



REPUBLIC OF ESTONIA
MINISTRY OF THE ENVIRONMENT

Report pursuant to Article 39 of Regulation (EU) 2018/1999

Estonia

Estonia 2021

PREFACE

Estonia is a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Under these international agreements Estonia is committed to provide annually information on its national anthropogenic greenhouse gas emissions by sources and removals by sinks for all greenhouse gases not controlled by the Montreal Protocol.

As a member of the European Union (EU), Estonia has also obligations for reporting on national policies and measures and national projections of anthropogenic greenhouse gas emissions under Article 39 of Regulation (EU) 2018/1999 of the European Parliament (Governance Regulation) and of the Council and Articles 36, 37 and 38 of Commission Implementing Regulation (EU) 2020/1208.

According to the Commission Implementing Regulation (EU) 2020/1208 Member States have an obligation to prepare a report in every two years, including:

- a) National systems for policies and measures and projections
- b) Updates relevant to their low-carbon development strategies;
- c) Planned additional policies and measures
- d) Links between the different policies and measures and the contribution of those policies and measures contribute to different projection scenarios.

Estonia's 2019 report on policies and measures and GHG projections up to 2050 is comprised of this report and Reportnet datasets.

The report was compiled by Estonian Environmental Research Centre.

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Abbreviations

AD –	activity data
BAT –	best available technology
CHP –	combined heat and power
EF –	emission factor
ESD –	Effort Sharing Decision
ETS –	Emissions Trading System
EU –	European Union
eq –	equivalent
F-gas –	fluorinated greenhouse gas
GDP –	gross domestic product
GHC –	gaseous heat carrier
GHG –	greenhouse gas
GWh –	gigawatt hour
GWP –	global warming potential
IPCC –	Intergovernmental Panel on Climate Change
IPPU –	Industrial processes and product use
kt –	kiloton
kWh –	kilowatt hour
LULUCF –	Land use, land-use change and forestry
MMR –	Monitoring Mechanism Regulation
MoE –	Ministry of the Environment
NFI –	National Forest Inventory
NIR –	National Inventory Report
PAM –	policies and measures
PJ –	petajoule
SHC –	solid heat carrier
TJ –	terajoule
UNFCCC –	United Nations Framework Convention on Climate Change
WAM –	with additional measures
WEM –	with existing measures
yr –	year

Documents

EFDP 2020 –	The Estonian Forestry Development Programme until 2020
EEDP 2030 –	Estonian Energy Sector Development Plan 2030
GPCP 2050 –	General Principles of Climate Policy 2050
ERDP –	Estonian Rural Development Plan
CAP –	Common Agricultural Policy
NWMP –	National Waste Management Plan 2014–2020, extended to 2022
NCDP –	Nature Conservation Development Plan until 2020
NECP 2030 –	National Energy and Climate Plan
NEEAP2 –	The Second National Energy Efficiency Action Plan of Estonia
ERDP –	Estonian rural development plan 2014–2020, extended to 2022
AFDP –	Agriculture and fisheries development plan until 2030

Greenhouse gases

CH ₄ –	methane
CO ₂ –	carbon dioxide
N ₂ O –	nitrous oxide
HFC –	hydrofluorocarbons
PFC –	perfluorocarbons
SF ₆ –	sulphur hexafluoride
NF ₃ –	nitrogen trifluoride

Atmospheric pollutants

NMVOC –	non-methane volatile organic compound
NH ₃ –	ammonia
NO _x –	nitrogen oxides

1. GENERAL INFORMATION

1.1. Information on changes to national system for reporting on policies and measures and projections

Information the national system is included in Reportnet dataset on National systems for policies and measures and projections.

1.2. Progress in achievement of quantified economy-wide emission reduction targets and relevant information

1.2.1. Emissions trading under the EU Emissions Trading System

The European Union Emissions Trading System (EU ETS) is one of the key policy instruments implemented in the EU to achieve its climate policy 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 2019 about 58% (without LULUCF), according Estonia's 2021 submission to the European Commission on 15th of March (2021 NIR).

1.2.2. The Effort Sharing Decision (2013-2020), the Effort Sharing Regulation and the LULUCF Regulation (2021-2030)

Under the current legislation, EU Member States have binding annual greenhouse gas emission targets for 2013–2020 and 2021–2030 for those sectors of the economy that fall outside the scope of the EU Emissions Trading System (EU ETS). These sectors, including transport, buildings, agriculture, non-ETS industry and waste, account for almost 60% of total domestic EU emissions.

Accordingly, *Decision no 406/2009/EC (Effort Sharing Decision - ESD)* limit the increase of the GHG emission in Estonia by 11% in 2020 compared to 2005 greenhouse gas emissions levels.

In October 2014, EU leaders set a binding economy-wide domestic emission reductions target of at least 40% by 2030 compared to 1990. The *Regulation (EU) 2018/842 of the European Parliament and of the Council (Effort Sharing Regulation - ESR)* translates this commitment into binding annual greenhouse gas emission targets for each Member State (totalling 30% reduction), based on the principles of fairness, cost-effectiveness and environmental integrity.

Estonia's *ESR* 2030 target for greenhouse gas emissions in sectors not covered by the EU Emissions Trading System (non-ETS) is -13% compared to 2005.

The cumulative projected emissions/removals in accordance with *Regulation (EU) 2018/841* for the periods 2021–2025 and 2026–2030 are presented in Reportnet dataset Table 5b. Cumulative emissions are compared to the reference values or base period emissions for calculating the accounted quantities, except for the afforested and deforested lands, where total cumulative net emissions are accounted. Accounting of Managed wetlands is mandatory

starting from 2026, and Estonia has not selected this category for accounting in the 2021–2025 period. According to the projections, total accounted removals exceed accounted emissions in the first commitment period. As accounting for the Managed forest land in 2026–2030 can be done after the final Forest Reference Level for that period is available, then during the compilation of 2021 projections it was not yet possible to assess whether Estonia will meet the „no-debit” rule in the second commitment period.

In 2019, the total emissions of GHGs (with indirect CO₂), measured as CO₂ eq., were 13 983.50 kt, and without LULUCF 14 699.12 kt. From 1990 to 2019 emissions with LULUCF decreased by 63%.

1.2.3. Long Term Strategy

Estonia's long-term *Low Carbon Development Strategy 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. The aim set in *GPCP 2050* is to decrease the GHG emissions 70% by 2030 and 80% by 2050 compared to 1990.

Principles and guidelines set in the document have to be taken into account when renewing and implementing the cross-sectoral and sectoral strategies and national development plans in place. Estonia will be transformed into an attractive environment mainly for the development of innovative technologies, products and services reducing the emission of GHG. In addition, the export and global implementation of such technologies, products and services shall 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 efficient use of resources in manufacturing processes.
- Considering economy and energy efficiency of the system as a whole when renovating the existing building stock and planning and constructing new buildings.
- Considering 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 the GHG emission 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 increase 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 soil's carbon stock incl. developing and maintaining significant carbon stock of land areas.
- Encouraging efficient and ecological use of agricultural land while avoiding the falling out of 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 the focus on eco-friendlier manure management for limiting ammonia emissions.
- Increasing forest increment and ability to sequester carbon through 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 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 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.

1.2.4. General documents

The national spatial plan *Estonia 2030+* (replacing the national reform programme *Estonia 2020*) is setting national guidelines to express public interest and improve the quality of space, adhering to the policies of energy efficiency and sustainable development that county and local governments need to consider when preparing plans. Long-term trends can be implemented nationally only by coordinating and influencing various sectors. The success of the implementation of this plan hinges to a very large extent on the transport, energy, environmental, fisheries and agricultural policies; however, there is a particularly close links between the national spatial plan and regional policy – based on the spatial bases for steering regional development nationally and the general directions, as defined in the national spatial plan, the regional development strategy shapes the more detailed policies and time-specific objectives, measures and activities for influencing and supporting regional development.

2. INFORMATION ON POLICIES AND MEASURES

This chapter includes sectoral information on Policies and Measures (PaMs) in ‘With Existing Measures’ (WEM) and ‘With Additional Measures’ (WAM) scenarios. Also, additional measures that are planned and not yet adopted are reported under ‘Not included in projections’ (NIP) scenario. Additional information on PaMs is included in Reportnet dataset on National greenhouse gas policies and measures.

2.1. Energy

2.1.1. Electricity supply

The major national-level document aimed at the electricity sector is *Estonia’s 2030 National Energy and Climate Plan (NECP 2030)*. The plan foresees a significant decrease in electricity production from oil shale and an increase in proportion of other sources of energy.

NECP 2030 emphasises that Estonia’s electricity sector requires fundamental changes as the impact of electricity generation on the environment must be reduced. This process is also affected by the need to use the resources of oil shale in a more sustainable way. Therefore, the plan provides scenarios for the restructuring of electricity production in Estonia. The electricity generation from wind turbines (mainly wind farms) could be increased up to annual generation of ~2500 GWh, from biomass ~1200GWh and from solar parks ~415GWh.

According to the NECP 2030 new electricity production units have to be competitive in open electricity market without any subsidies. The support schemes for new production units are set in Electricity Market Act and are primarily aimed at renewable energy, combined heat and power (CHP) production and complying to the criteria of local production units.

The WEM measures that have an effect on GHG emissions in Electricity supply sector are the following:

- 1) **Support for renewable and efficient CHP based electricity production** (PaM ID# 1) – The support rates are presented in Table 2.1.
- 2) **Investment support for wind parks** (PaM ID# 2) – It is estimated that by 2030 the production of wind power should be approximately 2 500 GWh.
- 3) **Increasing the share of solar energy in electricity generation** (PaM ID# 3) – Investments for construction of solar parks.
- 4) **Renewable energy support through underbidding auctions (technology neutral)** (PaM ID# 5) – Increase energy production from renewable energy sources.
- 5) **Introduction of renewable energy in maritime surveillance radar stations on small islands** (PaM ID# 9) – Increase energy production from renewable energy sources.

NIP (not included in projections) measures that have a direct or indirect effect on GHG emissions in Electricity supply sector, and might be added as an additional measure in the future, are the following:

- 1) **The acquisition of air surveillance** (PaM ID# 15) – To support the development of wind energy through the implementation of radars and other compensatory measures in order to promote the development of renewable energy in Estonia. Exempt onshore and

wind farm areas from altitude and national defense restrictions that allow for the construction of wind farms.

- 2) **Supporting the construction of electricity storage solutions** (PaM ID# 16) – Increase energy production capacity from renewable energy sources.
- 3) **Renewable energy support through underbidding auctions (technology specific)** (PaM ID# 18) – Increase energy production from renewable energy sources.
- 4) **Government actions to capture and store carbon or to promote its use** (PaM ID# 17) – In 2019-2021, Tallinn University of Technology will carry out the project “Climate change mitigation through CCS and CCU technologies”, the aim of which is to assess the suitability of different carbon capture technologies and develop scenarios for the implementation of these technologies in the Estonian oil shale industry.
- 5) **Research and development program for the National Development Plan of the Energy Sector** (PaM ID# 17) – Supporting the implementation of the energy economy development plan through research and development.

The projected effects of WEM measures related to electricity supply are presented in Table 2.2.

Table 2.1. Support for renewable and efficient CHP based electricity production

Level of subsidy	Conditions for receiving the subsidy
	Subsidies are paid for electricity that is produced:
0.0537 €/kWh	From renewable energy sources which do not exceed 100 MW
0.0537 €/kWh	From biomass in CHP mode. From 31.12.2010, 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 10MW

Table 2.2. Projected effects of the WEM measures in electricity production, kt CO₂ eq.

	2018	2020	2025	2030	2035	2040	2045	2050
Support for renewable and efficient CHP based electricity production	514.45	562.94	587.00	587.00	587.00	587.00	587.00	587.00
Investments for construction of wind parks	219.44	232.11	398.39	866.06	866.06	866.06	866.06	866.06
Increasing the share of solar energy in electricity generation	34.64	90.07	143.77	143.77	143.77	143.77	143.77	143.77
Renewable energy support through underbidding auctions (technology neutral)	0	225.18	225.18	225.18	225.18	225.18	225.18	225.18
Introduction of renewable energy in maritime surveillance radar stations on small islands	0	0	0.55	0.55	0.55	0.55	0.55	0.55

2.1.2. Heat supply

Heat supply, particularly district heating, is a sector with quite a large potential for increasing energy efficiency, which in turn will result in lower GHG emissions. The goals set in *NECP 2030* are to use the full potential of CHP plants, promote the use of local fuels and to reduce the share of imported fuels in heat supply. It is expected that the share of renewable energy in heat supply will be more than 60% and the share of imported fuels less than 30%.

Regarding biomass, a large amount of the primary energy arising from fuel wood (logs, chips, pellets and wood waste) is used in heat production. However, development is hindered by the large-scale exporting of biomass, due to which local energy producers in some cases do not have enough biomass resources. Exports result in elevated prices for some biomass products, especially wood pellets. The deployment of smaller-scale cogeneration CHPs as an element of decentralised energy production strategy would increase the security of energy supply in Estonia. A small heat load and the fact that new equipment producing only heat alone has already been installed in many areas with a favourable heat load can be indicated as hindrances to the development of combined heat and power production based on biomass.

As a rule, district heating is more environmentally benign as a heat supply option than local heating. Therefore, it is important that the *District Heating Act* enables the zoning of district heating as an element of regional heat supply planning. The Act gives local governments the power to introduce the zoning of heat supply based on analyses, carried out for alternative heat supply options during the planning phase. The zoning of heat supply as an instrument of regulation of the energy sector gives municipalities the authority to avoid chaotic disconnection from district heating (DH) systems. The latter process had been taking place in some towns and cities for many years.

The main WEM measures that have an effect on GHG emissions in Heat supply sector are the following:

1) Development of the heat economy (PaM ID# 6):

- **Renovation of boilerhouses** – This measure includes fuel switch from oil fuels to renewable and/or local energy sources like biomass, peat, etc.
- **Renovation of heat networks** – The aim of this measure is to reduce the losses in district heating networks.
- **Transition of consumers to local and place heating** – District heat networks that are operating inefficiently (the amount of MWh sold per meter of heat pipes is less than 1.2) will be restructured to local and place heating.

The main WAM measures that have an effect on GHG emissions in Heat supply sector are the following:

1) Additional development of the heat economy (PaM ID# 10):

- **Additional renovation of boilerhouses** – This measure includes fuel switch from oil fuels to renewable and/or local energy sources like biomass, peat, etc.
- **Additional renovation of heat networks** – The aim of this measure is to reduce the losses in district heating networks.
- **Additional transition of consumers to local and place heating** – District heat networks that are operating inefficiently (the amount of MWh sold per meter of heat pipes is less than 1.2) will be restructured to local and place heating.

The projected effects of the WEM and WAM measures in heat supply are presented in Table 2.3 and Table 2.4.

Table 2.3. Projected effects of the measures in heat production in the WEM scenario, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Development of the heat economy	91.09	103.23	117.32	117.32	117.32	117.32	117.32	117.32

Table 2.4. Projected effects of the measures in heat production in the WAM scenario, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Additional development of the heat economy	0	0	88.28	151.20	214.26	214.26	214.26	214.26

The additional savings in the WAM scenario are related to additional investments in the measures and therefore are projected to have greater effect on GHG emissions.

2.1.3. Energy consumption – Manufacturing industries and construction

The Second National Energy Efficiency Action Plan of Estonia (NEEAP2) declares that increasing the energy efficiency in Manufacturing industries is in Estonia mainly ensured by increasing environmental awareness and measures that are related to the wider energy policy, such as the opening up of the electricity market, the renewable energy charge, fuel and electricity excise duties and reduced differences in excise duty rates. For example, in the beginning of 2017 MoE opened a measure for increasing industrial resource efficiency, of which the main objectives are gaining energy savings in small and medium sized companies. The actions supported are raising awareness, educating experts, conducting audits and making investments. Investment support is provided to five most important sectors: mining, food processing, wood, pulp, paper and non-metallic minerals industries. According to the *Energy Sector Organization Act*, large companies are mandated to have regular energy audits.

2.1.4. Energy consumption – Other sectors (Commercial/institutional and residential sectors)

Measures taken into account in the Residential and Commercial/Institutional sector are mainly related to energy conservation through reconstruction of buildings. In Other sectors, the main measures having an effect on GHG emissions, that are already in place, include in the WEM scenario:

- 1) **Reconstruction of public and commercial buildings** (PaM ID# 7) – reconstruction of 20% of the existing buildings to energy efficiency class C by the year 2030.
- 2) **Reconstruction of private houses and apartment buildings** (PaM ID# 8) – reconstruction of 40% of existing private houses to energy efficiency class C or D and 50% of existing apartment buildings to energy efficiency class C by the year 2030.
- 3) **Street lighting reconstruction programme investments** (PaM ID# 4) – The aim of the programme is to increase the efficiency of the use of electricity in street lighting.

- 4) **Reconstruction of schools and kindergardens** (PaM ID# 11) – reconstruction of 40% of the existing schools and kindergardens by the year 2030.

A few additional measures are still under discussion or waiting additional funds and henceforth are reported as WAM. These measures include

- 1) **Additional reconstruction of public and commercial buildings** (PaM ID# 12) – reconstruction of additional existing buildings to energy efficiency class C by the year 2030.
- 2) **Additional reconstruction of private houses and apartment buildings** (PaM ID# 13) – According to the assumptions, an additional 10% of private houses and apartment buildings will be renovated by 2030.

The NIP measures that have a direct or indirect effect on GHG emissions in Energy consumption are the following:

- 1) **Implementation of the minimum requirements for nearly zero energy buildings** (PaM ID# 14) –The requirements will be implemented as required by the Energy Efficiency Directive and in the Government regulation "Minimum energy efficiency requirements".
- 2) **Investments into energy saving of greenhouses and vegetable warehouses and dissemination of renewable energy** (PaM ID# 20) – The aim of the measure is to increase the share of renewable energy and energy savings in the horticultural sector through the introduction of modern technology.

The projected effects of the WEM and WAM measures are presented in Table 2.5 and Table 2.6.

Table 2.5. Projected effects of the measures in Other sectors in the WEM scenario, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Reconstruction of public and commercial buildings	0.60	0.69	1.10	1.51	1.91	2.32	2.73	3.14
Reconstruction of private houses and apartment buildings	27.00	27.17	54.26	73.90	73.90	73.90	73.90	73.90
Street lighting reconstruction programme investments	3.10	3.10	3.92	3.92	3.92	3.92	3.92	3.92
Reconstruction of schools and kindergardens	0.0	0.0	4.81	8.55	8.55	8.55	8.55	8.55

Table 2.6. Projected effects of the measures in Other sectors in the WAM scenario, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Additional reconstruction of public and commercial buildings	0.0	0.0	2.16	3.38	4.56	5.30	6.11	6.93
Additional reconstruction of private houses and apartment buildings	0.0	0.0	5.43	10.85	14.78	14.78	14.78	14.78

The additional savings in the WAM scenario are related to additional investments in the measures and therefore are projected to have greater effect on GHG emissions.

2.2. Transport

In 2019, Estonia started to develop a new *Transportation and mobility development plan 2021+*. The development plan sets forth the following relating to climate policy:

- Decreasing the use of vehicles in towns by improving the conditions for walking, cycling and using public transport and use smart solutions to offer various new services, particularly short-term bicycle and car rent.
- Increasing the number of departures and speed of connection for train traffic for trains to become the most favoured means of transport that connects Tallinn and other towns; improving the train connection with Latvia (on Tartu–Riga line, Rail Baltic) and Russia (the trip to St Petersburg should be shorter than 5 hours).
- Increasing the share of more economic vehicles that run on renewable energy so that biomethane or compressed gas generated from domestic biomass and waste would become the main alternative type of fuel in Estonia.

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

Reducing GHG emissions in the Transport sector is one of the key questions for Estonia in meeting the ESD targets in the future as the energy consumption has been growing in the same trend as the gross domestic product (GDP). The main goals for the measures implemented or planned in the Transport sector are directed at increasing the efficiency of vehicles and reducing the demand in domestic transport.

In the transport sector, the main WEM measures having an effect on GHG emissions, that are already in place, include:

- 1) **Increasing the share of biofuels in transport** (PaM ID# 21) – The main target of this measure is to achieve the 10% share of biofuels in transport sector by 2030.
- 2) **Increasing of fuel economy in transport** (PaM ID# 22) – Includes developing support system for energy efficient cars and also support the use of hybrid buses, hybrid trolleys, electrical buses etc.
- 3) **Promotion of economical driving** (PaM ID# 23) – This measure includes promoting the eco-driving.
- 4) **Spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system** (PaM ID# 24):
 - **Improvement of the traffic system** - This measure includes updating the parking policies in cities, planning the land use to reduce the use of private cars, restructuring the streets in cities, etc.
 - **Reduction of forced movements with personal vehicles in transport** - This measure includes developing telecommunication and also developing short-term rental cars systems.

- **Development of the of convenient and modern public transport, development of ticket systems and new services** – Includes improving the availability of public transport, developing ticket systems and new services.
- 5) **Road usage fees for heavy duty vehicles** (PaM ID# 25) – This measure includes a system of road usage fees for heavy duty vehicles. The system is based on time.
 - 6) **Electric car purchase support** (PaM ID# 26) – Support for the purchase of electric cars is targeted at companies and individuals with high transport needs.
 - 7) **Promotion of clean and energy efficient road transport vehicles in public procurement** (PaM ID# 27) – The government must implement the system provided in the Clean Vehicles Directive within 24 months, i.e., from August 2021.
 - 8) **The railroad electrification** (PaM ID# 28) – Electrification of existing railway and extension of its use.
 - 9) **Developing the railroad infrastructure (includes the building of Rail Baltic)** (PaM ID# 29) – This measure includes building Rail Baltic, additional stops and raising speed limits.

Following measures are still in discussion and henceforth are reported as planned in the WAM scenario:

- 1) **Additional promoting economical driving** (PaM ID# 30) – This measure includes additional implementation of the measure "Promotion of economical driving", which means a public campaign to raise awareness.
- 2) **Additional spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system** (PaM ID# 31) – To ensure safety in cities, the construction of main networks of bicycle paths that serve the main connections within Tallinn between the city center and districts, as well as sustainable mobility in other major cities.
- 3) **Road usage fees for heavy duty vehicles** (PaM ID# 32) – The system is based on mileage.
- 4) **Heavy duty tyres and aerodynamics** (PaM ID# 33) – The measure introduces better rolling resistance tyres and improves the aerodynamics of vehicles. The training materials for truck drivers will be complemented to highlight the importance of checking tyres and tyre pressures.
- 5) **Ferry traffic electrification** (PaM ID# 34) – Includes the electrification of the ferry traffic between the continent and the islands.

The NIP measures that have a direct effect on GHG emissions in the Transport, and might be added as an additional measure in the future, are the following:

- 1) **Pilot project for hydrogen** (PaM ID# 35) – A project covering the entire hydrogen use chain, i.e., from production, transport, storage to consumption in public transport (eg by hydrogen bus).

- 2) **Passenger car registration and annual tax** (PaM ID# 36) – Passenger car registration and annual tax based on location, environmental aspects, etc.
- 3) **Developing and implementing a congestion charge system in cities** (PaM ID# 37) – The main target is to reduce traffic in the centre of the cities.

The projected effects of the WEM, WAM and NIP measures are presented in Table 2.7, Table 2.8 and Table 2.9.

Table 2.7. Projected effects of the measures in transport sector in the WEM scenario, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Increasing the share of biofuels in transport	97.94	195.87	0.0	0.0	0.0	0.0	0.0	0.0
Increasing of fuel economy in transport	14.09	28.18	127.96	288.63	430.58	787.20	1271.54	1777.36
Promotion of economical driving	24.05	24.05	24.05	24.05	24.05	24.05	24.05	24.05
Spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system	0.0	0.0	35.68	35.68	37.09	37.90	38.66	0.0
Road usage fees for heavy duty vehicles	2.15	4.37	4.37	4.37	4.37	4.37	4.37	4.37
Electric car purchase support	0.0	0.1	74.20	19.64	0.0	0.0	0.0	0.0
Promotion of clean and energy efficient road transport vehicles in public procurement	0.0	0.0	15.04	15.04	15.04	15.04	15.04	15.04
The railroad electrification	0.0	0.0	22.82	22.82	22.82	22.82	22.82	22.82
Developing the railroad infrastructure (includes the building of Rail Baltic)	0.0	0.0	27.32	61.09	61.09	61.09	61.09	61.09

Table 2.8. Projected effects of the measures in transport sector in the WAM scenario, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Additional promotion of economical driving	0.0	0.0	4.90	24.05	24.05	24.05	24.05	24.05
Additional spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system	0.0	0.0	0.00	26.00	27.02	27.61	28.17	0.0
Road usage fees for heavy duty vehicles	0.0	0.0	20.20	19.80	19.80	19.80	19.80	19.80
Vehicle tyres and aerodynamics	0.0	0.0	28.40	46.10	46.10	46.10	46.10	46.10
Ferry traffic electrification	0.0	0.0	16.57	16.57	16.57	16.57	16.57	16.57

Table 2.9. Projected effects of the NIP measures in transport sector, kt CO₂ eq

	2018	2020	2025	2030	2035	2040	2045	2050
Passenger car registration and annual tax	0.0	0.0	129.70	210.90	210.90	210.90	210.90	210.90
Developing and implementing a congestion charge system in cities	0.0	0.0	101.70	99.20	99.20	99.20	99.20	99.20

2.3. Industrial processes and product use (IPPU)

Emissions from the IPPU sector are regulated by the duty for manufacturing industries to implement *best available technologies* (BAT) (stipulated in the *Industrial Emissions Act (IEA)* and *Industrial Emissions Directive 2010/75/EU*). A production plant has to comply to 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.

The already in place WEM measure **Bans and duties from the Regulation (EU) No 517/2014 on fluorinated greenhouse gases and Directive 2006/40/EC related to emissions from mobile air conditioners (MACs)** (PaM ID# 38), that affects GHG emissions in IPPU sector, consists of two policies:

- *Regulation (EU) No. 517/2014* on fluorinated greenhouse gases. This regulation affects only GHG emissions, the same way in WEM and WAM scenarios. The effect is ongoing at least until 2030. The objectives are to significantly reduce fluorinated greenhouse gas emissions and replace fluorinated greenhouse gases by refrigerants with low GWP, limiting the total amount of the most important F-gases that can be sold in the EU from 2015 onwards and phasing them down in steps to one-fifth of 2014 sales in 2030. To achieve this, a phase down scheme of F-gases brought onto 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.
- *Directive 2006/40/EC* related to emissions from mobile air conditioners (MACs) affects only GHG emissions, the same way in WEM and WAM scenarios. The objective of MACs Directive 2006/40/EC is to reduce F-gas emissions from passenger cars and pick-up vehicles by prohibiting the use of F-gases with a global warming potential 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 produced from 2017.

No additional measures are planned specifically for the IPPU sector. The cross-sectional Transport and IPPU sector WEM and WAM scenario measures are described in Chapter 2.7.

2.4. Agriculture

Development of the Agriculture sector and the implementation of various targeted measures are mostly governed by the *Estonian rural development plan 2014–2020 (ERDP)*¹, the

¹ Estonian Rural Development Plan 2014–2020. [www] <https://www.agri.ee/et/eesmargid-tegevused/eesi-maaelu-arengukava-mak-2014-2020> (26.02.21).

*Agriculture and fisheries development plan until 2030 (AFDP)*², which is being prepared, *Climate change adaptation development plan until 2030*³ and the *General principles of climate policy until 2050 (GPCP 2050)*⁴. Climate change mitigation and adaptation have been considered in the development of different measures, and directly or indirectly the majority of environmental and investment grants along with different environmental awareness-raising activities contribute to these efforts in the *ERDP*. The measures of *ERDP* which are reported in Reportnet dataset Table 1 are extended until the year 2022 due to the time-consuming process of developing post-2020 Common Agricultural Policy (CAP).

One of the *ERDP* priority areas is **reducing GHG and ammonia emissions from the agricultural sector** which aims to include 49.6% of the agricultural land currently in use under economizing agreements by 2022. The objectives include promoting the use of biomass, producing renewable energy, investing in livestock buildings (incl. manure storage) and increasing the technological capacity of agricultural enterprises.

WEM scenario measures of *ERDP* that contribute to reducing GHG are the following:

- 1) **Knowledge transfer and awareness** (PaM ID# 63) – The general objective of the measure is to develop and enhance the technical, economic and environmental knowledge of the enterprisers and their employees in the agriculture, food and forest sector to improve the bioeconomy and adapt to new challenges to use resources sustainably. The measure aims to promote organisation of educational trainings, presentations, awareness-raising activities, organising workshops or visits to enterprises and long-term programs.
- 2) **Advisory services, farm management and farm relief services** (PaM ID# 64) – The general objective of the measure is to enhance the sustainable management or effectiveness of agricultural holdings or enterprisers by providing high-quality advisory services to the people working in the agriculture sector. Advisory services include inter alia environmental and climatic topics.
- 3) **Agri-environment-climate measure** (includes seven sub measures: four affecting agriculture sector and three cross cutting measures affecting both LULUCF and agriculture sector and therefore reported in Chapter 2.7) (PaM ID# 110):
 - **Regional water protection support** – The objectives are to prevent and reduce water nitrogen pollution to preserve the water quality by decreasing agricultural soil leaching.
 - **Support for environment-friendly horticulture** – The general objective is to promote the use of environment-friendly practices in gardening. One of the more specific aims is to decrease leaching.
 - **Support for growing local plant varieties** – The objective is to ensure the preservation of the local plant varieties valuable for cultural heritage and genetic diversity. The measure helps to preserve crop varieties more suitable for local conditions (more resistant to locally spread diseases and climate

² Agriculture and Fisheries Development Plan until 2030. [www] <https://www.agri.ee/et/pollumajanduse-ja-kalanduse-valdkonna-arengukava-aastani-2030> (26.02.21).

³ Climate Change Adaption Development Plan until 2030 [www] https://www.envir.ee/sites/default/files/national_adaptation_strategy.pdf (26.02.21).

⁴ General Principles of Climate Policy until 2050 [www] <https://www.envir.ee/en/news-goals-activities/climate/general-principles-climate-policy> (26.02.21).

conditions) and therefore gives a good basis for developing new breeds and supports organic farming.

- **Support for keeping animals of endangered breeds** – The objective is to ensure the preservation of animal breeds that are endangered and considered important for cultural heritage and genetic diversity.
- 4) **Organic production** (PaM ID# 40) – The objectives of the measure are to develop organic production, increase the competitiveness of organic production, preserve and improve biodiversity and landscape diversity, preserve and enhance soil fertility and water quality and develop animal well-being. The measure helps to reduce GHG emissions by using organic fertilizers instead of mineral fertilizers. Additionally, emission per one hectare is lower compared to the conventional production.
 - 5) **Animal welfare support** (PaM ID# 68) – The measure should reduce animal stress level, e.g. by having more space per animal. Having less stress enables an animal to achieve better feed digestibility which reduces emissions from enteric fermentation.

The WAM scenario measure that affects GHG emissions is the following:

- 1) **Improvement of manure management** (PaM ID# 109) – CO₂ reduction potential is reflected by significantly lower CH₄ emissions from covered storages compared to uncovered storages with a natural crust. The measure is targeted at agricultural holdings. Methane emission is 70% smaller from covered storages than from uncovered storages. Further, more accurate reductions in greenhouse gas emissions need to be explored through ongoing research and pilot projects.

The NIP scenario measures that contribute to reducing GHG are the following:

- 1) **Studies and pilot projects** (PaM ID# 105) – The studies and pilot projects would enable to evaluate the effect of different agricultural practices and technologies on climate more precisely and to develop country-specific emission factors. This is a prerequisite for the effective development and implementation of several agricultural and EU Common Agricultural Policy's measures, as the impact of these measures will contribute to meeting Estonian climate policy objectives only in case if the impact of these measures can be reflected in GHG inventory.
- 2) **Audits in large agricultural holdings** (PaM ID# 107) – The objective of the measure is to develop an auditing system of nitrogen, phosphorus and CO₂ for large agricultural holdings and to give resulting improvement recommendations, thereafter. The measure would cover the development of methodology, training of the audit team and conducting the audits.
- 3) **Support for site-specific fertilization equipment** (PaM ID# 108) – The measure supports the purchase of equipment for site-specific fertilization to enable to reduce the use of nitrogen fertilizers. The objective is to enhance the efficiency of fertilizer use by using site-specific fertilization equipment (e.g., GPS, equipment for incorporating manure and mineral fertilizers).

The *Accession Treaty* for the new members of the European Union specified that the measures of the *Nitrates Directive* had to be implemented in Estonia by the end of 2008. Therefore, a *Code of Good Agricultural Practices* was agreed upon between the Ministry of Rural Affairs and the MoE in 2001 and an Action Programme for the establishment of Nitrate Vulnerable Zone (NVZ) was defined with the aim of being implemented by the end of 2008.

Actions to reduce nitrogen losses from agriculture, for example, based on the requirements of the *Nitrates Directive*, 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. In 2001 the *Code of Good Agricultural Practices* (updated in 2020) and a Government decree on water protection requirements for fertilizer, manure and silage (revised several times) were introduced and both of these are relevant to Annex II and III in the *Nitrates Directive*. The *Water Act* (RT I, 22.02.2019, 1) is one of the principal legal acts that the prime measures in the *Estonian Water Management Plan measure programme 2015–2021* are grounded upon. Measures in the *Estonian Water Management Plan measure programme 2015–2021* striving to limit nitrogen exposure from agriculture to the environment are based on the *ERDP* and its measures.

2.5.Land use, land-use change and forestry (LULUCF)

The *Forest Act* (RT I, 30.12.2020, 8) 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 recovery of the forest after logging or natural disaster. According to the *Forest Act*, the forest owner is obliged to ensure reforestation 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.

Estonian Forestry Development Plan until 2020 (EFDP 2020) determines the forestry targets for 2011–2020 and describes the measures and resources to achieve these targets. The main objective of the *EFDP 2020* is to ensure forest productivity and vitality, and the diverse and efficient use of this resource. One of the objectives of *EFDP 2020* is to increase the forest increment and carbon capture ability via the relevant forest management activities like regeneration cutting, cleaning and thinning. The main criterion for sustainable forest management in the long run is the use of forest resource in as uniform manner as possible in the extent of growth. Use of forests in the limits of growth will ensure constant income for the society, at the same time maintaining the ability of forests to offer economic, social, environmental and cultural benefits. The *EFDP 2020* includes also methods for the protection of natural processes and threatened species which helps to achieve the objectives set out in the Extended Programme of Work on Forest Biological Diversity, Global Strategy for Plant Conservation and the Programme of Work on Protected Areas of the Convention on Biological Diversity. Financing of the *EFDP 2020* measures that are considered in projections continues and they are likely to be included also in the next Forestry Development Plan.

The Ministry of the Environment started to draw up the *Forestry Development Plan 2021–2030* in December 2017 by forming a necessary work group for compiling the terms of reference of the development plan. The task of the work group is to find out the forestry problems to be solved and draw up the terms of reference. After completion of the terms of reference, the Ministry of the Environment will coordinate it with the stakeholders and other ministries. Drawing up the development plan considers the sectoral guidelines set in *GPCP 2050*.

The *Nature Conservation Development Plan until 2020 (NCDP)* is a strategic base document for the development of sectors related to the conservation and use of nature. The goals of *NCDP* include enhancing the nature-awareness of people, ensuring the favourable conservation status of species and habitats, and long-term sustainability of natural resources.

Achieving the objectives of the *EFDP 2020* and *NCDP* is supported by the *ERDP*, through which the measures for supporting the private forestry, and maintaining semi-natural habitats and Natura 2000 sites are (co-)financed. One of the objectives set in *ERDP* is to reduce GHG emissions and promote carbon conservation and sequestration in agriculture and forestry. The measures of *ERDP* have been extended until 2022.

According to *Earth's Crust Act* (RT I, 10.07.2020, 59) 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 recognized value or to any other kind of land that can be used for beneficial purposes.

Specific measures that are already in place and included in the WEM scenario are the following:

- 1) **Increasing the net increment of forests for alleviating the climate changes and capability of carbon capture via timely reforestation** – The overall objective of the measure is to support activities related to timely regeneration of forests in order to mitigate climate change.
- 2) **Promoting reforestation of the managed private forests with the habitat type compatible tree species** – The measure grants the supply of tree species suitable for the habitat type to promote efficient and fast regeneration of private forests.
- 3) **Reduction of environmental impacts related to the use of fossil fuels and non-renewable natural resources by increasing the Estonian timber production and use** – The objective of the measure is to encourage timber production and use in Estonia through supported activities.
- 4) **Conservation of biological processes and maintenance of species common in Estonia** – The aim of the measure is maintaining biological processes in Estonian forests, including preserving the natural processes and population of species that are common to Estonia. The measure also includes Natura 2000 support for private forest land.
- 5) **Investments to the forest area development and improvement of the vitality of forests** – The overall objective of the measure is sustainable and effective forest management which promotes increasing the vitality of forests by improving its species composition or implementing other silvicultural techniques, maintaining and restoring forest biological diversity, integral ecosystem and protection function, helping to preserve the multifunctional role of forests and its spiritual and cultural heritage.

No additional measures are planned in the LULUCF sector. Cross-sectional measures with GHG reduction potential in Agriculture and LULUCF are described in Chapter 2.7.

2.6. Waste

General waste related requirements and rules are stipulated under *Waste Act* (RT I, 10.12.2020, 7) according to which all landfills had to meet the EU established requirements by 16 July 2009 and had to be conditioned in accordance with the requirements no later than 31 December 2015.

The Estonian *Waste Act* (RT I, 10.12.2020, 7) includes the following paragraphs to limit and reduce GHG emissions:

- 1) **Prohibition concerning percentage of biodegradable waste deposited** (PaM ID# 33) – the percentage of biodegradable waste in the total amount by weight of municipal waste deposited in landfills in Estonia shall not exceed: 45% by 16 July 2010; 30% by

16 July 2013 and 20% by July 2020. Reducing the amount of biodegradable waste deposited is also included in the *Estonian Waste Management Plan 2014–2020 (NWMP)*, extended until the end of 2022). The amount of biodegradable waste in the total amount by weight of municipal waste deposited in landfills was 57% in 2011 and decreased to 48% by 2014 and to 40% by 2018.

- 2) **Increasing reusing and recycling of waste materials** – to meet the requirements of the directive 2009/98/EC, the *Waste Act* stipulates that by 1st of January 2020, preparation for reuse and the recycling of waste materials such as paper, metal, plastic and glass from households and possibly from other origins as far as these waste streams are similar to waste from households, shall be increased at least to the extent of 50% of the total weight of such waste per calendar year. The same target is also included in the *NWMP*. The level of preparing for reuse and recycling of waste materials according to IV calculation method was 27% in 2011, which increased to 35% by 2014. The recycling rate in 2019 was 31%. The recycling rate of municipal waste will increase to 55% in 2025, 60% in 2030 and 65% in 2035 in accordance with the bill on amendments to *Waste Act* and *Packaging Act*. The amendment was not yet adopted during the compilation of the 2021 projections.

Establishment of waste management rules incl. adoption and updating the local waste management plan is stipulated under the *Local Government Organization Act* (RT I, 10.07.2020, 97) and is the responsibility of the local government. Most of the local government waste management plans also stipulate the prohibition of open burning of municipal solid waste (MSW).

The *National Environmental Strategy until 2030* includes the following policy:

- 1) **Reducing landfilling waste** (PaM ID# 114) – by 2030, landfilling waste is reduced by 30% and the hazard of waste is reduced significantly. Reaching the target is supported by measures that are included in the *NWMP*.

On 25.02.2021, the Government of Estonia adopted a decision to extend the *NWMP 2014–2020* retroactively until the end of 2022 as the *NWMP* and its objectives are still relevant. A report on the implementation of the *NWMP* until 2020 has been prepared. Estonia has also started preparing a new *NWMP 2023+*. The 4 main objectives of the new *NWMP* are: sustainable and conscious production and consumption, prevention of waste generation and promotion of re-use, increasing the safe circulation of materials and taking into account the effects of waste management on the human and natural environment as a whole. Thorough studies on waste management are currently underway (World Bank's analysis of the waste management sector funded by the European Commission under the Structural Reform Support Programme 2017-2020, and a domestic analysis of the future potential and support measures of the waste sector), which will be both completed in 2021. These studies will provide strategic direction for further planning of national waste policy and will be the basis of the new *NWMP*. The new *NWMP* is scheduled to be admitted by November 2022, the latest. This timeline also includes the execution of the strategic environmental assessment.

The objective of the current *NWMP* is to introduce sustainable waste management that follows the waste hierarchy principle, mainly focusing on modern product design, clean resource-saving productions and recycling of already produced materials. Also, the reduction of hazardous substances in materials and products. *NWMP* has set following target levels (Table 2.10).

Table 2.10. Target levels in NWMP

NWMP	Target level 2020, extended until 2022
Recycling percentage of biodegradable waste in the total amount by weight of municipal waste.	13%
The share of biodegradable waste in total landfilled MSW	20%
Recycling percentage of municipal solid waste in the total amount by weight of municipal waste.	50%

The current NWMP comprises following measures to limit and reduce GHG emissions:

- 1) **Limiting the percentage of biodegradable waste going to landfill and increasing the preparing for reuse and recycling of waste materials** (PaM ID# 113) – Increasing of recovery has to happen by preferring recycling of waste. Focus of the measure is to increase the volume of recycling of municipal waste, including increasing recycling of biodegradable waste and reducing the share of biodegradable waste in landfills, and developing a nationwide waste collection network with a more efficient reporting information system.
- 2) **Promoting the prevention and reduction of waste generated, including reducing the hazard of waste** (PaM ID# 115) – General objective of the measure is to improve the resource efficiency of the Estonian economy and to promote waste prevention in order to reduce the negative effects on the environment and human health.
- 3) **Reducing environmental risks arising from waste, improvement of monitoring and supervision** (PaM ID# 116) – General objective of the measure is to supplement the range of methods used for the management of hazardous waste and to reduce the environmental risks associated with waste disposal.

In 2013, Eesti Energia finished building the modern and efficient waste-to-energy power unit at the Iru power plant to generate heat and electricity from mixed municipal waste. With the completion of the Iru waste-to-energy unit, it was possible to decrease the large-scale depositing of mixed municipal waste in landfills. In Iru's *Air pollutants emissions reduction action plan 2013–2030* it is estimated that the maximum total amount of mixed municipal waste used for energy production is 260 kt per year. Iru CHP plant is mostly burning Estonia's mixed municipal waste that is supported by imported waste to keep up the yearly capacity target of 260 kt.

Circular economy

The purpose of circular economy is to decouple economic growth from the use of primary raw materials by creating a circular system of manufacturing and consumption with minimal losses. Transition from a wasteful, linear economic model to a circular economy requires a systemic change throughout the value chain of a product, from product design to new business models and consumption patterns. For new and existing products, the main focus is on life-cycle design, emphasizing on the sustainable material selection (avoiding or reducing hazardous substances), on quality (long product life, the potential for repairing products), supply chain optimization (local raw material preferred) and recycle / reuse (component segregation and recycling). In addition to smart designs, research and development, eco-innovation, technological development, the collaborative economy also have an important role.

Circular Economy is a cross-cutting principle, which is why cooperation between companies and international agreements are important, creating significant opportunities for new markets

and partnerships. The role of the state in the transition is to create favourable conditions for the implementation of the circular economy principles and to remove barriers. In order for the circular economy to reach its full potential, systemic thinking and change throughout the socio-economic system are needed to bring real changes in consumption, production, planning, politics, lifestyle, culture and values.

Materials management, including the production, consumption and disposal of materials, products and infrastructure, contributes a major share of global greenhouse gas emissions. The circular economy has a direct contribution to reducing GHG emissions e.g. through resource-efficient production and consumption, extending product lifespan, innovative business models that reduce dependence on and use of primary raw materials and material losses or developing waste management and recycling and preventing downcycling, reducing the need to produce new products and materials.

By the end of 2021, Estonia aims to develop a circular economy strategic approach and action plan, led by the Ministry of the Environment, to accelerate the transition towards a more circular Estonia. Those documents will set the direction and framework for the objectives of Estonian circular economy. The development paper and action plan are planned in cooperation with all parties involved and are divided into the following steps:

1. Studies: Development of Circular Economy Indicators (2019) and Mapping the Current Situation of the Estonian Circular Economy (2020-2021)
2. Development of a circular economy development paper and action plan (2020-2021)
3. Involving stakeholders and all ministries throughout the process
4. Support Programmes (EU and local funds)

The Circular Economy Programme supports the implementation of circular economy solutions through the Environmental Investment Centre. The purpose of the Circular Economy Programme is to support research and development in environmental management, waste, earth's crust, chemicals and related activities, resource efficiency, adoption of circular economy principles, prevention of waste and emissions, environmental awareness-raising and sustainable consumption and production solutions and its wider use.

2.7. Cross-sectoral parameters and measures

Following cross-cutting priority and measures with the potential for GHG reduction in both LULUCF and Agriculture sector WEM scenario are:

- 1) **Fostering carbon conservation and sequestration in agriculture and forestry (ERDP priority)** (PaM ID# 69) with an aim to have at least 14.8% of the agricultural and forest land currently in use, under management practices which enhances further carbon sequestration by the year 2022. The priority is supported by the regulation on Good agricultural and environmental conditions of land, in which is stated that the proper agrotechnical techniques to hinder erosion has to be implemented when cultivating the arable land on the areas where the slope exceeds 10%. The appropriate techniques include soil cultivation across the slope, establishing permanent grassland, growing grass, minimizing soil cultivation, establishing buffer zones on the hillslopes or on the shores of water bodies or any other activity that inhibits the soil erosion.
- 2) **Natura 2000 support for agricultural land (ERDP)** (PaM ID# 58). The overall objective of the measure is to ensure conformity with nature protection requirements in Natura 2000 network areas, to maintain agricultural activity in those areas and help to adopt with limitations, resulting from the implementation of Directives 2009/147/EC

on the conservation of wild birds and 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, in order to ensure the efficient management of Natura 2000 areas.

- 3) **Payment for agricultural practices beneficial for the climate and the environment** (PaM ID# 112) (a measure based on the Regulations (EU) No 1307/2013 and (EU) No 639/2014) aims to implement climate and environmentally friendly farming practices. Greening contributes to the maintenance of permanent grassland, soil and water quality, and to the improvement of biodiversity through crop diversification, the maintenance of permanent grassland and the existence of ecological focus areas.
- 4) **Securing protection of habitats (NCDP)** (PaM ID# 62). The objective of the measure is to improve the conservation status of at least 14 habitat types in Estonia. The immediate outcomes of the measure are the restoration and maintenance of semi-natural grasslands (45 000 ha), and the restoration of fen and transition mire habitats and raised bog margins (lag-zones, mixotrophic and ombrotrophic forests, degraded raised bogs still capable of natural regeneration) in protected areas (10 000 ha). The expected effect of the measure is to reduce GHG emissions from degraded raised bogs in protected areas and to protect semi-natural grasslands.
- 5) **Agri-environment-climate measures (including seven sub-measures) (ERDP)** (PaM ID# 110). The common sub-measures of Agriculture and LULUCF sector are the following:
 - **Support for environmentally friendly management.** The objectives are a) to promote the introduction and continual use of environmentally friendly management methods in agriculture, in order to protect and increase biological and landscape diversity and to protect water and soil conditions; b) to promote environmentally friendly planning in agriculture and c) to raise environmental awareness of agricultural producers.
 - **Regional soil protection support.** The general objective is to ensure the sustainable use of eroded and peat soils and to minimize soil degradation by improving management of soils and using other activities improving cropland management. The measure includes bringing agricultural lands with erosion and peat soils under permanent grassland.
 - **Support for maintaining semi-natural habitats.** The general objective is to ameliorate the conditions of semi-natural habitats and its species by improving grazing land or grassland management.

Cross-cutting Agriculture and LULUCF sector NIP measure **neutralization of acid soils** (PaM ID# 95) is still under discussion and henceforth reported as planned and thus is not used in calculations of GHG emission projections. The aim is to neutralize the acid soils to achieve the optimum conditions for plant growth. As a result, the loss of agricultural land in use can be avoided and the soil carbon pool will be increased.

Following cross-cutting priority and measures with the potential for GHG reduction in both Energy and Agriculture sector WEM scenario are:

- 1) **Facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw material for purposes of the bioeconomy** (PaM ID# 39). The main requirement underlined within this priority is to support the production of heat and electricity from biogas.
- 2) **Investments into diversification of non-agricultural economic activity in rural regions (ERDP)** (PaM ID# 82). Under this measure investments for producing renewable (bio-, solar, wind) energy is supported to gain an increase in renewable energy. The input of bioenergy production can be of agricultural origin, e.g., manure or

crop residues. The measure is aiming to benefit wider society, e.g., to produce bioenergy for sale.

- 3) **Investments into improved performance of agricultural holdings (ERDP)** (PaM ID# 65). The objectives of this measure are to improve animal waste management systems by supporting reconstruction or construction of new livestock facilities (incl. manure and silage storage facilities) and gain an increase in renewable energy and improving its production by providing investments into bioenergy. Another objective of the measure is to increase the competitiveness of agricultural producers so that the producers would get support for their agricultural work. For instance, the bioenergy produced with the support is used for the farm activities.

Cross-cutting Agriculture and Energy sector NIP scenario measure **producing bioenergy and increasing its share in the agriculture** (PaM ID# 111) is still under discussion and henceforth reported as planned and thus are not used in calculations of GHG emission projections. The measure aims to support the establishment of agricultural biomethane stations that would use manure, plant biomass and different biodegradable waste as an input. The measure is targeted at small or middle-sized installations (200–500 animal units).

Following measures affect mainly the Transport sector in the WEM and WAM scenarios (see Chapter 2.2, but also have a small effect on IPPU sector WEM and WAM scenarios through a reduction of final energy demand for road transport and diesel fuel exhaust fluid (usage of Ad Blue is reported under IPPU sector, see Chapter 3.2.3.1):

WEM measures

- 1) **Promotion of economical driving**, which includes promoting the eco-driving.
- 2) **Road usage fees for heavy duty vehicles**, which includes a system of road usage fees for heavy duty vehicles. The system is based on time.
- 3) **Developing the railroad infrastructure (includes the building of Rail Baltic)**, which includes building Rail Baltic, additional stops and raising speed limits. IPPU sector is affected through the modal shift to railroad transportation.

WAM measures

- 1) **Additional promoting economical driving**, that includes additional implementation of the measure "Promotion of economical driving", which means a public campaign to raise awareness and that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.
- 2) **Road usage fees for heavy duty vehicles**, with a system is based on mileage.
- 3) **Heavy duty tyres and aerodynamics**, which introduces better rolling resistance tyres and improves the aerodynamics of vehicles. The training materials for truck drivers will be complemented to highlight the importance of checking tyres and tyre pressures.

3. PROJECTED GREENHOUSE GAS EMISSIONS UNTIL 2050

3.1. Key assumptions and parameters used

The key underlying assumptions used in the projections are presented in Reportnet 3 dataset Table 2 and Table 3.

3.2. Sectoral projections

Detailed information on sectoral projections with WEM and WAM scenarios are presented in Reportnet 3 dataset Table 1

3.2.1. Energy

3.2.1.1. Methodology

Two projections scenarios of GHG emissions have been calculated for the period from 2019–2050. Reference year 2018 used in projections is consistent with Estonia's 2020 submission to the UNFCCC on 15th of April 2020. The 'With Existing Measures' (WEM) scenario evaluates future GHG trends under current policies and measures. In the second scenario a number of additional measures and their impact are taken into consideration forming the basis of the 'With Additional Measures' (WAM) scenario.

The scenarios projecting GHG emission in the Energy sector are mainly based on the *NECP 2030* scenarios, for which numerous studies from the *Estonian Energy Development Plan until 2030 (EEDP 2030+)* were used. In addition, the scenarios were updated by the input from the Ministry of Economic Affairs and Communication, the Ministry of Environment and from the meeting points of the Government's Environment and Climate Commission.

The Balmorel model was used for the electricity generation projections in the electricity generation sector. It is a model for analysing the electricity and combined heat and power sectors in an international perspective while minimising the total costs of the system. The Balmorel model combines the approach of bottom-up modelling in a classic technical modelling tradition with top-down economic analysis, projections and forecasts. The main assumption for the projection was that step-by-step, the use of oil shale shall decrease for the production of electricity and increase for the production of shale oil. The retort gas that occurs as a side product during the production of shale oil is used for electricity production. The projected future usage of fuel based on the model was applied while using the emission calculations of the *2006 IPCC Guidelines*.

The projections for heat generation in the public heat and electricity generation sector are based primarily on the reconstruction rate of the *NECP 2030* scenarios. The projections in the heat production are based on the studies done in the process of compiling *EEDP 2030+*. The scenarios developed in the *EEDP 2030+* were used in combination with the methodology of the *2006 IPCC Guidelines*.

The projections of the GHG emissions of shale oil production in the Manufacturing of solid fuels and other energy industries were calculated based on input from the industry. The amounts of oil shale used and the rate of construction of new shale oil production plants were used for the GHG projections.

The GHG projections in the Manufacturing industries and construction sector and in Other sectors are also based on historical trends, long term real GDP growth rate (the Ministry of Finance) and the scenarios created in *NECP 2030*. The emissions are calculated based on the methodology of the 2006 IPCC and EMEP/EEA 2019 Guidebook.

3.2.1.2. GHG emissions projections

The Energy sector 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; Transport; Other sectors (Commercial/institutional, Residential and Agriculture/Forestry/Fishing/Fish farms sub-sectors) and Fugitive emissions from natural gas distribution. The GHG emission decrease in 2019 comparing to 2018 was mainly from the energy industries, because of the rise of ETS CO₂ quota price.

The Energy sector's projected emissions in the WEM scenario are presented in Figure 3.1. In the WEM scenario, the emissions are projected to decrease by 63.1% from 2018 to 2050. The largest absolute decrease occurs in the Energy industries.

The main electricity producer in Estonia is Enefit Energiatootmine AS incl. the Eesti Power Plant and the Balti Power Plant. Both of these plants mainly use oil shale for electricity production. Enefit Energiatootmine Plants are also the largest producers of GHG emissions in Estonia. Due to the phasing out of oil shale pulverized combustion in these plants and building of a more effective Auvere oil shale combustion plant, and the introduction of new shale oil production plants (fluidized bed combustion), GHG emissions are projected to decrease by 67.2% by 2050 compared to 2018 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 17.9% by 2050 compared to 2018. In this sector, only one WEM scenario is projected, as there are no additional planned policies or measures.

The emissions from the Transport sector are projected to decrease by 82.9% by 2050, mainly due to the uptake of alternative fuel vehicles (biomethane and electricity).

The emissions in Other sectors (Commercial/institutional, Residential and Agriculture/Forestry/Fishing/Fish farms) are expected to increase by 13.3% in 2050 compared to 2018.

The projected emissions of the Energy sector in the WAM scenario are presented in Figure 3.1. In the WAM scenario, the emissions are projected to decrease by 64.7% in the period of 2018 – 2050. The increased reduction of GHGs in the WAM scenario results from 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. Decreased GHG emissions also result from an increased amount of energy unions that help to produce energy more efficiently for certain locations or interest groups. The largest absolute decrease occurs in the Energy industries sector. The decrease is projected to be 68.8% in the period of 2018–2050.

The emissions of the Transport sector are projected to decrease by 84.7% by 2050 compared to 2018 in the WAM scenario. The larger decrease compared to the WAM scenario is caused by

implementing additional measures e.g. increasing the use of public transport, rail transport, also result in lowered private transport demand which in return lowers emitted GHGs.

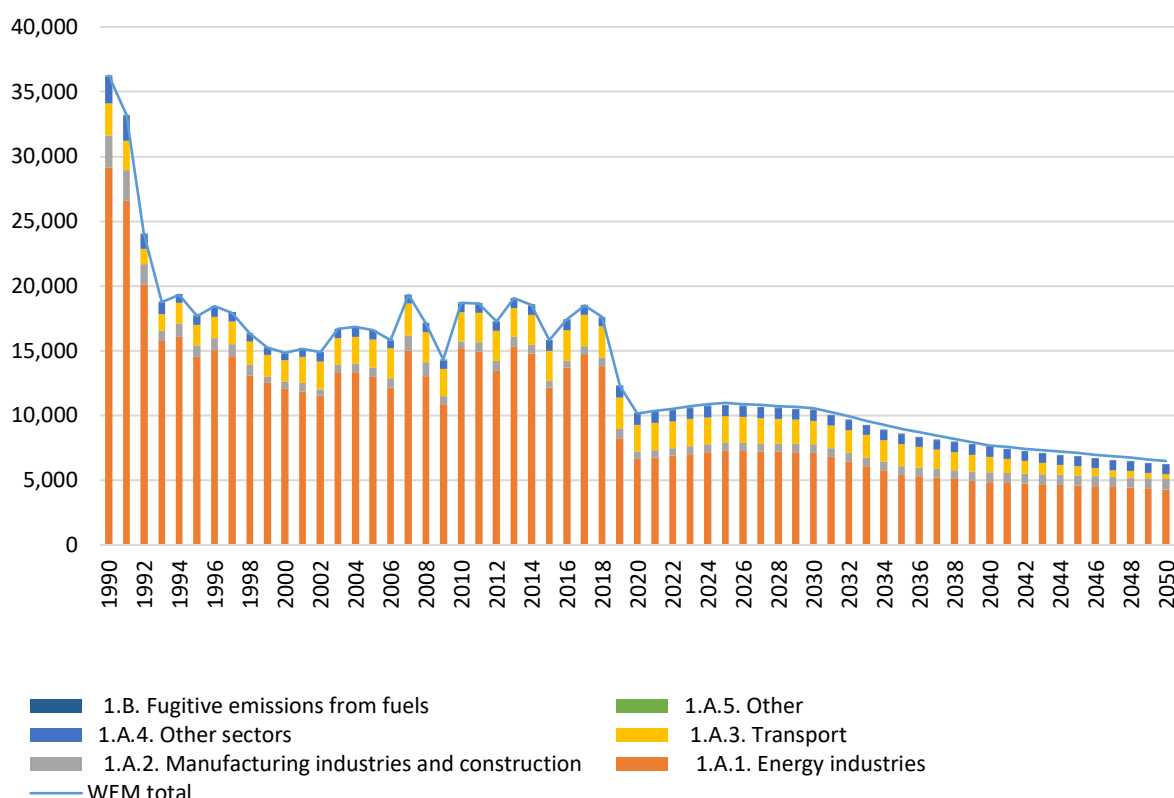


Figure 3.1. Historical and projected emissions from Energy sector in 1990–2050 according to the WEM and WAM scenario, kt CO₂ eq.

3.2.2. Transport

3.2.2.1. Methodology

Two projections scenarios of GHG emissions have been calculated for the period from 2019–2050. Reference year 2018 used in projections is consistent with Estonia’s 2020 submission to the UNFCCC on 15th of April 2020. The ‘With Existing Measures’ (WEM) scenario evaluates future GHG trends under current policies and measures. In the second scenario a number of additional measures and their impact are taken into consideration forming the basis of the ‘With Additional Measures’ (WAM) scenario.

The projections in the Transport sector are based on the information from the ITF report “*The Future of Passenger Mobility and Goods*”, Ministry of Economic Affairs and Communication, the Ministry of Environment and from the meeting points of the Government’s Environment and Climate Commission. As well as emission factor data from 2006 IPCC and EMEP/EEA 2019 Guidebook along with country-specific emission factors were used to estimate GHG emissions.

The projections for the WEM scenario are also in line with Regulation (EC) No 2019/631 of the European Parliament and of the Council. By year, the average emissions target for a new passenger car is 95 gCO₂/km and 147 gCO₂/km for light duty vehicles.

3.2.2.2. GHG emissions projections

The main share of GHG emissions in the Transport sector originate from road transport. Historically, the share of GHG emissions of road transport have been more than about 95% of total GHG emissions of the Transport sector.

The emissions in the Transport sector in the WEM scenario are expected to decrease about 82.9% in 2050 compared to 2018. The emissions in the Road transportation are projected to decrease in the future. The total projected GHG emissions in the WEM scenario are presented in Figure 3.2.

The emissions in the Transport sector in the WAM scenario are expected to decrease 84.7% in 2050 compared to 2018. Domestic aviation and the Railways emissions are expected to stay approximately at the same level (as in the WEM scenario) during the period of 2018–2050. Domestic navigation and Road transportation emissions are projected to decrease compared to the base year. The largest emission reductions occur in Road transportation sector – emissions are projected to decrease by 86.2% in 2050 compared to 2018 to a total of 324.82 kt CO₂ eq, which is the result of implementing additional measures that will help lower demand for private transport even more. The total projected GHG emissions in the WAM scenario are presented in Figure 3.2.

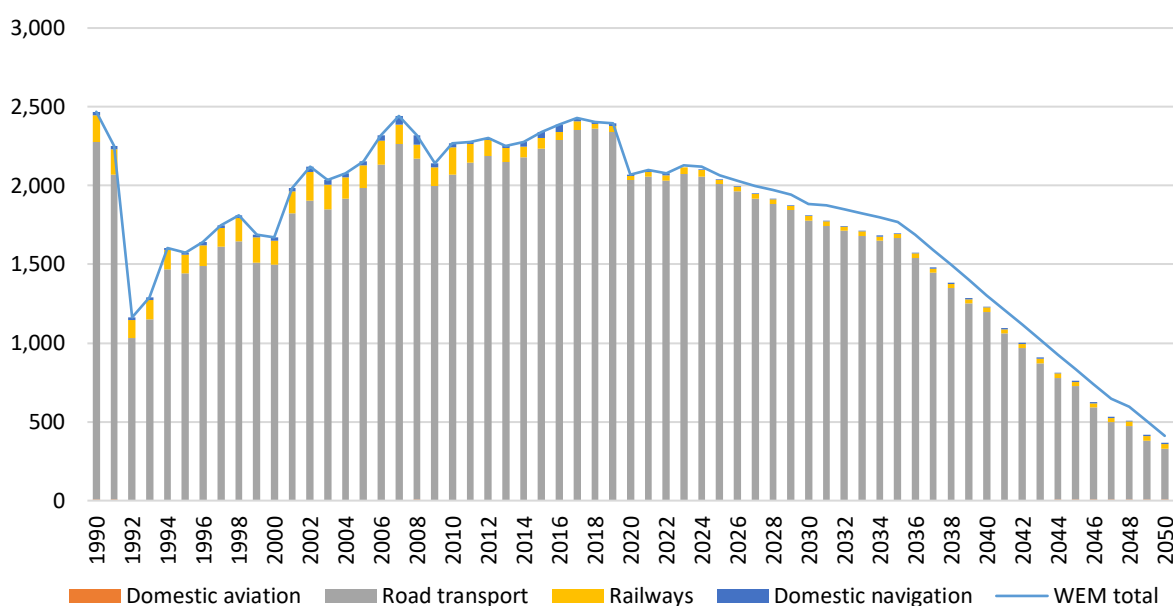


Figure 3.2. Historical and projected emissions from Transport sector in 1990–2050 according to the WEM and WAM scenario, kt CO₂ eq.

3.2.3. IPPU

3.2.3.1. Methodology

Two projections scenarios of GHG emissions have been calculated for the period from 2019–2050. Reference year 2018 used in projections is consistent with Estonia’s 2020 submission to the UNFCCC on 15th of April 2020. Emissions from IPPU sector are projected according to the ‘With Existing Measures’ (WEM) scenario, which evaluates future GHG trends under current

policies and measures and the ‘With Additional Measures’ (WAM) scenario, whereby WAM affects only the emission from urea-based catalysts for motor vehicles.

The Estonian industry sector is relatively small. The majority of emissions from subcategories, such as 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 (Statistics Estonia), the long-term real GDP growth rate (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.

Mineral industry’s projected emissions are based on industries’ operator’s projections taking into account planned production capacities and and/or maximal production capacities according companies’ environmental permits.

Chemical (ammonia) industry’s operator plans to relaunch the plant in 2024 if prices of urea and natural gas are favourable at this time. In 2024 the plant will comply with best available technique after modernization.

The Metal Industry’s projected emissions are based on industries’ operators production forecasts and quantities of raw materials they have used in past 5 years.

Consumption of lubricants is based on 2014–2019 consumption trend and projection of GDP growth rate and is slightly increasing.

Consumption of paraffin waxes (candles and other paraffin waxes) is affected by GDP growth and slight population decline and is projected to increase.

Indirect CO₂ emissions from Solvent use sector, affected both by GDP growth and population decline, are projected to decrease a little because of decreasing emission factors in domestic solvent use and coating (paint use) categories.

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 is consistent with projections of the Transport sector (see Chapter 3.2.2.1).

Emissions of fluorinated gases are projected according GHG inventory’s calculation methods. Emissions from each group of HFC-containing equipment are projected separately. Bans and restrictions stipulated in the *Regulation (EU) No. 517/2014* and *Directive 2006/40/EC* were taken into account. Trends in domestic market of refrigeration and air-conditioning could be seen from national database for F-gases (according Article 6 paragraph 2 of *Regulation (EU) No. 517/2014*). Some companies who service large commercial refrigeration systems were interviewed about their intentions towards restrictions of *Regulation (EU) No. 517/2014*. Trends in import of pre-charged air conditioning equipment could be seen from import reports of companies.

Emissions were 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 into account:

1. Bans on placing on the market e.g.:
 - stationary refrigeration equipment that contains HFC-s with GWP of 2500 or more (the ban comes into effect in 2020);

- commercial refrigeration equipment (hermetic equipment with HFC-s, multipack systems (40 kW or more) with HFC-s except multilevel cascade systems partly with HFC-134a (in 2020);
- single split stationary air conditioners and heat pumps that contain HFC-s with GWP of 750 or more (in 2025);
- fire protection equipment with HFC-23 (additionally, HFC-227ea containing fire protection systems have a sharply decreasing trend);
- one component foams that contain HFC-s with GWP 150 or higher
- ban of sale of new vehicles with EU type approval having refrigerant with GWP over 150 in air conditioner since 01.01.2017 is taken into account (according to the Directive 2006/40/EC);

2. Ban of refilling equipment that contain HFC-s with GWP of 2500 or more (in 2020).

It is assumed that an effect of completed project of promotion of alternative and low-GWP refrigerants is that majority of commercial and industrial refrigeration is switching to alternative refrigerants (CO₂ and NH₃ based systems respectively). In categories where use of banned, high-GWP HFC-s was subtracted but there is no information about alternatives, substitutions with lower GWP HFC-s were taken into account.

It was assumed that HFC refrigerants are properly collected from discharged equipment.

Projection of emissions from subsector 2.F.2 Foam blowing agents is based on forecasts of foam producers, real GDP growth rate and population size. Projection of emissions from 2.F.3 Fire protection is based on expert opinion from service companies concerning new equipment and a method of calculating the stock based on the GHG inventory. Projection of emissions from 2.F.4 Aerosols is based on trend of medical aerosol use in 2014–2019, population size and real GDP growth rate.

SF₆ emissions (from 2.G Other product manufacture and use) are not regulated by the *Regulation (EU) No. 517/2014*. SF₆ emissions were calculated according the methods of GHG inventory while taking into account plans on equipment replacement by the electrical network operators in Estonia.

Regarding N₂O – consumption of medical N₂O was predicted by wholesalers who explained that sales either stay at current level or decline slowly and consumption of N₂O in aerosols was calculated with projection of population size and average emissions of N₂O per population in 2017–2019.

3.2.3.2. GHG emissions projections

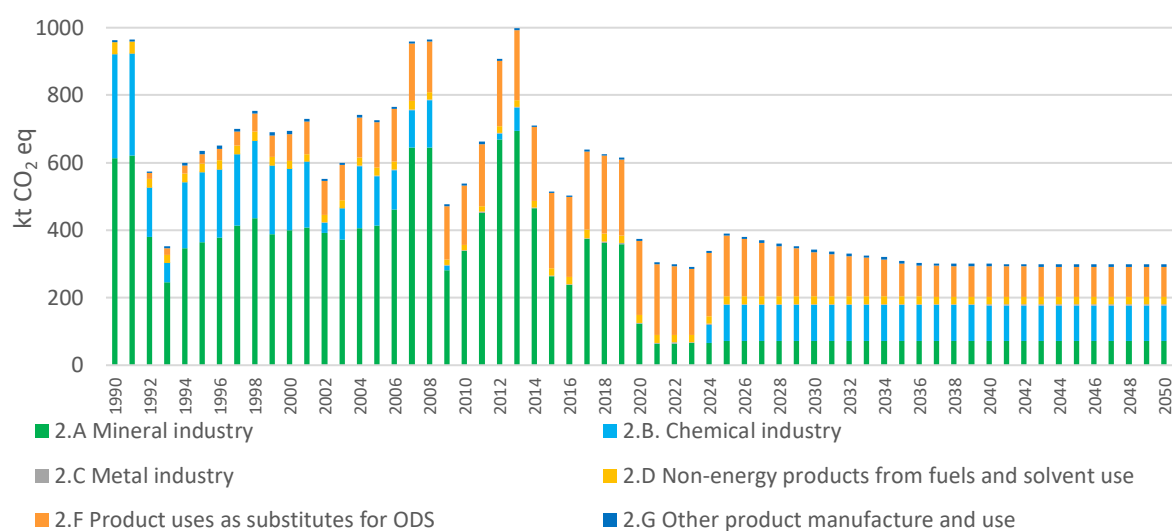
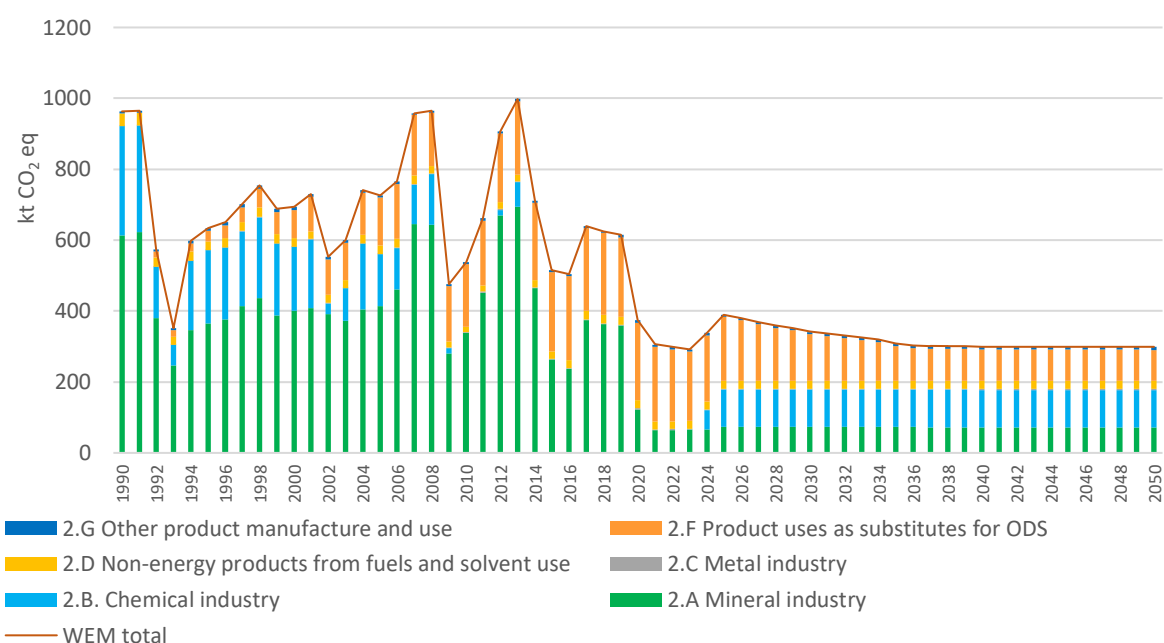
Emissions from IPPU sector are projected according WEM and WAM scenarios whereby WAM affects only the emission from urea-based catalysts for motor vehicles.

The WAM scenario for IPPU is projected because additional measures of transport – additional promotion of economical driving, road usage fees for heavy duty vehicles, vehicle tyres and aerodynamics – have effect on subsector 2.D.3 Other – Urea based catalysts for motor vehicles (the measure affects values of parameter Final energy demand for road transport and also diesel exhaust fluid consumption). In the WAM scenario diesel fuel consumption is decreased and consumption of urea-based diesel exhaust fluid also (Table 3.1).

Table 3.1. The comparison of emissions from AdBlue consumption, kt CO₂

		2018	2020	2025	2030	2035	2040	2045	2050
WEM	AdBlue consumption, kt	4.82	4.70	5.18	5.64	6.39	5.23	4.11	3.12
	Emissions, kt CO ₂	1.15	1.12	1.23	1.35	1.52	1.25	0.98	0.74
WAM	AdBlue consumption, kt	4.82	4.70	5.03	4.99	5.44	4.27	3.16	2.23
	Emissions, kt CO ₂	1.15	1.12	1.20	1.19	1.30	1.02	0.75	0.53

The historical and projected emissions in 1990–2050 according WEM and WAM scenarios are depicted in the Figure 3.3 and Figure 3.4 respectively.

**Figure 3.3.** Historical and projected emissions from IPPU sector (with Solvent use) in 1990–2050 according to the WEM scenario, kt CO₂ eq.**Figure 3.4.** Historical and projected emissions from IPPU sector (with Solvent use) in 1990–2050 according to the WAM scenario, kt CO₂ eq.

The overall emissions from IPPU sector are projected to decrease 52.2% from 2018 until 2050 in WEM scenario and 52.3% in WAM scenario. Main decrease comes from mineral industry (because a large plant ceases production) and product uses as substitutes for ODS (F-gases). Emissions from the chemical industry on the other hand might increase substantially because under favourable conditions ammonia production may start again.

Emissions from mineral industry actually decreased in 2020 when the cement industry ceased burning clinker in wet process kilns because it was not economically feasible anymore. The plant does not foresee starting the production again. Other mineral industries estimated future production volumes in 2025 either the same as in 2018-2019 or up to 50% higher. Nevertheless, total emissions from mineral industry sector remain ca 4 times lower than before shutdown of cement production.

In the only GHG emitting chemical industry – ammonia industry – production is planned to be restarted in 2024. In the first year the production is predicted to be 50% of the maximum and from 2025 onwards the production volumes are predicted to be almost maximal – 200 000 tonnes of both ammonia and carbamide. The emissions are calculated according the IPCC 2006 Guidelines⁵ and CO₂ captured into carbamide that is exported or used in agriculture is subtracted.

Emissions (both direct and indirect CO₂) from non-energy products from fuels and solvent subsector use (2.D.3) are projected to decrease little in WEM scenario –5.7% from 2018 until 2050) – and 6.6% in WAM scenario. This is because emissions from some subcategories (use of diesel exhaust fluid AdBlue and use of solvents) are projected to decrease and emissions from subcategories lubricant use and paraffin wax use are projected to increase. A smaller part of these emissions are CO₂ emissions from urea containing diesel exhaust fluid use which decrease 35.2% from 2018 until 2050 in WEM scenario and 53.9% in WAM scenario. This difference in WAM scenario is mainly caused by curbing diesel fuel consumption and urea containing diesel exhaust fluid consumption as a result of additional measures in transport sector.

Emissions from lubricants, paraffin waxes are projected to increase slightly, 27% and 15% respectively (up to 0.5 kt CO₂) from 2018 until 2050. Consumption of these products depends on economic situation of many small industries (linked to real GDP growth rate). Given the economic growth (Ministry of the Finance) these emissions are projected to increase slightly.

Emission of NMVOCs from Solvents sector and indirect CO₂ from NMVOCs is projected to decrease. Although the consumption of solvent containing products has an upward trend because of its correlation with GDP growth, the emission factors have a declining trend. Concerning paints (2.D.3.d Coating applications) probably the Directive 2004/42/CE on the limitation of emissions of VOCs from paints and varnishes and vehicle refinishing products has contributed to declining emission factors. The same declining trend of emission factors can be seen in domestic use of solvents (2.D.3.a) and it results from the restrictions of the regulations (EC) No 648/2004 on detergents, (EC) No 1223/2009 on cosmetic products and (EU) No 528/2012 on biocidal products. In some subcategories NMVOCs decrease because of declining population. In comparison to 2018 the emissions are projected to decrease by 10% by 2030 and stay at this level by 2040 and 2050.

Emissions of HFC-s (substitutes for ozone-depleting substances (ODS) are projected to be the same in WEM and WAM scenarios. HFC-s emissions projections have a linear declining trend until 2035 when they have decreased by 59% and after that they decrease little. The majority

⁵ IPCC 2006 Guidelines, Volume 3, Chapter 3, page 3.13.

of R-404A containing equipment (which installation and servicing bans are applying from 2020) should be decommissioned until 2035 and also most old split-type air conditioners and heat pumps.

Directive 2006/40/EC has a gradual effect on HFC emission until 2030 when most old vehicles equipped with HFC-134a based air conditioners should have been replaced.

By 2050 emissions from F-gases (in CO₂ equivalent) are projected to have decreased 62%. This will be the result of Regulation (EU) No. 517/2014 and measure consisting of project-based activities to support effects of the Regulation.

Emissions of SF₆ reported under CRF subcategory Other Product Manufacture and Use are projected to rise steadily until 2050 when they possibly will be 81% larger than today (according WEM and WAM scenarios). SF₆ insulated electrical equipment is not directly affected by *Regulation (EU) No. 517/2014*. Until 2030 new equipment is installed instead of old air insulated switchgear. After 2030 emissions continue to rise because of many SF₆ insulated equipment exceeding their service life will be decommissioned. After 2040 it is assumed that no more medium-voltage switchgear with SF₆ will be installed.

N₂O emissions from the subcategory Other Product Manufacture and Use are projected to stay at 2018 year's level until 2050.

3.2.4. Agriculture

3.2.4.1. Methodology

Two projections scenarios of GHG emissions have been calculated for the period from 2019–2050. Reference year 2018 used in projections is consistent with Estonia's 2020 submission to the UNFCCC on 15th of April 2020. The 'With Existing Measures' (WEM) scenario evaluates future GHG trends under current policies and measures. In the second scenario one additional measure is taken into consideration forming the basis of the 'With Additional Measures' (WAM) scenario.

Estonia's agricultural GHG emissions and its projections consist of CH₄ emissions from enteric fermentation of domestic livestock, CH₄ and N₂O emissions from manure management systems, direct and indirect N₂O emissions from agricultural soils and CO₂ emissions from liming and urea fertilization. Direct N₂O emissions include emissions from synthetic and organic fertilizers applied to agricultural soils, emissions from animal waste, emissions from crop residues, emissions from cultivation of organic soils and emissions from mineralization associated with loss of soil organic matter. Indirect N₂O emissions include emissions from atmospheric deposition and leaching and run-off.

Projections of emissions are calculated based on the 2006 IPCC methodology applied in the Estonian Greenhouse Gas Inventory. The projected numbers of animals have been received from the expert judgements of the officials of the Ministry of Rural Affairs. Also, projected amounts of mineral fertilizers used have been received from the Ministry of Rural Affairs. Global demand for meat- and dairy products along with suitable climatic conditions favour cattle production in Estonia to expand. With the supporting mechanisms of CAP raising sheep and goats may be presumed to grow moderately. Demand after lamb and goat meat, wool and milk will grow. The number of horses is projected to continue to rise. The population of rabbits is expected to remain at last five year's average while the population of fur animals is expected to stay at the last three years average level. The number of pigs is anticipated to rise distinctly at nearly the antecedent level of the outbreak of African swine fever (2014) by 2035 and will remain at the same level by 2050. The number of poultry production is expected to stay near

2018th year level. Feed intake parameters and the methane conversion rate are harmonized with the national GHG inventory. Gross energy intake of dairy cows was calculated on the basis of projected milk yields. Average milk yield per cow should increase until 2025. Projected values are in accordance with projections in *GPCP 2050*. Milk fat (%) for the projected period until 2050 was assumed to be the same level as in 2019 (3.89%).

Main activity data for the calculation of CH₄ and N₂O emissions from manure management are livestock population, data on animal waste management systems (AWMS) and milk yields.

For calculation of N₂O emissions from manure management systems the following projected parameters were used: livestock population, milk yield (kg/head/year) and AWMS systems. Estonia-specific volatile solids (VS) and N excretion values of dairy cows have been calculated on the basis of projected milk yields.

Projected N₂O emissions from the Agricultural soils' subsector are based on the amount of organic and synthetic N-containing fertilizers applied to soil, quantities of harvested crops and area of cultivated organic soils.

Estonia's crops production is projected to remain at the average level of the last five years. The use of synthetic fertilizers in Estonia is projected to increase until 2025 compared to 2018 and then to stay at stable level.

CO₂ emissions from liming are foreseen to increase compared to the present situation as the current level of liming used for neutralizing the naturally acidic agricultural soils is presently insufficient in Estonia. The calculations of emissions from liming are based on the planned measure Neutralization of acid soils and on a study "*Analysis of possibilities raising Estonia's climate ambition*".

Emissions from Agriculture sector are projected according WEM and WAM scenarios. According to the WAM scenario, the use of low-emission manure storage technologies (storage of liquid manure in tented roof or concrete roof storage facilities as well as in closed steel or plastic tanks) will increase by 2030 compared to 2018. The WAM scenario uses reduced NH₃ emission amounts from the report of Estonian Atmospheric pollutant emissions projections until 2050 as an input data for GHG projections.

3.2.4.2. GHG emissions projections

GHG projections were made using both, WEM (Figure 3.5) and WAM (Figure 3.6) scenarios. Differences of WEM and WAM scenario's results were caused by implementing the measure *Improvement of manure management*. WAM measure affected only Manure management and Agricultural soils sub-sectors due to the projected changes in the shares of types and covers of the manure stores. The values of the respective shares of WEM and WAM scenarios are presented in Reportnet dataset Table 3. As the measure aims to increase the share of covering of manure storages it decreases NH₃ emissions due to the decrease direct sunlight (temperature impacts) and wind effects on the storage surface. In the contrary, covering the manure storages increases N₂O emissions as more N₂O is emitted in anaerobic conditions. This caused the increase of WAM scenario's total GHG emissions from Agriculture sector compared to WEM scenario. According to the WEM scenario emissions from Agriculture sector will increase from 1437.79 kt CO₂ eq. in 2018 to 1603.13 kt CO₂ eq. (11.5%) by 2050. Increase in Enteric fermentation sub-sector is projected to be 72.90 kt CO₂ eq., Manure management 29.78 kt CO₂ eq., Agricultural soils 45.76 kt CO₂ eq., Liming 16.96 kt CO₂ eq. and decrease in Urea application 0.05 kt CO₂ eq. in 2050 compared to 2018. According to the WAM scenario emissions will increase from 1437.79 kt CO₂ eq. to 1604.22 kt CO₂ eq. (11.6%) by 2050.

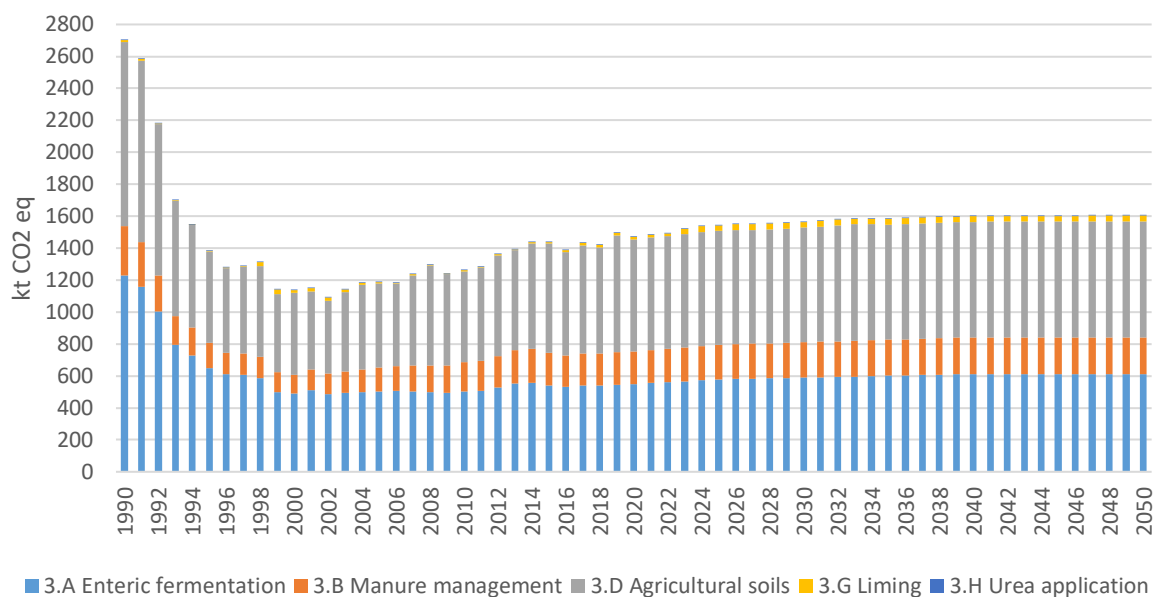


Figure 3.5. Total GHG emissions from Agriculture sector according to WEM scenario, kt CO₂ eq.

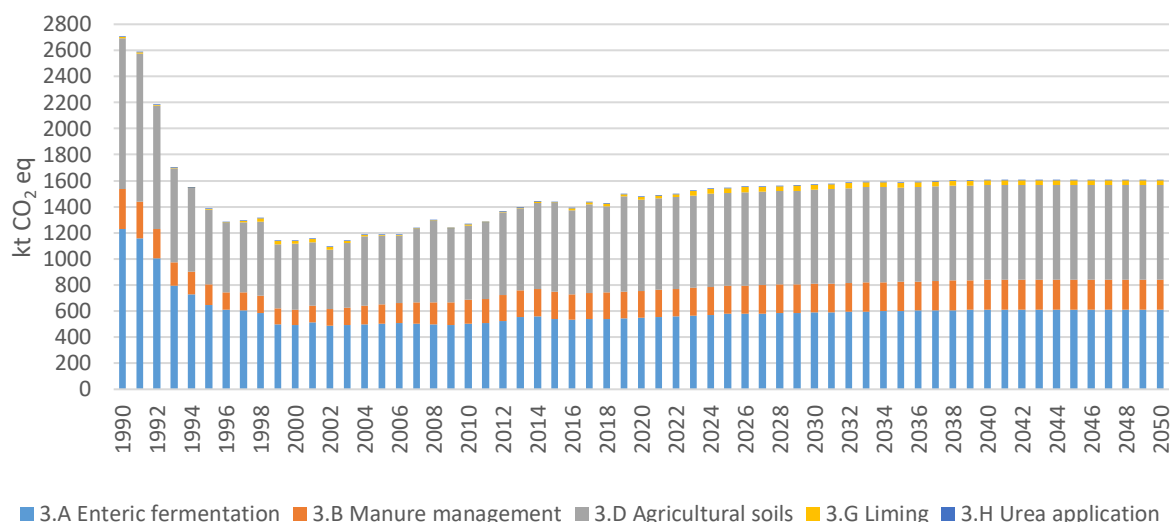


Figure 3.6. Total GHG emissions from Agriculture sector according to WAM scenario, kt CO₂ eq.

3.2.5. LULUCF

3.2.5.1. Methodology

LULUCF sector ‘With Existing Measures’ (WEM) scenario GHG projections have been calculated for the period from 2019–2050. Reference year 2018 used in projections is consistent with Estonia’s 2021 submission to the European Commission on 15th of March (2021 NIR). The use of the latest data was considered more appropriate as methodological changes have resulted significant recalculations of emissions compared to the 2020 submission. WEM scenario evaluates future GHG emission trends under current policies and measures.

LULUCF sector includes emissions and removals of GHG-s from Forest land, Cropland, Grassland, Wetlands, Settlements, Other land and Harvested wood products. As no specific measures have addressed future land use, the total areas of all land-use categories were expected to remain constant at the 2019 level. Following assumptions were made in projecting Forest land category:

- The projections for Forest land are based on the uniform final felling scenario composed by Estonian Environment Agency. An average even annual final felling area is assumed during the whole rotation period;
- The growing stock in Forest land remaining forest land is expected to increase slightly despite the moderate decrease of annual increment;
- Area of Land converted to forest land decrease linearly, reaching 20 kha in 2050. This assumption based on expert judgement. Total Forest land area expected to be stable and equal to the area in 2019;
- Carbon stock changes in soils and dead organic matter were estimated as the average of the 2015–2019 period;
- Non-CO₂ emissions from drained organic forest soils, N₂O emissions from N mineralization and leaching, and emissions from wildfires were estimated with similar approach. Projected CH₄ emissions from land converted to Forest land categories were reported as “IE” in the Reportnet dataset Table 1b as those emissions are included under Forest land remaining forest land category. N₂O emissions from land converted to Forest land (except for Grassland converted to forest land) are also included in Forest land remaining forest land category and reported as “IE” in the Reportnet dataset Table 1b.

Estimations for 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, calculation methodology is described in more detail in the *National Forestry Accounting Plan 2021–2025*.

Projections of CO₂ emissions from Cropland remaining cropland category were estimated using the methodologies described in the Estonia’s 2021 NIR (Chapter 6.3.2). Following assumptions were made:

- The area of long-term cultivated croplands in mineral soils, as well as the shares of crops with different C inputs will remain constant. Average values of the period 2015–2019 were used in calculations;
- Shares of areas with different tillage practices will remain at the 2019 level;
- The area of croplands on organic soils was also expected to be stable and equal to the area in 2019.

Projected GHG emissions from land conversion to croplands were calculated as the average of the 2015–2019 emissions. GHG emissions from wildfires were not estimated under Croplands category as they are considered insignificant in terms of the overall level and trend in national emissions (reported as “NE” in the Reportnet dataset Table 1b).

GHG emissions in the Grassland category were assumed to stay at the same level as the average of the 2015–2019 period. Projected CH₄ and N₂O emissions from biomass burning in the Grassland remaining grassland category also include emissions from Land converted to grassland and Wetlands categories (reported as “IE” under respective categories in the Reportnet dataset Table 1b).

The majority of emissions from the Wetlands category derive from the horticultural use of peat and from the surface of peat extraction areas. The latter was expected to remain at the same

level as in 2019, but peat extraction depends on the weather conditions and has large inter-annual variability. Therefore, long-term average emissions from the extraction of horticultural peat were calculated as the average of the last 5 years. Methodologies for estimating the emissions related to peat extraction are presented in Estonia's 2021 NIR. Losses of C due to land use change to wetlands were projected as the mean of 2015–2019.

Under the Settlements remaining settlements and Other land remaining other land categories, C stocks are assumed to be in equilibrium and projected CO₂ emissions were reported as “NA” in the Reportnet dataset Table 1b. Projections for Land converted to Settlements and Land converted to Other land were based on the average emissions for the period 2015–2019. Under Forest land converted to settlements, also GHG emissions arising from the deforestation due to the construction of Rail Baltic were taken into account; calculation methods have been described in Estonia's 2021 NIR (Chapter 6.6.2). Deforested area was taken as 560 ha⁶ and divided equally over the period 2023–2025. Emissions from biomass burning in settlements were considered insignificant in terms of the overall level and trend in national emissions and were not estimated.

3.2.5.2. GHG emissions projections

Since no additional measures are planned in the LULUCF sector, the WAM scenario emissions are equal to the WEM scenario emissions.

Projected area of land use by classes is presented in Table 3.2.

Table 3.2. Projected land use in the LULUCF sector, thousand hectares

Land use class	2018 (2021 inventory)	2019 (2021 inventory)	2020–2050
Forest land	2 450.4	2 450.1	2 450.1
Cropland	985.2	985.6	985.6
Grassland	276.9	276.0	276.0
Wetlands	424.0	423.9	423.9
Settlements	356.6	357.4	357.4
Other Land	40.8	40.9	40.9
LULUCF Total	4533.9	4533.9	4533.9

According to the projections, the LULUCF sector is expected to become a source of GHGs from 2031 onwards (Figure 3.7). Forest land and HWP will continue to sequester carbon, however in other categories, emissions occur throughout the period. Despite the moderate decline in felling rate, net annual increment in 2018 and 2019 has been lower than in previous years. The age structure of managed forests in Estonia is dominated by mature stands as approximately 39% of forest stands are more than 60 years old. Due to the high proportion of mature forests, management is needed to increase the carbon sequestration capacity. Although carbon sequestration will temporarily decrease in the coming years, it will increase in the long run. It is expected, that in 2031–2040 the CO₂ sequestration from forest land is going to decline to -1 277.8 kt CO₂ eq, due to the increasing share of very young and old stands where sequestration rate is lower. In 2041–2050, net removal from forest land will increase and reach -1 912.9 kt CO₂ eq.

⁶ Data from: Rail Baltic maakonnaplaneeringute KSH aruanne. [www] https://rbestonia.ee/wp-content/uploads/2017/08/KSH_aruanne_EP_etapp_2017-08-10_heakskiidetud.pdf

C sequestration in HWP will decrease from -701.9 kt CO₂ in 2020 to -328.0 CO₂ in 2050. It is likely that production will become more efficient and thus it can be assumed that production volumes and consequently carbon sequestration has been considered rather conservatively.

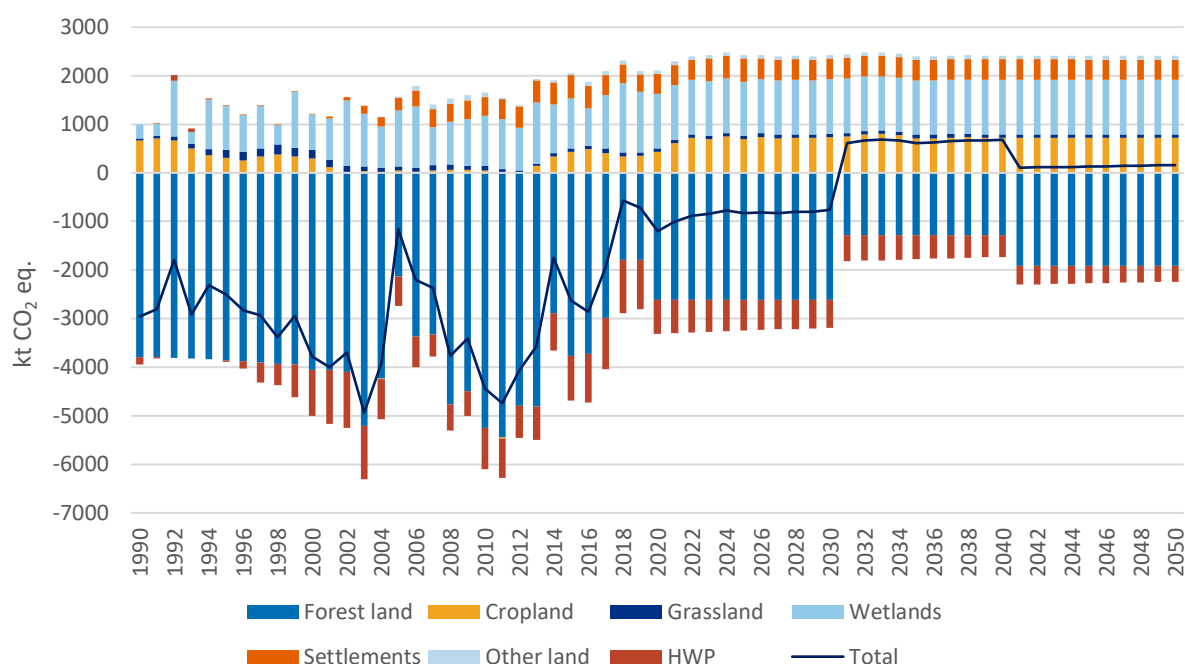


Figure 3.7. Total GHG emissions from LULUCF sector by land use class, kt CO₂ eq.

Emissions from the Cropland category are expected to increase compared to the current level, even so cropland area, land use and management practices are expected to remain the same. The reason behind this is that Estonia uses default method with aggregated activity data for calculating C stock changes in cropland mineral soils. According to this methodology, soil organic C reaches a stable value over 20 years given that land use and management practices do not change during that period. In 2040–2050, the projected emissions from the Cropland category are 722.8 kt CO₂ eq. Emissions originate mainly from cultivation of organic soils, smaller part also from land conversion to croplands.

Grassland category has been a small source of GHG emissions in recent years and this trend is expected to continue. Net emissions from the Grassland in the period 2020–2050 are estimated at 72.5 kt CO₂ eq., which is the average of the 2015–2019 emissions.

In total, estimated emissions from the Wetlands category for the 2020–2050 period were 1117.3 kt CO₂ eq., of which 961.0 kt CO₂ were *off-site* emissions from the production and use of horticultural peat.

Under the Settlements and Other land categories, only emissions arising from the land conversions have been reported. It was assumed that land conversions will continue to occur at the same level as the average of 2015–2019 and related emissions for the period 2020–2050 were estimated at 421.1 and 69.6 kt CO₂ eq. for the Settlements and Other land, respectively. Higher emissions from the Settlements category in the period 2023–2025 result from deforestation due to the construction of Rail Baltic. Changes in soil organic C stock take place during 20 years after deforestation event and cause small CO₂ and N₂O emissions until 2045.

The cumulative projected emissions/removals in accordance with *Regulation (EU) 2018/841* for the periods 2021–2025 and 2026–2030 are presented in Table 3.3. Cumulative emissions

are compared to the reference values or base period emissions for calculating the accounted quantities, except for the afforested and deforested lands, where total cumulative net emissions are accounted. According to the projections, total accounted removals exceed accounted emissions in the first commitment period. Accounting of Managed wetlands is mandatory starting from 2026, and Estonia has not selected this category for accounting in the 2021–2025 period.

Table 3.3. Projections of accounted emissions and removals from the LULUCF sector in accordance with Regulation (EU) 2018/841

Land use category	Summary emissions/removals, kt CO ₂ eq.		Reference value/base period emissions*	Accounted emissions/removals, kt CO ₂ eq.	
	2021–2025	2026–2030		2021–2025	2026–2030
Managed forest land (incl. HWP)	-15 629.02	-15 406.64	-8 700.00	-6 929.02	NA
Afforested land	-752.59	-657.10	-	-752.59	-657.10
Deforested land	2 802.48	2 665.60	-	2 802.48	2 665.60
Managed cropland	3 634.11	3 798.47	355.20	3 278.91	3 443.27
Managed grassland	74.81	74.81	156.99	-82.18	-82.18
Managed wetland	5 500.21	5 500.21	4 842.29	Not selected	657.93

*Managed forest land reference value is Forest Reference Level (FRL) multiplied by 5, other categories are compared with the average of period 2005-2009 multiplied by 5.

3.2.6. Waste

3.2.6.1. Methodology

Waste sector ‘With Existing Measures’ (WEM) scenario GHG projections have been calculated for the period from 2019–2050. Reference year 2018 used in projections is consistent with Estonia’s 2020 submission to the UNFCCC on 15th of April 2020. WEM scenario evaluates future GHG emission trends under 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 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 IPCC for estimating CH₄ emissions from solid waste disposal sites. The MSW generation projections take into account population projection (Statistics Estonia) and the long-term real GDP growth rate (the Ministry of Finance). The composition and the amount of generated MSW were also connected with the amount of incinerated MSW in Iru CHP plant, decrease percentage of biodegradable waste in the total amount by weight of MSW allowed to be deposited in landfills by 2020 and the increasing amount of biologically treated waste. *Mixed Municipal Solid Waste Composition Study* carried out in 2019 was used for a precise MSW composition projection. Real GDP growth rate was also used for projecting industrial waste generation.

Projections in the subcategory Biological treatment of solid waste are based on the long-term real GDP growth rate (the Ministry of Finance) applied to the previous year’s biologically treated solid waste amount. While calculating, it is considered, that the biodegradable waste in the total amount by weight of municipal waste recycling percentage will reach 13% by 2020

(*NWMP 2014–2020, extended to 2022*) and that there will be additional biodegradable waste from industrial sources (calculated under Solid waste disposal subcategory).

Only small amount of waste gets incinerated without energy recovery. Projections in the subcategory Waste incineration and Open burning was done using the assumptions of no open burning take place after 2030 and that small amount of waste will be incinerated without energy recovery (for burning contrabands, utilizing hazardous waste etc). Open burning of municipal solid waste is prohibited, nevertheless an expert judgment is used to evaluate the amount of waste that might be open burned based on the amount MSW generated. The MSW generation is in accordance with the subsector Solid waste disposal on land. Activity data about generated MSW is projected under SWD.

Projections of GHG emissions in Wastewater treatment and discharge subcategory account population projection (Statistics Estonia) and an expert judgement given by the MoE on the usage of different wastewater treatment types and the coverage of centralised wastewater system. Different wastewater treatment systems are covering both high and low density settlements. GHG emissions from Industrial wastewater, was conducted using a stable production throughout the time series of 2018-2050.

3.2.6.2. GHG emissions projections

Since there are no additional measures intended in the Waste sector then the WAM scenario emissions are equal to the WEM scenario emissions (Figure 3.8).

Compared to 2018, 2050 WEM scenario CO₂ eq. projections from Waste sector are projected to decrease by 46.3%. Emission decrease is mainly related to the increase of reusing and recycling waste materials, decreasing amount of biodegradable waste deposited in landfills and to waste incineration in Iru CHP plant. The decrease of 2050 emissions from Solid waste disposal subcategory are projected to be -83.5% compared to base year emissions. Increase in GHG emissions from biological treatment of solid waste (28.8% in 2050 compared to 2018) is correlated to the decreased amount of biodegradable waste in the total amount of solid waste disposed in landfills. The emission decrease from wastewater treatment and discharge (9.6% in 2050 compared to 2018) is connected with the expanding sewerage network.

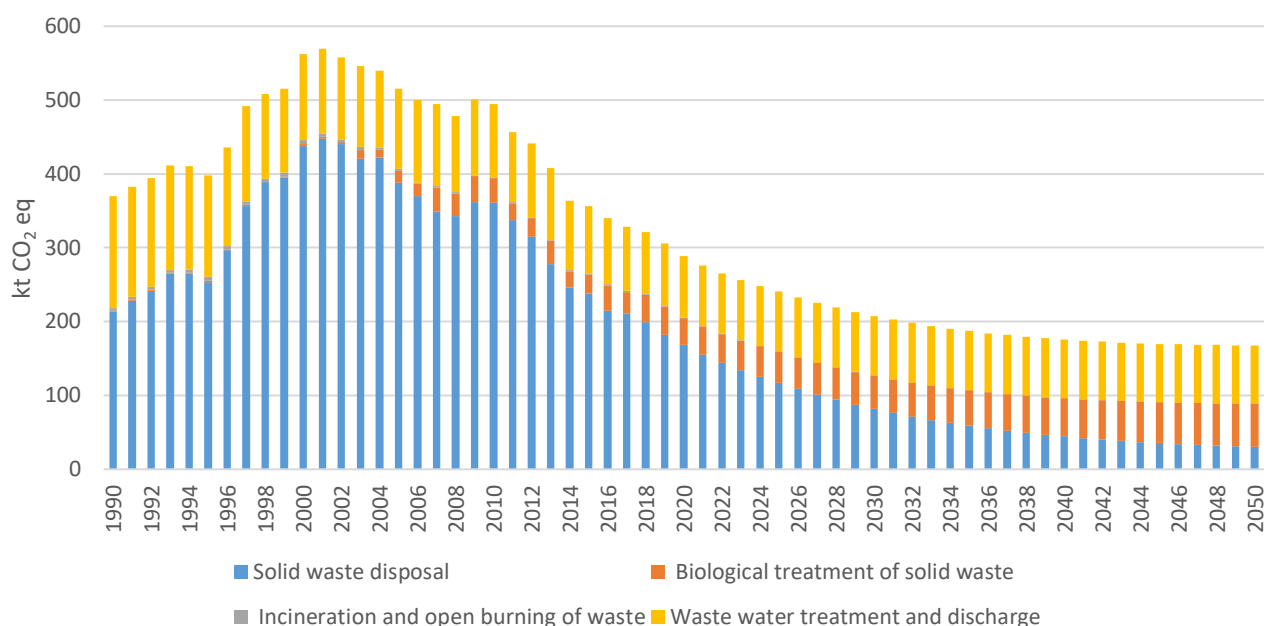


Figure 3.8. Total WEM=WAM GHG emissions from Waste sector 1990–2050, kt CO₂ eq.

3.3. Total projected GHG emissions of Estonia

Estonia's total projected GHG emissions are presented in Figure 3.9 and Figure 3.10.

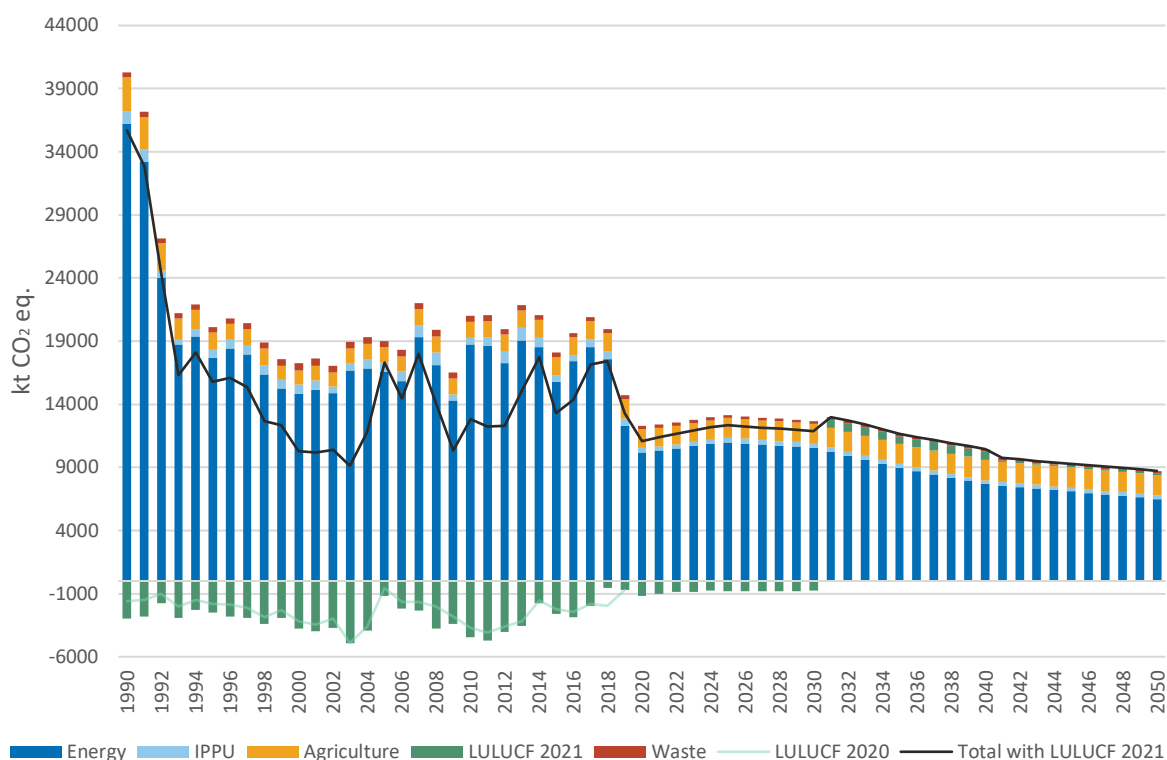
Energy, IPPU, Agriculture and Waste sectors' reference year 2018 used in projections is consistent with Estonia's 2020 submission to the UNFCCC on 15th of April 2020 (NIR 2020). LULUCF sector's reference year 2018 used in projections is consistent with Estonia's 2021 submission to the UNFCCC on 15th of April 2020 (NIR 2021) (see Chapter 3.2.5.1).

Estonia's GHG emissions are expected to decrease about 57.17% in the WEM scenario (without LULUCF) and about 58.55% in the WAM scenario (without LULUCF) by 2050 compared to the base year of 2018. GHG emissions in WEM scenario (with LULUCF) are expected to decrease about 55.07% and in the WAM scenario (with LULUCF) about 56.49% by 2050 compared to the base year of 2018.

Table 3.4 presents Estonia's GHG emissions' reduction commitments (%) under *Effort Sharing Regulation* (ESR) and *General Principles of Climate Policy 2050* (GPCP 2050) and compliance according to the current projections. Reference year 1990 used in compliance comparison is consistent with Estonia's 2021 submission to the UNFCCC on 15th of April 2020 (NIR 2021).

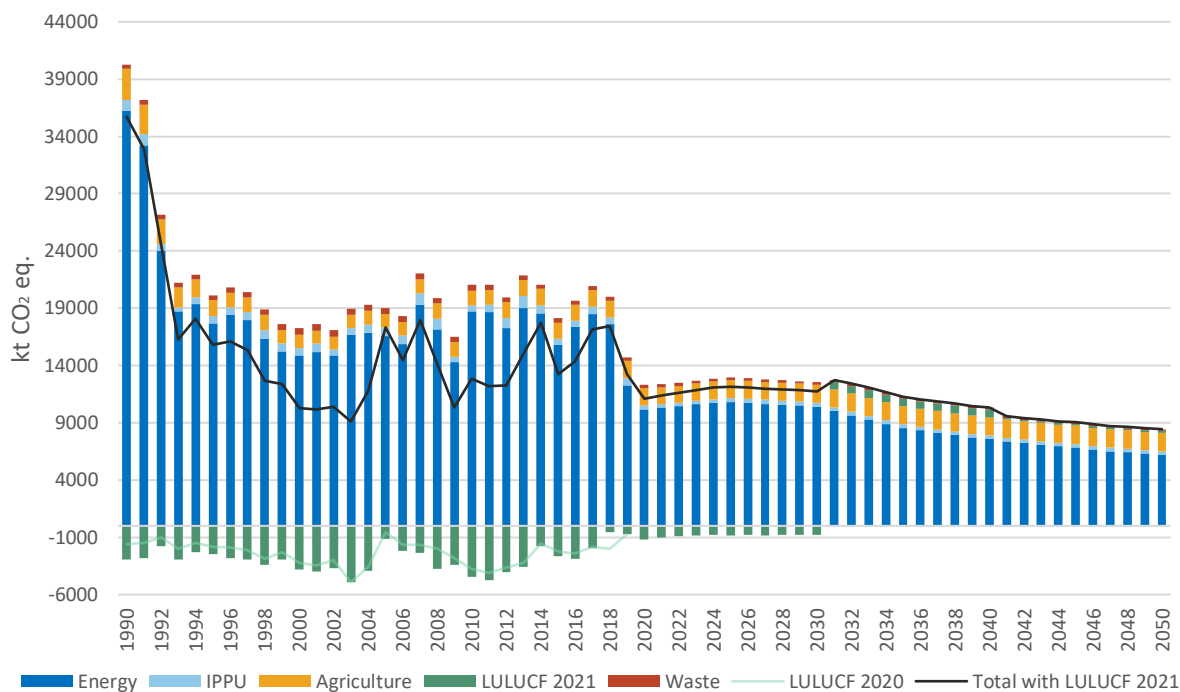
Table 3.4. Estonia's GHG emissions' reduction targets and compliance projections

Commitment	Target	Base year 1990, kt CO ₂ eq.	Base year 2005, kt CO ₂ eq.	Target year 2030, kt CO ₂ eq.	Reduction, %
ESR	-13% by 2030 compared to 2005		6138	WEM	5 399
				WAM	5 285
GPCP 2050	-70% by 2030 compared to 1990	38086		WEM	11 887
				WAM	11 755



*LULUCF sector's reference year 2018 used in projections is consistent with Estonia's 2021 submission to the UNFCCC on 15th of April 2020 (NIR 2021)

Figure 3.9 Total GHG emissions 1990–2050 in WEM scenario, kt CO₂ eq.



*LULUCF sector's reference year 2018 used in projections is consistent with Estonia's 2021 submission to the UNFCCC on 15th of April 2020 (NIR 2021)

Figure 3.10 Total GHG emissions 1990–2050 in WAM scenario, kt CO₂ eq.

3.4. Sensitivity analysis

4.3.1. Energy

The Shale Oil Production industry is a growing branch in Estonia. According to the WEM and WAM projections, the companies are planning to expand their production in the next ten years. Two additional solid heat carrier (SHC) technology shale oil production plants are planned, which are taken into account in the WEM and WAM scenario. However, this can be considered as optimistic scenario and such a wide expansion might not get the necessary funding for these plants investments. Therefore, an alternative scenario has been modelled (SEN scenario).

In the Energy sector SEN scenario, it is expected that in the period of 2020–2050, instead of two additional SHC technology shale oil production plants (WEM and WAM scenario), none will be built. This situation could be the result of political decisions or if the economic situation is not suitable for shale oil production etc. This means that approximately 3 million tons of oil shale will be used less for shale oil production. By this, the amount of oil shale gas used for electricity production is reduced compared to the WEM scenario. In the SEN scenario, it is expected that the amount of electricity produced from oil shale gas is imported. When comparing GHG emissions between WEM and SEN scenarios, the emissions are projected to decrease by 15.9% in 2040 and 21.4% in 2050. The results of the SEN scenario are presented in Figure 3.11

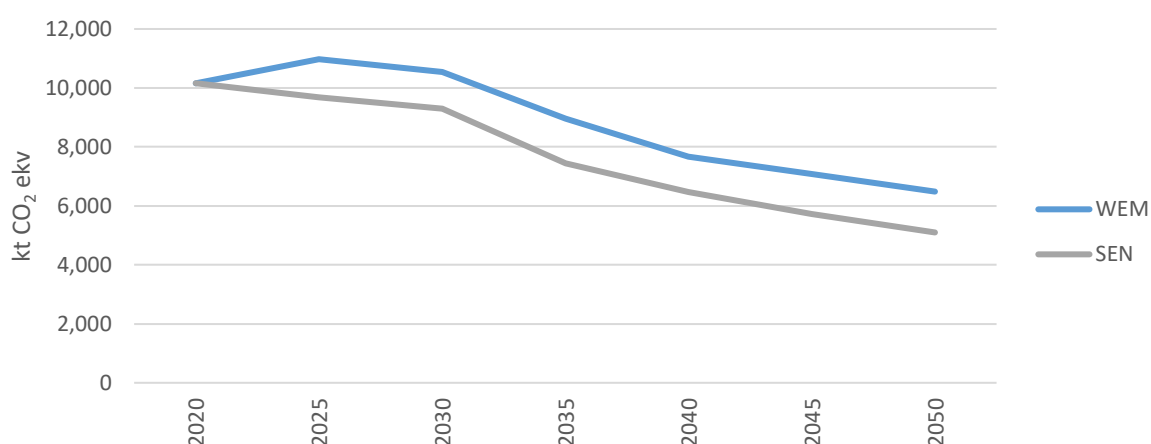


Figure 3.11. Comparison of GHG emissions of WEM and SEN scenarios, kt CO₂ eq.

4.3.1. Waste

Sensitivity analysis for Waste sector emissions are based on the scenarios, where population and annual real GDP growth rate (Table 3.5) are based on the harmonised values given by the European Commission (*Recommended parameters for reporting on GHG projections in 2021* 30 June 2020).

Table 3.5. Recommended parameters by European Commission for reporting on GHG projections in 2017

Indicator	2020	2025	2030	2035	2040
Annual real GDP growth rate (in market prices), %	-6.9	2.7	2.3	1.4	1.3
Population in Estonia, million	1.327	1.331	1.319	1.301	1.285

Under SEN scenario (Figure 3.12), population and GDP growth rate from Table 3.5 were both used in projection calculations. The methodology for calculating SEN (and WEM) scenario is provided in Chapter 3.2.6.1. All subcategories in Waste sector are affected by the change of population projections and fluctuations in GDP.

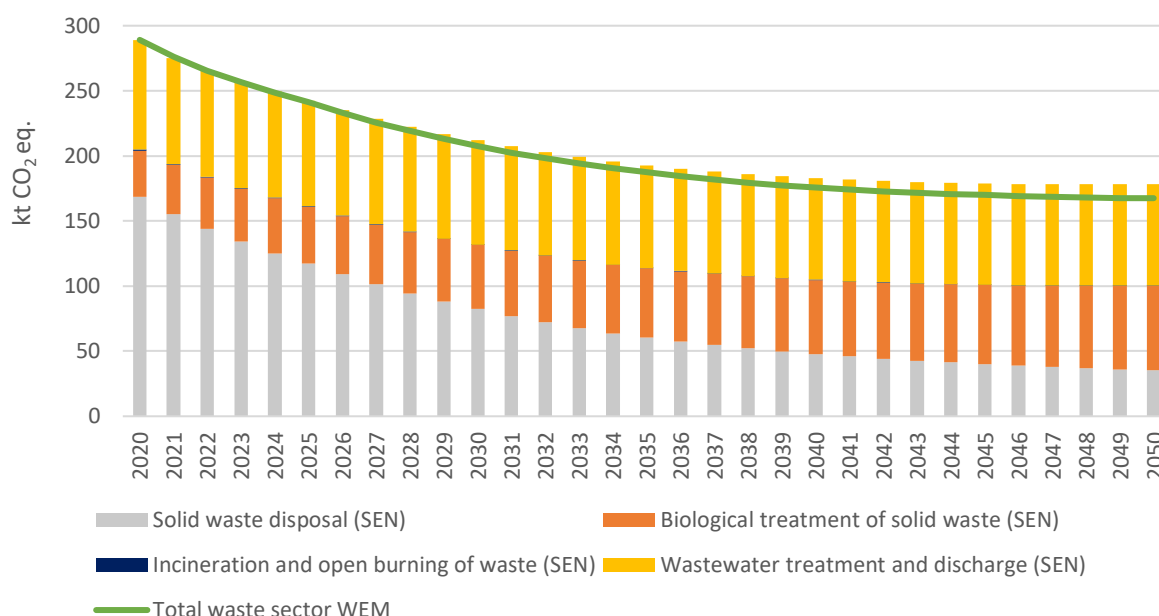


Figure 3.12. Comparison of GHG emissions of SEN and WEM scenario waste sector total emissions, kt CO₂ eq.

The results of SEN analysis show that Waste sector emissions in general are dependent on the population projections and changes in GDP estimations. Incineration and open burning of waste and wastewater treatment and discharge category are not highly affected when using SEN parameters. Incineration and open burning subcategory have a marginal share in total share of emissions and the wastewater treatment and discharge subcategory would be more affected by the change of different wastewater treatment methodologies. However, population and GDP growth are affecting solid waste disposal and biological treatment of solid waste subcategories. Comparing WEM and SEN parameters, it can be seen, that according to Statistics Estonia, the population is projected to grow more but GDP is expected to grow more according to the harmonised values given by the European Commission. When comparing 2040 emissions, total emissions are projected to decrease by 4.1% in WEM scenario compared to SEN scenario.

3.5. Changes with respect to the 2019 submission

3.5.1. Energy

The comparisons of CO₂ eq. emissions with respect to the 2019 submission are presented on Table 3.6 and Table 3.7, for WEM and WAM scenarios, respectively. The changes in Energy industries category have three main reasons. Firstly, electricity generation emissions are now based on an updated Balmorel scenario of fuel consumption for electricity generation due to a changed economic situation. Secondly, the projections in the heat production are based on updated analysis of past fuel consumption trends of the sector to reflect the actual fuel consumption trends in the sector. Thus, influencing also the projections of the WAM measures in the WAM scenario. Thirdly, in 2021 projections, the number of new shale oil production plants planned by the companies have been reduced due to changed economic situation.

The changes in Manufacturing and construction sector and Other sectors occur, because in the previous submission input from *EEDP 2030+* was used. However, in the latest submission projections are based on the *NECP 2030* scenarios. Also, the emission calculation in this sector take historical data into account, which have been updated due to using Joint Questionnaire dataset made by Statistics Estonia (sent to Eurostat and IEA databases), instead of national energy balance and consequently this has influenced emission projections.

Fugitive emissions have increased due to changes in the 2021 NIR methodology, due to using Joint Questionnaire dataset made by Statistics Estonia, which is sent to Eurostat and IEA databases, instead of national energy balance. In addition, Other sector is calculated under 1.A.4.a category.

Table 3.6. Comparison of 2019 and 2021 WEM scenario Energy sector projections, kt CO₂ eq.

Submission	Energy WAM	2020	2025	2030	2035	2040
2019	Energy industries	13 745.13	12 059.03	8568.81	7 640.45	6 874.80
2021		6 641.63	7 443.13	7 191.27	5 712.96	4 893.08
2019	Manufacturing industries and construction	581.26	616.13	651.01	666.33	681.66
2021		551.37	615.72	649.51	688.05	727.22
2019	Transport	2 180.97	2 327.18	2 395.05	2 489.25	2 572.37
2021		2 070.19	2 066.42	1 882.31	1 770.33	1 303.90
2019	Other sectors	682.17	678.59	686.1	691.80	701.15
2021		873.91	826.84	792.45	760.52	732.80
2019	Other	39.69	39.69	39.69	39.69	39.69
2021		0.00	0.00	0.00	0.00	0.00
2019	Fugitive emissions	17.73	17.73	17.73	17.73	17.73
2021		22.33	22.33	22.33	22.33	22.33
2019	Total, kt CO ₂ eq.	17246.94	15738.36	12358.39	11545.26	10887.40
2021		10159.42	10974.42	10537.87	8954.18	7679.33

Table 3.7. Comparison of 2019 and 2021 WAM scenario Energy sector projections, kt CO₂ eq.

Submission	Energy WAM	2020	2025	2030	2035	2040
2019	Energy industries	13 598.04	11 487.62	7 867.76	7 257.05	6 493.53
2021		6 641.63	7 286.44	7 134.32	5 394.22	4 862.54
2019	Manufacturing industries and construction	581.26	616.13	651.01	666.33	681.66
2021		551.37	615.72	649.51	688.05	727.22
2019	Transport	2 114.66	1 946.55	1 714.05	1 784.17	1 884.94
2021		2 070.19	2 040.93	1 811.68	1 698.67	1 231.66
2019	Other sectors	678.80	608.85	591.18	581.95	577.84
2021						

Submission	Energy WAM	2020	2025	2030	2035	2040
2021		873.91	823.67	787.57	754.38	726.46
2019	Other	39.69	39.69	39.69	39.69	39.69
2021		0.00	0.00	0.00	0.00	0.00
2019	Fugitive emissions	17.73	17.73	17.73	17.73	17.73
2021		22.33	22.33	22.33	22.33	22.33
2019	Total, kt CO ₂ eq.	17030.18	14716.57	10881.41	10346.92	9695.38
2021		10159.42	10789.08	10405.40	8557.65	7570.21

3.5.2. Transport

Comparison of Transport sector CO₂ eq. emissions with respect to the 2019 submission in the WEM scenario is presented in Table 3.8 and in the WAM scenario is presented in Table 3.9. The previous WEM and WAM projections in the transport sector were based on the analysis of transport and mobility scenarios in *EEDP 2030*. The 2019 projections are based on the information in the ITF report “*The Future of Passenger Mobility and Goods*”. Also, using the input from Ministry of Economic Affairs and Communication, the Ministry of the Environment and from the meeting points of the Government’s Environment and Climate Commission. In addition, the projections for the WEM scenario are also in line with Regulation (EC) No 2019/631, which stipulates that by year 2021, the average emissions target for a new passenger car is 95 gCO₂/km and 147 gCO₂/km for light duty vehicles.

Table 3.8 Comparison of 2019 and 2021 WEM scenario Transport sector projections, kt CO₂ eq.

Submissions	Transport WEM	2020	2025	2030	2035	2040
2019	Domestic aviation	3.87	3.87	3.87	3.87	3.87
2021		3.37	4.62	4.84	5.08	5.32
2019	Road transportation	2075.66	2221.87	2289.74	2383.95	2467.06
2021		2034.00	2013.60	1828.37	1715.25	1247.68
2019	Railways	62.45	62.45	62.45	62.45	62.45
2021		22.82	27.65	27.65	27.65	27.65
2019	Domestic navigation	39.00	39.00	39.00	39.00	39.00
2021		10.00	20.55	21.45	22.35	23.25
2019	Other transportation	NO	NO	NO	NO	NO
2021		NO	NO	NO	NO	NO

Table 3.9 Comparison of 2019 and 2021 WAM scenario Transport sector projections, kt CO₂ eq.

Submissions	Transport WAM	2020	2025	2030	2035	2040
2019	Domestic aviation	3.87	3.87	3.87	3.87	3.87
2021		3.37	4.62	4.84	5.08	5.32
2019	Road transportation	2009.36	1865.62	1633.12	1703.25	1804.01
2021		2034.00	2004.68	1774.31	1660.16	1192.00
2019	Railways	62.45	62.45	62.45	62.45	62.45
2021		22.82	27.65	27.65	27.65	27.65
2019	Domestic navigation	39.00	14.61	14.61	14.61	14.61
2021		10.00	3.98	4.88	5.78	6.68
2019	Other transportation	NO	NO	NO	NO	NO
2021		NO	NO	NO	NO	NO

3.5.3. IPPU

Comparison of IPPU sector CO₂ eq. emissions with respect to the 2019 submission in the WEM scenario is presented in Table 3.10 and in the WAM scenario is presented in Table 3.11.

The WEM and WAM scenario in 2021 as well as in 2019 submission differ only in emissions from the category 2.D. Non-energy products from fuels and solvent use.

Projections of mineral industry's emissions have decreased almost sevenfold in comparison with 2019 submission. The reason is that the cement industry stopped burning clinker in 2020 and does not plan to start it again because it is not economically feasible with old technology with high CO₂ emissions. In 2021 submission emissions from chemical industry are projected to start from 2024. The ammonia production plant plans relaunching and gains full production volume in 2025. In 2019 submission no emissions from chemical industry were projected because the plant did not plan to start production again. Projected emissions from metal industry are almost the same in 2019 and 2021 submissions. Emissions from subsector 2.D Non-energy products from fuels and solvent use are projected to decrease very little in 2021 submissions' WEM scenario. The decrease is caused by decreasing emission factors. In 2019 year's submission on the contrary there was a slight increase in emissions from the beforementioned subcategories.

In WAM scenario of 2021 submission emissions from subsector 2.D Non-energy products from fuels and solvent use are projected to decrease even more than in WEM scenario (due to reduction of urea-based catalyst fluid use which is caused by additional measures in the Transport sector that reduce diesel fuel consumption). In 2019 year's submission emissions from subsector 2.D increased slightly because growth of emissions from solvent use and urea-based catalyst fluid use. In the category 2.F Product uses as substitutes for ODS the projected emissions in the year 2020 in WEM and WAM scenarios were smaller in 2021 submission than in 2019 submission. This is because the 2019 year's numbers (which are basis for subsequent years' calculations) are from the GHG inventory and turned up to be smaller than numbers projected in 2019 submission and therefore the following years' emissions are smaller too. 2040 years' emissions are projected to be larger in 2021 submission than in 2019 submission because

of recent years' trend of quickly growing number of air conditioning equipment which effect extends up to 2050. In the category 2.G Other product manufacture and use the projected emissions are larger in 2021 submission than in 2019 submission. There are two reasons for that: 1) 2019 years' numbers in subcategory 2.G.1 Electrical equipment are from GHG inventory and turned up to be are larger, thus the future emissions are larger; 2) the calculation method of emissions in the subcategory 2.G.3 Other product manufacture and use; 3) N₂O from product use was changed.

Table 3.10. Comparison of 2019 and 2021 WEM scenario IPPU sector projections, kt CO₂ eq.

Submissions	WEM	2020	2025	2030	2035	2040
2019	2.A Mineral industry	420.52	503.53	503.53	503.53	503.53
2021		122.79	72.60	72.60	72.60	71.56
2019	2.B Chemical industry	NO	NO	NO	NO	NO
2021		NO	105.93	105.93	105.93	105.93
2019	2.C Metal industry	2.46	2.55	2.64	2.72	2.79
2021		2.47	2.62	2.68	2.74	2.80
2019	2.D Non-energy products from fuels and solvent use	19.76	20.47	21.51	22.54	23.36
2021		22.62	22.10	22.14	22.53	22.47
2019	2.F Product uses as substitutes for ODS	232.56	187.02	133.42	103.96	80.85
2021		219.79	179.93	131.30	97.62	90.08
2019	2.G Other product manufacture and use	5.30	5.54	5.78	5.98	6.14
2021		6.03	6.54	7.04	7.16	7.28
2019	Total CO ₂ eq.	680.60	719.11	666.88	638.73	616.67
2021		373.70	389.73	341.68	308.58	300.13

Table 3.11. Comparison of 2019 and 2021 WAM scenario IPPU sector projections, kt CO₂ eq.

Submissions	WAM	2020	2025	2030	2035	2040
2019	2.A Mineral industry	420.52	503.53	503.53	503.53	503.53
2021		122.79	72.60	72.60	72.60	71.56
2019	2.B Chemical industry	NO	NO	NO	NO	NO
2021		NO	105.93	105.93	105.93	105.93
2019	2.C Metal industry	2.46	2.55	2.64	2.72	2.79
2021		2.47	2.62	2.68	2.74	2.80
2019	2.D Non-energy products from fuels and solvent use	19.76	20.21	20.89	21.78	22.52
2021		22.62	22.06	21.98	22.30	22.25

Submissions	WAM	2020	2025	2030	2035	2040
2019	2.F Product uses as substitutes for ODS	232.56	187.02	133.42	103.96	80.85
2021		219.79	179.93	131.30	97.62	90.08
2019	2.G Other product manufacture and use	5.30	5.54	5.78	5.98	6.14
2021		6.03	6.54	7.04	7.16	7.28
2019	Total CO ₂ eq.	680.60	718.85	666.26	637.97	615.83
2021		373.70	389.69	341.53	308.35	299.90

3.5.4. Agriculture

The main reason for the fall in projected WEM emissions in the 2021 submission compared to the 2019 submission (Table 3.12) is explained by the anticipation of more pessimistic agricultural output. The numbers of projected animals have generally decreased compared to the previous submission. The change in total and subsectorial emission values reflect also remarkably the corrections performed in GHG emission calculation methodology under different subsectors.

In Enteric fermentation subsector, the emissions are projected to decrease in the 2021 submission compared to the 2019 submission due to decrease in the projected number of animals. In Manure management subsector the emissions are projected to increase in 2021 submission compared to the 2019 submission which is caused by the updated allocation of manure management systems and grazing of cattle and swine. The respective updates are based on the study of Kaasik and Möls (2018)⁷. As a result, the increase of the share of liquid manure management system increased the emissions from CH₄. An update of emission factors for calculating NH₃ emissions in *Estonian Informative Inventory Report 1990–2019* changed the input values of NH₃ amounts for projecting indirect N₂O emissions from manure management. Also, the calculation methods for indirect N₂O emissions has been improved. In Agricultural soils subsector, the emissions are projected to decrease because projected emissions from compost decreased due to the updated methods of the calculations of N amounts used from compost. Since 2021 submission the dry weight of compost has been used in calculations of projected N amounts from compost instead of the formerly used wet weight of compost. In Liming subsector, the emissions are projected to increase because the projected amount of lime fertilizers has increased as there is a measure Neutralization of acid soils planned to improve soil conditions by increasing pH, Ca²⁺, Mg²⁺ and C content in the soils and thus improving conditions to use fertilizers more effectively. In Urea application subsector, projected emissions were similar to the previous projections, a very small decrease was projected which was associated with the decreased urea use in 2018 compared to the projections made in 2019.

Table 3.12. Comparison of 2019 and 2021 WEM scenario Agriculture sector projections, kt CO₂ eq.

Submissions	Agriculture WEM	2020	2025	2030	2035	2040
2019	Enteric fermentation	575.01	613.93	643.47	672.49	672.22

⁷ Kaasik, A., Möls, M. Loomakasvatusest eralduvate saasteainete heitkoguste inventuurimetoodikate täiendamine ja heite vähendamistehnoloogiate kaardistamine. [www] https://www.envir.ee/sites/default/files/nh3_eriheite_ja_sonnikukaitlustehnoloogiate_ajaloolise_ulevaate_lopparuanne_0.pdf (16.02.2021).

Submissions	Agriculture WEM	2020	2025	2030	2035	2040
2021		549.62	577.72	588.33	601.07	612.60
2019	Manure management	140.53	147.82	153.98	157.87	157.84
2021		205.43	218.01	222.98	226.13	229.00
2019	Agricultural soils	706.42	733.73	750.93	762.35	764.51
2021		700.61	710.75	717.18	719.34	723.10
2019	Liming	17.18	20.42	23.66	26.90	30.14
2021		16.72	36.23	36.23	36.23	36.23
2019	Urea application	0.11	0.11	0.11	0.11	0.11
2021		0.08	0.08	0.08	0.08	0.08
2019	Total, kt CO ₂ eq.	1439.25	1516.01	1572.14	1619.72	1624.82
2021		1472.46	1542.80	1564.82	1582.86	1601.02

2019 projections did not include Agriculture WAM scenario projections.

3.5.5. LULUCF

Differences in projected emissions between 2019 and 2021 submissions are presented in Table 3.13.

Differences in projections in 2021 compared to the 2019 are due to the recalculation of historical emissions, updated uniform final fellings scenario for Forest land and HWP projections, and new methodologies for estimating projected GHG emissions for Cropland, Grassland, Wetlands, Settlements and Other land categories.

The entire time series of activity data from the National Forest Inventory (NFI) is annually recalculated for all areas of land categories and land-use conversions, since new data about land-use transitions is collected every year and new estimates will be integrated into overall activity data. For instance, in 2020 the land use change data in NFI plots was corrected, resulting in significant increase of emissions. Most important methodological changes that have caused the recalculation of emissions in 1990–2018 include the implementation of country-specific BCEFs values for living biomass C pool and development of new methodology for estimating the amount of peat removed for horticultural use. More detailed information about recalculations can be found in the 2021 NIR.

Table 3.13. Comparison of 2019 and 2021 LULUCF sector projections, kt CO₂ eq.

Submission	LULUCF	2020	2025	2030	2035	2040
2019	Forest land	-2 355.86	-1 277.94	-1 609.34	-1 353.98	-862.19
2021		-2611.40	-2611.40	-2611.40	-1277.84	-1277.84
2019	Cropland	718.57	820.37	922.16	1023.96	1125.75
2021		433.66	687.42	737.66	711.73	722.79
2019	Grassland	28.06	24.28	20.5	16.72	12.94
2021		72.53	72.53	72.53	72.53	72.53

Submission	LULUCF	2020	2025	2030	2035	2040
2019	Wetlands	567.07	518.1	469.13	420.16	413.81
2021		1 117.30	1 117.30	1 117.30	1 117.30	1 117.30
2019	Settlements	292.22	341.23	390.25	439.26	488.28
2021		421.08	476.09	425.77	425.77	425.77
2019	Other land	36.09	40.84	45.6	50.35	55.11
2021		69.63	69.63	69.63	69.63	69.63
2019	Harvested wood products	-688.7	-537.81	-446.54	-442.92	-456.76
2021		-701.90	-639.31	-576.61	-501.14	-451.69
2019	Total CO ₂ eq.	-1 402.56	-70.94	-208.24	153.55	776.93
2021		-1 199.10	-827.75	-765.11	617.98	678.49

3.5.6. Waste

The general reason for the projection differences in the 2021 submission compared to the 2019 projections (Table 3.14) is connected with the changes in GDP and population growth rate, both parameters are essential and affecting waste sector emissions greatly, especially emissions from Solid waste disposal which is the main source for projection changes comparing the 2019 and 2021 submission. The emission changes from the Biological treatment of solid waste is strongly connected with the treated waste amount during base year and the amount of waste separately collected. Compared to the previous submission, 2021 submission Biological treatment of solid waste projections are expected to remain at the same level. Emissions from Waste incineration and open burning is included in 2050 projections in 2021. In the previous submission, it was expected that waste burning without energy recovery and open burning of waste will stop by 2030. In 2021 this evaluation was revisited and small quantities of burned waste (for burning contrabands, utilizing hazardous waste etc) was included in projections. The emission changes from Wastewater treatment and discharge are connected with the updated projections of different wastewater treatment types in high-density settlements and the coverage percentage of the centralised wastewater system and it is expected that the emissions will remain at a similar level compared to the 2019 submission.

Table 3.14. Comparison of 2019 and 2021 WEM=WAM scenario Waste sector projections, kt CO₂ eq.

Submission	Waste WEM	2020	2025	2030	2035	2040
2019	Solid waste disposal on land	170.78	122.28	87.51	65.82	51.93
2021		168.58	117.46	81.87	58.92	44.40
2019	Biological treatment of solid waste	36.95	41.13	44.90	47.94	50.73
2021		36.10	41.77	44.75	48.14	51.59
2019	Waste incineration and open burning	1.74	0.93	NO	NO	NO
2021		0.80	0.45	0.05	0.05	0.05
2019		83.75	83.35	82.80	82.08	81.38

2021	Wastewater treatment and discharge	83.63	81.47	80.83	80.23	79.65
2019	Total, kt CO ₂ eq	293.23	247.68	215.21	195.84	184.03
2021		289.10	241.15	207.50	187.33	175.68

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