, of the Paris Agreement and with decision 4/CMA.1

<i>Reporting requirement</i>	<i>Description or reference to the relevant section of the BTR</i>
<i>For the first NDC under Article 4:^a</i>	
Accounting approach, including how it is consistent with Article 4, paragraphs 13–14, of the Paris Agreement (para. 71 of the MPGs)	Net GHG emissions, calculated from emissions and removals from the GHG inventory of the EU and supplemented with data on international aviation and navigation collected in the Joint Research Centre’s Integrated Database of the European Energy System (JRC-IDEES), are used to quantify progress towards implementing and achieving of the NDC in respect of the NDC target. This approach promotes environmental integrity, transparency, accuracy, completeness, comparability and consistency and ensures the avoidance of double counting, as described below. Existing methods and guidance under the

	Convention are taken into account, as described below.
<i>For the second and subsequent NDC under Article 4, and optionally for the first NDC under Article 4:^b</i>	
Information on the accounting approach used is consistent with paragraphs 13–17 and annex II of decision 4/CMA.1 (para. 72 of the MPGs)	The European Union accounts for anthropogenic emissions and removals corresponding to its NDC consistent with paragraphs 13–17 and annex II of decision 4/CMA.1, as detailed below.
Explain how the accounting for anthropogenic emissions and removals is in accordance with methodologies and common metrics assessed by the IPCC and in accordance with decision 18/CMA.1 (para. 1(a) of annex II to decision 4/CMA.1)	The accounting for anthropogenic emissions and removals is based on the data contained in the EU GHG inventory, which is compiled in accordance with the 2006 IPCC Guidelines. The accounting for emissions from international aviation and navigation in the scope of the NDC is based on activity data, emission factors and methods which are in line with the IPCC guidelines. The accounting approach is also in accordance with decision 18/CMA.1 because the EU GHG inventory conforms with the provisions of chapter II of the Annex to decision 18/CMA.1.
Explain how consistency has been maintained between any GHG data and estimation methodologies used for accounting and the Party's GHG inventory, pursuant to Article 13, paragraph 7(a), of the Paris Agreement, if applicable (para. 2(b) of annex II to decision 4/CMA.1)	The GHG data used for accounting is based on the GHG inventory of the EU. The methodology used for accounting consists of a balancing of GHG emissions and removals, which is consistent with the methodologies used in the GHG inventory of the EU.
Explain how overestimation or underestimation has been avoided for any projected emissions and removals used for accounting (para. 2(c) of annex II to decision 4/CMA.1)	Not applicable. Projected emissions and removals are not used for accounting.
<i>For each NDC under Article 4:^b</i>	
<i>Accounting for anthropogenic emissions and removals in accordance with methodologies and common metrics assessed by the IPCC and adopted by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement:</i>	
Each methodology and/or accounting approach used to assess the implementation and achievement of the target(s), as applicable (para. 74(a) of the MPGs)	The methodology used to assess the implementation and achievement consists of a comparison of the reduction of net GHG emissions from the GHG inventory national total, including a share of GHG inventory international aviation and navigation emissions in line with the NDC scope, with the NDC target. The EU will account for its cooperation with other

	Parties in a manner consistent with guidance adopted by the CMA.
Each methodology and/or accounting approach used for the construction of any baseline, to the extent possible (para. 74(b) of the MPGs)	Progress is tracked by comparing annual net emissions with net emissions in the base year. No baseline is constructed.
If the methodology or accounting approach used for the indicator(s) in table 1 differ from those used to assess the implementation and achievement the target, describe each methodology or accounting approach used to generate the information generated for each indicator in table 4 (para. 74(c) of the MPGs)	Not applicable. The methodology/accounting approach used for the indicator in table 1 is the same as the methodology/accounting approach used to assess the implementation and achievement the target.
Any conditions and assumptions relevant to the achievement of the NDC under Article 4, as applicable and available (para. 75(i) of the MPGs)	Not applicable. The NDC is unconditional.
Key parameters, assumptions, definitions, data sources and models used, as applicable and available (para. 75(a) of the MPGs)	Net GHG emissions are the key parameter used for tracking progress in implementing and achieving the NDC. The GHG inventory of the EU is the data source used. Details on assumptions, definitions and models used for determining net GHG emissions can be found in the National Inventory Document of the EU.
IPCC Guidelines used, as applicable and available (para. 75(b) of the MPGs)	2006 IPCC Guidelines; and 2019 refinement to the 2006 IPCC Guidelines for some source categories.
Report the metrics used, as applicable and available (para. 75(c) of the MPGs)	100-year time-horizon global warming potential (GWP) values from the IPCC Fifth Assessment Report.
For Parties whose NDC cannot be accounted for using methodologies covered by IPCC guidelines, provide information on their own methodology used, including for NDCs, pursuant to Article 4, paragraph 6, of the Paris Agreement, if applicable (para. 1(b) of annex II to decision 4/CMA.1)	Not applicable.
Provide information on methodologies used to track progress arising from the implementation of policies and measures, as appropriate (para. 1(d) of annex II to decision 4/CMA.1)	Progress arising from the implementation of policies and measures is expressed in a reduction of GHG emissions or increase of GHG removals. The methodology used to assess such progress is based on the estimation of GHG emissions and removals in the GHG inventory of the EU and on data on international aviation and navigation monitored in the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES).
Where applicable to its NDC, any sector-, category- or activity-specific assumptions, methodologies and approaches consistent with IPCC guidance, taking into account any relevant decision under the Convention, as applicable (para. 75(d) of the MPGs)	Sector-, category- and activity-specific assumptions, methodologies and approaches applicable to the NDC are described in the national inventory document of the EU and are consistent with IPCC guidance.

	Emissions from international aviation and navigation in the scope of the NDC are determined based on activity data from the JRC-IDEES, using emission factors and methodologies consistent with IPCC guidance.
For Parties that address emissions and subsequent removals from natural disturbances on managed lands, provide detailed information on the approach used and how it is consistent with relevant IPCC guidance, as appropriate, or indicate the relevant section of the national GHG inventory report containing that information (para. 1(e) of annex II to decision 4/CMA.1, para. 75(d)(i) of the MPGs)	NA ²⁵²
For Parties that account for emissions and removals from harvested wood products, provide detailed information on which IPCC approach has been used to estimate emissions and removals (para. 1(f) of annex II to decision 4/CMA.1, para. 75(d)(ii) of the MPGs)	The EU accounts for emissions and removals from harvested wood products as an integral part of net GHG emissions and removals in the scope of the NDC. GHG emissions and removals from harvested wood products are determined in accordance with the production approach, as defined in Annex 12.A.1 to Volume 4 of the 2006 IPCC Guidelines for National GHG Inventories.
For Parties that address the effects of age-class structure in forests, provide detailed information on the approach used and how this is consistent with relevant IPCC guidance, as appropriate (para. 1(g) of annex II to decision 4/CMA.1, para. 75(d)(iii) of the MPGs)	The EU does not address the effects of age-class structure in forests in the accounting approach for its NDC.
How the Party has drawn on existing methods and guidance established under the Convention and its related legal instruments, as appropriate, if applicable (para. 1(c) of annex II to decision 4/CMA.1)	The EU has drawn on existing methods and guidance established under the Convention by using an NDC target which is an advancement of the quantified economy-wide emission reduction target for 2020, which was communicated and tracked under the Convention.
Any methodologies used to account for mitigation co-benefits of adaptation actions and/or economic diversification plans (para. 75(e) of the MPGs)	The NDC does not consist of mitigation co-benefits of adaptation actions and/or economic diversification plans. Hence these co-benefits were not accounted for, and no related methodologies were used.
Describe how double counting of net GHG emission reductions has been avoided, including in accordance with guidance developed related to Article 6 if relevant (para. 76(d) of the MPGs)	GHG emissions and removals from the EU's GHG inventory, complemented with JRC-IDEES data for determining the share of emissions from international aviation and navigation in the NDC scope, are used for tracking the net GHG emission reductions. Emissions and removals are reported in line with IPCC guidelines, with the aim of neither over- nor underestimating GHG emissions.

²⁵² To determine emissions and removals in the scope of the NDC, the EU does not disaggregate emissions and removals on managed land into those considered to result from human activities and those considered to result from natural disturbances.

	<p>GHG emissions and removals are reported by the EU and its Member States in their respective GHG inventories. For tracking progress towards implementing and achieving the EU NDC, only those net GHG emission reductions are counted which are reported at EU level.</p> <p>For cooperative approaches under Article 6, corresponding adjustments are made in a manner consistent with guidance adopted by the CMA.</p>
Any other methodologies related to the NDC under Article 4 (para. 75(h) of the MPGs)	Not applicable.
<i>Ensuring methodological consistency, including on baselines, between the communication and implementation of NDCs (para. 12(b) of the decision 4/CMA.1):</i>	
Explain how consistency has been maintained in scope and coverage, definitions, data sources, metrics, assumptions and methodological approaches including on baselines, between the communication and implementation of NDCs (para. 2(a) of annex II to decision 4/CMA.1)	The scope, coverage, definitions, data sources, metrics and approaches are consistent between the communicated NDC and its implementation, as described in the BTR.
Explain how consistency has been maintained between any GHG data and estimation methodologies used for accounting and the Party's GHG inventory, pursuant to Article 13, paragraph 7(a), of the Paris Agreement, if applicable (para. 2(b) of annex II to decision 4/CMA.1) and explain methodological inconsistencies with the Party's most recent national inventory report, if applicable (para. 76(c) of the MPGs)	The GHG inventory of the EU is the primary source for the GHG data used for accounting. The share of GHG inventory emissions from international aviation and navigation in the scope of the NDC have been determined separately based on JRC-IDEES data, using emission factors and methodologies consistent with IPCC guidance. There are no methodological inconsistencies with the most recent national inventory report.
<i>For Parties that apply technical changes to update reference points, reference levels or projections, the changes should reflect either of the following (para. 2(d) of annex II to decision 4/CMA.1):</i>	
Technical changes related to technical corrections to the Party's inventory (para. 2(d)(i) of annex II to decision 4/CMA.1)	No technical changes related to technical corrections to the GHG inventory were applied to update reference points, reference levels or projections.
Technical changes related to improvements in accuracy that maintain methodological consistency (para. 2(d)(ii) of annex II to decision 4/CMA.1)	No technical changes related to improvements in accuracy were applied to update reference points, reference levels or projections.
Explain how any methodological changes and technical updates made during the implementation of their NDC were transparently reported (para. 2(e) of annex II to decision 4/CMA.1)	Methodological changes and technical updates are reported in the chapter entitled 'recalculations and improvements' of the National Inventory Document of the EU.

	GHG emissions from international aviation and navigation in the scope of the EU NDC are reported for the first time in this BTR (see Annex 2 to the BTR).
<i>Striving to include all categories of anthropogenic emissions or removals in the NDC and, once a source, sink or activity is included, continuing to include it (para. 3 of annex II to decision 4/CMA.1):</i>	
Explain how all categories of anthropogenic emissions and removals corresponding to their NDC were accounted for (para. 3(a) of annex II to decision 4/CMA.1)	The indicator used for tracking progress towards implementing and achieving the NDC target comprises all categories of anthropogenic emissions and removals corresponding to the NDC.
Explain how Party is striving to include all categories of anthropogenic emissions and removals in its NDC, and, once a source, sink or activity is included, continue to include it (para. 3(b) of annex II to decision 4/CMA.1)	The scope of the NDC of the EU covers all categories of emissions and removals reported in the GHG inventory, in line with IPCC guidelines. Member States report some specific source categories as ‘not estimated’ when the estimates would be insignificant as defined in paragraph 32 of the annex to decision 18/CMA.1. Information on these categories is provided in Common Reporting Table 9 of the respective Member States’ GHG inventory submission. Besides including all sectors listed in decision 18/CMA.1, a share of emissions from international aviation and navigation are also included in the NDC scope.
Provide an explanation of why any categories of anthropogenic emissions or removals are excluded (para. 4 of annex II to decision 4/CMA.1)	All categories of anthropogenic emissions and removals contained in the national total of the EU GHG inventory are included in the NDC.
<i>Each Party that participates in cooperative approaches that involve the use of ITMOs towards an NDC under Article 4, or authorizes the use of mitigation outcomes for international mitigation purposes other than achievement of its NDC</i>	
Provide information on any methodologies associated with any cooperative approaches that involve the use of ITMOs towards an NDC under Article 4 (para. 75(f) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA, when applicable.
Provide information on how each cooperative approach promotes sustainable development, consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA, when applicable.
Provide information on how each cooperative approach ensures environmental integrity consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA, when applicable.

Provide information on how each cooperative approach ensures transparency, including in governance, consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA, when applicable.
Provide information on how each cooperative approach applies robust accounting to ensure, inter alia, the avoidance of double counting, consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA, when applicable, when applicable.
Any other information consistent with decisions adopted by the CMA on reporting under Article 6 (para. 77(d)(iii) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA, when applicable.

Notes: (1) Pursuant to para. 79 of the MPGs, each Party shall report the information referred to in paras. 65–78 of the MPGs in a narrative and common tabular format, as applicable. (2) A Party may amend the reporting format (e.g. Excel file) to remove specific rows in this table if the information to be provided in those rows is not applicable to the Party’s NDC under Article 4 of the Paris Agreement, in accordance with the MPGs.

^a For the first NDC under Article 4, each Party shall clearly indicate and report its accounting approach, including how it is consistent with Article 4, paras. 13–14, of the Paris Agreement (para. 71 of the MPGs).

^b For the second and subsequent NDC under Article 4, each Party shall provide information referred to in chapter III.B and C of the MPGs consistent with decision 4/CMA.1. Each Party shall clearly indicate how its reporting is consistent with decision 4/CMA.1 (para. 72 of the MPGs). Each Party may choose to provide information on accounting of its first NDC consistent with decision 4/CMA.1 (para. 71 of the MPGs).

Table 7.1 Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement

	Unit, as applicable	Reference point(s), level(s), baseline(s), base year(s) or starting point(s), as appropriate (paras. 67 and 77(a)(i) of the MPGs)	Implementation period of the NDC covering information for previous reporting years, as applicable, and the most recent year, including the end year or end of period (paras. 68 and 77(a)(ii–iii) of the MPGs)		Target level ^b	Target year or period	Progress made towards the NDC, as determined by comparing the most recent information for each selected indicator, including for the end year or end of period, with the reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras. 69–70 of the MPGs)
			2021	2022			
Indicator(s) selected to track progress of the NDC or portion of NDC under Article 4 of the Paris Agreement (paras. 65 and 77(a) of the MPGs):							
Annual total GHG emissions and removals consistent with the scope of the NDC	kt CO ₂ eq ²⁵³	4 699 405	3 272 650	3 205 223	(55% below base year level)	2030	The most recent level of the indicator is 31.8% below the base year level.
Where applicable, total GHG emissions and removals consistent with the coverage of the NDC (para. 77(b) of the MPGs)	kt CO ₂ eq	4 699 405	3 272 650	3 205 223			
Contribution from the LULUCF sector for each year of the target period or target year, if not included in the inventory time series of total net GHG emissions and removals, as applicable (para. 77(c) of the MPGs)	NA		NA	NA			
Each Party that participates in cooperative approaches that involve the use of ITMOs towards an NDC under Article 4 of the Paris Agreement or authorizes the use of mitigation outcomes for international mitigation purposes other than achievement of the NDC, shall provide (para. 77(d) of the MPGs):							
If applicable, an indicative multi-year emissions trajectory, trajectories or budget for its NDC implementation period (para. 7(a)(i), annex to decision 2/CMA.3)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			
If applicable, multi-year emissions trajectory, trajectories or budget for its NDC implementation period that is consistent with the NDC (para. 7(b), annex to decision 2/CMA.3)	NA		NA	NA			
Annual anthropogenic emissions by sources and removals by sinks covered by its NDC or, where applicable, from the emission or sink categories as identified by the host Party pursuant to paragraph 10 of annex to decision 2/CMA.3 (para. 23(a), annex to decision 2/CMA.3) (as part of para. 77 (d)(i) of the MPGs)	kt CO ₂ eq		3 272 650	3 205 223			

²⁵³ Net GHG emissions in the scope of the NDC

Annual anthropogenic emissions by sources and removals by sinks covered by its NDC or, where applicable, from the portion of its NDC in accordance with paragraph 10, annex to decision 2/CMA.3 (para. 23(b), annex to decision 2/CMA.3)	kt CO ₂ eq		3 272 650	3 205 223			
If applicable, annual level of the relevant non-GHG indicator that is being used by the Party to track progress towards the implementation and achievement of its NDC and was selected pursuant to paragraph 65, annex to decision 18/CMA.1 (para. 23(i), annex, decision 2/CMA.3)	NA		NA	NA			
Annual quantity of ITMOs first transferred (para. 23(c), annex to decision 2/CMA.3) (para. 77(d)(ii) of the MPGs)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			
Annual quantity of mitigation outcomes authorized for use for other international mitigation purposes and entities authorized to use such mitigation outcomes, as appropriate (para. 23(d), annex to decision 2/CMA.3) (para. 77(d)(ii) of the MPGs)	NA		NA	NA			
Annual quantity of ITMOs used towards achievement of the NDC (para. 23(e), annex to decision 2/CMA.3) (para. 77(d)(ii) of the MPGs)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			
Net annual quantity of ITMOs resulting from paras. 23(c)-(e), annex to decision 2/CMA.3 (para. 23(f), annex to decision 2/CMA.3)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			
If applicable, the cumulative amount of ITMOs, divided by the number of elapsed years in the NDC implementation period (para. 7(a)(ii), annex to decision 2/CMA.3)	NA		NA	NA			
Total quantitative corresponding adjustments used to calculate the emissions balance referred to in para. 23(k)(i), annex to decision 2/CMA.3, in accordance with the Party's method for applying corresponding adjustments consistent with section III.B, annex to decision 2/CMA.3 (Application of corresponding adjustments) (para. 23(g), annex to decision 2/CMA.3)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			

The cumulative information in respect of the annual information in para. 23(f), annex to decision 2/CMA.3, as applicable (para. 23(h), annex to decision 2/CMA.3)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			
For metrics in tonnes of CO ₂ eq. or non-GHG, an annual emissions balance consistent with chapter III.B (Application of corresponding adjustment), annex, decision 2/CMA.3 (para. 23(k)(i), annex to decision 2/CMA.3) (as part of para. 77 (d)(ii) of the MPGs)	kt CO ₂ eq		To be reported in subsequent BTR	To be reported in subsequent BTR			
For metrics in non-GHG, for each non-GHG metric determined by participating Parties, annual adjustments resulting in an annual adjusted indicator, consistent with para. 9 of chapter III.B (Corresponding adjustments), annex to decision 2/CMA.3, and future guidance to be adopted by the CMA (para. 23(k)(ii), annex to decision 2/CMA.3)	NA		NA	NA			
Any other information consistent with decisions adopted by the CMA on reporting under Article 6 (para. 77(d)(iii) of the MPGs)	The EU will account and report for its cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA in a subsequent BTR or initial report, when applicable.						

Notes: (1) Pursuant to para. 79 of the MPGs, each Party shall report the information referred to in paras. 65–78 of the MPGs in a narrative and common tabular format, as applicable. (2) A Party may amend the reporting format (e.g. Excel file) to remove specific rows in this table if the information to be provided in those rows is not applicable to the Party's NDC under Article 4 of the Paris Agreement, in accordance with the MPGs. (3) The Party could add rows for each additional selected indicator.

^a This table could be used for each NDC target in case Party's NDC has multiple targets.

^b Parties may provide information on conditional targets in a documentation box with references to the relevant page in their biennial transparency report.

Annex 2: Methodology applied for the identification of GHG emissions from international aviation and navigation in the scope of the EU NDC

The scope of the EU NDC goes beyond national GHG emissions and removals in the scope of the national GHG inventory; it also includes specific emissions from international aviation and navigation. This annex describes the methodology for identifying these emissions.

International aviation and maritime emissions are estimated by using the Joint Research Centre's Integrated Database of the European Energy System ([JRC-IDEES](#)).⁷⁶ It allows to split the international transport CO₂ emissions into intraEU/extraEU and intraEEA/extraEEA and the departing flights from the EU to the UK and Switzerland, categories backwards in time (i.e. 1990) (i.e. for the time period back to 1990).²⁵⁴

For international transport, JRC-IDEES applies a decomposition methodology that reconciles the scopes of available primary statistics and harmonises historical data on international aviation and maritime emissions, energy use, and transport activity. The resulting annual dataset covers 1990-2021 and distinguishes domestic, intra-EU/intra-EEA, and extra-EU/extra-EEA activity for each EU Member State, Norway and Iceland.

In aviation, JRC-IDEES distinguishes passenger and freight modes, with three geographical categories of flight origin/destinations for each mode: domestic, intra-EEA + UK, and extra-EEA + UK. Intra-EU, the UK, and EEA²⁵⁵ categories are also used internally during calibration but aggregated for reporting. For each mode/category combination, JRC-IDEES estimates activity (as passenger-km or tonnes-km), energy use and CO₂ emissions, aircraft stock (expressed as representative aircraft), load factors, and aircraft efficiencies. As country-specific activity statistics are not available, the decomposition first allocates EU-level activity data from the Transport Pocketbook²⁵⁶ of the European Commission's Directorate-General for Mobility and Transport to each country and flight category.

For passenger modes, this allocation calculates average load factors using Eurostat data on total passengers and flights. These load factors and total flight numbers are combined with average flight distances from EUROCONTROL, the pan-European organisation dedicated to air traffic management, to yield an initial estimate for passenger transport activity. For intra-EU activity, a uniform scaling factor is then applied across Member States to match total EU-level Transport

²⁵⁴ The JRC-IDEES analytical database is designed to support energy modelling and policy analysis, by combining primary statistics with technical assumptions to compile detailed energy-economy-emissions historical data for each key energy sector. For aviation, EEA emissions includes emissions related to the UK but not to Switzerland, where total CO₂ emissions for the scope are additionally estimated from EUROCONTROL data.

²⁵⁵ In this annex, EEA stands for European Economic Area, which comprises the 27 EU Member States, Iceland, Liechtenstein and Norway.

²⁵⁶ Statistical pocketbook 2023, https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook/statistical-pocketbook-2023_en.

Pocketbook data. Freight activity follows a similar process, using a ‘representative flight’ concept with a common load factor across all Member States to account for mixed passenger-freight flights.

Next, the decomposition estimates fuel use from EUROCONTROL data, by deriving a distance-dependent average aircraft efficiency, then applying it to the country-specific ensemble of flights and routes. The final step scales the estimates to meet Eurostat energy balances for total domestic and international consumption back to 1990 values, maintaining intra-EEA/extra-EEA fuel use ratios derived from EUROCONTROL. JRC-IDEES additionally reports resulting differences with submissions by Parties to the UNFCCC. The above process is followed throughout the entire decomposition period (1990-2021). Data gaps are estimated from the existing indicators as follows:

- The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
- Average flight distance is kept constant for early years without EUROCONTROL data (generally before 2004).
- If the load factor (passengers per flight) cannot be calculated due to a lack of passenger and/or flight data, it is estimated from the trend of the existing time series.
- Missing numbers of flights are calculated from the load factor and the passengers carried.
- If no passenger data is available, the total mileage is estimated from the energy consumption, and combined with average flight distance to estimate the number of flights. The number of flights is then combined with the load factor to estimate the total passengers carried.
- For early years without data, constant values are assumed for the factors used to *i*) scale intra-EU activity to the Transport Pocketbook, *ii*) adjust the estimated fuel use to EUROCONTROL data for specific routes, and *iii*) scale this adjusted fuel use to Eurostat energy balances (e.g. before 1995 for Transport Pocketbook data; before 2004 for EUROCONTROL data).

For international maritime transport, JRC-IDEES estimates data both for intra-EU/extra-EU and intra-EEA/extra-EEA geographical categories. The emission estimates in the GHG inventory already include CO₂, CH₄, and N₂O gases. Transport activity (tonnes-km) is estimated from Eurostat data on gross weight of transported goods, using port-level and country-level data for intra-EU and extra-EU categories, respectively. Intra-EU activities are then scaled to match the Transport Pocketbook totals, accounting for domestic coastal shipping (calibrated separately in JRC-IDEES). Next, transport activity is combined with data reported under the monitoring, reporting and verification system for maritime transport under the EU ETS (‘THETIS MRV’²⁵⁷), namely EU-level mileage data and country-specific vessel sizes to estimate load factors (tonnes per movement). The load factors and resulting annual mileage (km) are calibrated to meet EU-

²⁵⁷ THETIS MRV, <https://mrv.emsa.europa.eu/#public/eumrv>.

level THETIS MRV mileage. The annual mileage is in turn combined with THETIS MRV average efficiency to yield a total technical energy consumption, with corresponding emissions derived from default emissions factors. This energy consumption is scaled to Eurostat energy balances so as to minimise discrepancy to total intra-EU THETIS MRV emissions. As with aviation, JRC-IDEES reports corresponding differences to submissions under the UNFCCC. Early years with data gaps are estimated from existing indicators as follows:

- The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
- Average distance of voyages is kept constant for early years without Eurostat activity data (generally before 1997-2000).
- If the load factor (tonnes per movement) cannot be estimated due a lack of activity data, it is kept constant.
- If activity data is not available, it is estimated from Eurostat energy consumption.
- Missing mileage data is derived from the activity and load factor estimates.
- For early years without data, constant values are assumed for the factors used to i) scale intra-EU activity to the Transport Pocketbook, ii) scale estimated mileage to meet EU-level THETIS MRV mileage, and iii) scale domestic and intra-EU CO₂ emissions estimated from energy consumption so as to match total THETIS MRV CO₂ emissions.
- Finally, the ratios between the estimated MRV emissions and the CO₂ emissions for the reported transport activity (for intra-EU/EEA and extra-EU/EEA categories) between 2018 and 2021 are used to calculate the MRV compliant estimates back to 1990 levels.

For the year 2022, the international navigation and aviation emissions under the EU NDC scope have been estimated by applying the same share of those emissions on the total international navigation and aviation emissions (as reported in the GHG inventory) as in 2021.

Aviation emissions covered by the EU NDC scope

Emissions	Domestic aviation			Intra-EEA aviation				Extra-EEA aviation
	Domestic EU flights (e.g. Palermo Milan)	Domestic “non-EU EEA” flights (e.g. Oslo to Bergen)	To OMRs (e.g. Canary Islands to Madrid)	Flights between “non-EU EEA” countries (from Oslo to Reykjavik)	Flights within the EEA, involving an EU airport	Flights within the EEA, departing from EU airports	departing flights from EU airports to OMRs	departing flights from EU airports to UK and Switzerland
Current NDC commitment	Yes	No	Yes	No	No	Yes	Yes	Yes

			From Jan 2024				From Jan 2024	
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Navigation emissions covered by the EU NDC

Emissions	Domestic waterborne navigation		International waterborne navigation				At berth	
	Voyages within a MS (e.g. Valencia - Barcelona)	Voyages within NO/IS (e.g. Oslo - Bergen)	Voyages between two EU MS (e.g. Valencia - Rotterdam)	Voyages between a MS and NO/IS (e.g. Rotterdam - Oslo)	Voyages between an EU MS and a third country	Voyages between NO/IS and a third country (or IS/NO)	At berth emissions in a port of an EU MS (reported under domestic emissions)	At berth emissions in a port of NO or IS
Current NDC commitment (CO ₂ , CH ₄ , N ₂ O)	Yes	No	Yes	No	No	No	Yes	No

Glossary

AEA	Annual Emission Allocation
AFS 2030	Agriculture and Fisheries Strategy 2030
APM	Agriculture Projection Model
ARIB	Agricultural Registers and Information Board
BAT	Best available technologies
BTR	Biennial Transparency Report
CAP	Common Agricultural Policy
CH ₄	Methane
CHP	Combined heat and power
CITES	Convention on International Trade in Endangered Species
CO ₂	Carbon dioxide
COPERT	European road transport emission inventory model
CRT	Common Reporting Tables
CTF	Common Tabular Format
EC	European Commission
EE 2035	Estonia 2035 strategy
EEA	European Environment Agency
EERC	Estonian Environmental Research Centre
EFDP 2030	Estonian Forestry Development Programme until 2030
EIC	Environmental Investment Centre
EMHI	Estonian Meteorological and Hydrological Institute
ENMAK 2030	Estonian Energy Development Plan 2030
eq.	Equivalent
ESR	Effort Sharing Regulation
EstEA	Estonian Environment Agency

ETCB	Estonian Tax and Customs Board
EU ETS	European Union Emissions Trading System
EU	European Union
EUR	European Euro
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse gas
GPCP 2050	General Principles of Climate Policy until 2050
GWP	Global warming potential
HFC	Hydrofluorocarbon
HWP	Harvested wood products
IFAD	International Fund for Agricultural Development
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC 2006 GL	Guidelines for National Greenhouse Gas Inventories
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
ITF	International Transport Forum
JRC-IDEES	The Joint Research Centre's Integrated Database of the European Energy System
IUCN	International Union for Conservation of Nature
LULUCF	Land use, land-use change and forestry
MAC	Mobile air conditioners
MoC	Ministry of Climate
MoE and Agriculture	Ministry of Environment MoRAA Ministry of Regional Affairs

MSW	Municipal solid waste
N ₂ O	Nitrous oxide
NA	Not applicable
NAP	National Adaptation Plan
NAS	National Adaption Strategy
NDC	Nationally determined contributions
NE	Not estimated
NECP	National energy and climate plan
NECPR	National energy and climate progress report
NF ₃	Nitrogen trifluoride
NFI	National Forest Inventory
NID	National Inventory Document
NIR	National Inventory Report
NMVOC	Non-methane volatile organic compounds
NO	Not occurring
NWP	National Waste Plan 2023–2028
ODS	Ozone-depleting substances
OECD	Organisation for Economic Co-operation and Development
PFCs	Perfluorocarbons
QA	Quality assurance
QC	Quality control
SEN scenario	Alternative scenario
SF ₆	Sulphur hexafluoride
SWD	Solid waste disposal
TalTech	Tallinn University of Technology
TJ	terajoule

TWh	Terawatt hours
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WEM	With Existing Measures
WOM	Without Measures