REPUBLIC OF ESTONIA
MINISTRY OF THE ENVIRONMENT

2019

ESTONIA'S FOURTH BIENNIAL REPORT

under the United Nations Framework Convention on Climate Change

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

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Glossary

CHP –	combined heat and power
EERC –	Estonian Environmental Research Centre
EF –	emission factor
ESD –	Effort Sharing Decision
EstEA–	Estonian Environment Agency
ESR –	Effort Sharing Regulation
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
Mt–	megaton
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
ODA –	Official development assistance
PAM –	policies and measures
PJ –	petajoule
SHC –	solid heat carrier
TJ –	terajoule
TWh–	terawatt hour
UNFCCC –	United Nations Framework Convention on Climate Change
WAM –	with additional measures
WEM –	with existing measures
yr –	year

Documents

CAP –	Common Agricultural Policy
EEDP 2030 –	Estonian Energy Sector Development Plan 2030
EFDP 2020 –	The Estonian Forestry Development Programme until 2020
ERDP–	Estonian Rural Development Plan for 2014-2020
GPCP 2050 –	General Principles of Climate Policy 2050
NEEAP2–	The second National Energy Efficiency Action Plan
NWMP –	National Waste Management Plan 2014-2020

Greenhouse gases

CH_4 –	methane
CO_2 –	carbon dioxide
N_2O –	nitrous oxide
HFC –	hydrofluorocarbons
PFC –	perfluorocarbons
SF_6 –	sulphur hexafluoride
NF_3 –	nitrogen trifluoride

Other pollutants

NMVOC –	non-methane volatile organic compound
NO_x –	nitrogen oxides

CONTENTS

1. INTRODUCTION

Estonia is pleased to submit its Fourth Biennial Report (BR4) under decision 2/CP.17 of the Conference of the Parties under the United Nations Framework Convention on Climate Change (UNFCCC).

As defined in the UNFCCC biennial reporting guidelines for developed country Parties[1], the information is structured into:

- information on greenhouse gas (GHG) emissions and trends incl. information on the national inventory system (Chapter 2),
- quantified economy-wide emission reduction target (Chapter 3),
- progress in achievement of the quantified economy-wide emission reduction targets (Chapter 4),
- projections (Chapter 5) and
- provision of financial, technological and capacity building support to developing countries (Chapter 6).

Tabular information as defined in the common tabular format (CTF) for the UNFCCC biennial reporting guidelines for developed country Parties (decision 19/CP.18 and 9/CP.21.) are enclosed to the BR4 submission (BR4 CTF). For the CTF submission to the UNFCCC, the electronic reporting facility provided by the UNFCCC Secretariat has been used as required by UNFCCC decision 19/CP.18.

2. INFORMATION ON GHG EMISSIONS AND TRENDS

2.1. Introduction and summary information from the national GHG inventory

This chapter is to provide an overview of Estonia's GHG emissions and their trends for the period of 1990–2017. It also provides information on Estonia's national inventory arrangements. The GHG data presented is consistent with Estonia's 2019 submission to the UNFCCC Secretariat (2019 National Inventory report (NIR)). Summary tables of GHG emissions are presented in CTF Table 1.

The chapter presents data on direct GHG: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). Chapter 5, Table 5.12 includes historical GHG data from 2019 NIR and GHG projections that are based on the 2018 NIR for the period of 1990–2040.

2.1.1. Overall greenhouse gas emission trends

Total emissions of the greenhouse gases in Estonia (without LULUCF) decreased steadily from 40,431.5 kt CO_2 eq. in 1990 to 20,879.9kt CO_2 eq. in 2017 (Figure 2.1). From 1990 to 2017 emissions without LULUCF decreased by 48.36%. This decrease was mainly caused by the transition from a planned economy to a market economy and the successful implementation of the necessary reforms. Estonia has made significant progress in improving its environmental performance by decoupling economic growth from the primary environmental pressures

[1] Annex I to UNFCCC decision 2/CP.17.

(Figure 2.2). The final energy intensity has decreased, due in part to energy efficiency measures put in place pursuant to the EU Directive on Energy End-Use Efficiency and Energy Services[2]. Also, the share of renewable energy in final consumption in Estonia has been increasing continuously since 2006. In 2006, the share was 16.1%[3], in 2010, it was 24.6%, and in 2017, it was as high as 29.2%.

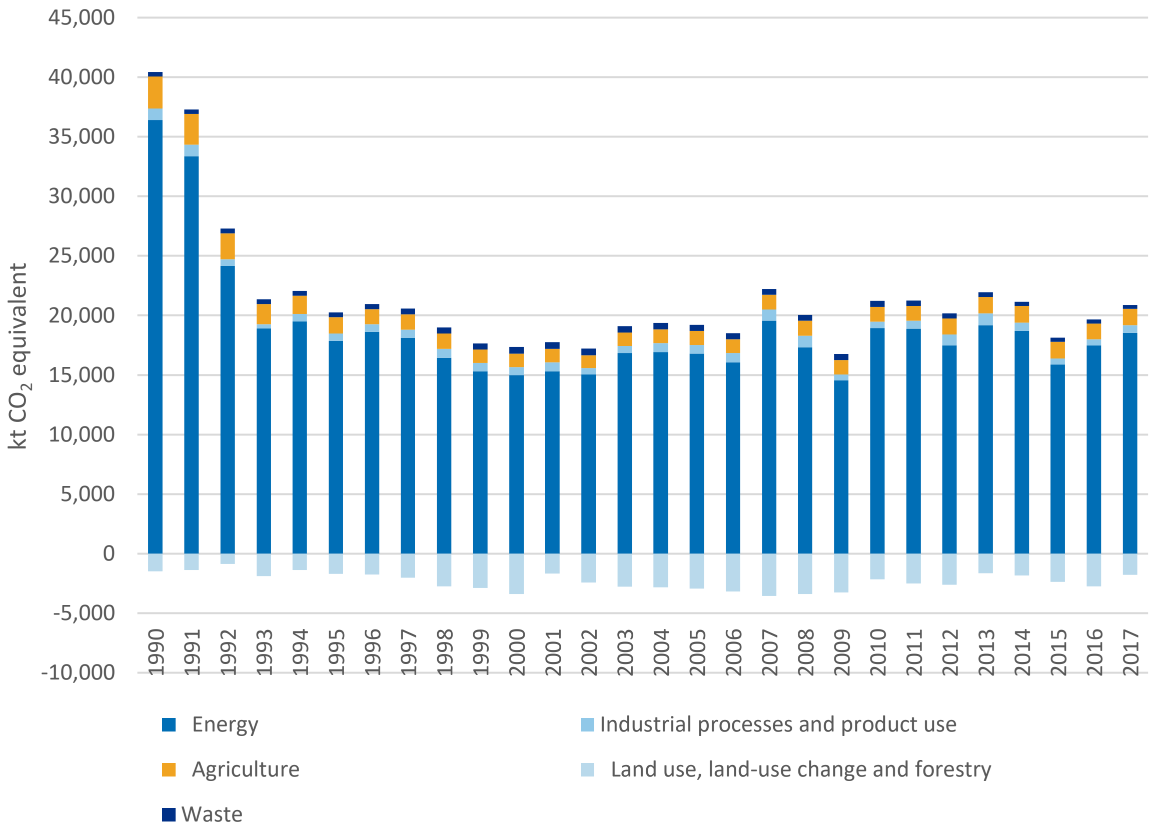

Figure 2.1. Estonia's GHG emissions by sector, 1990–2017, excluding LULUCF, kt CO_2 eq.

[2] OECD Environmental Performance Reviews: Estonia 2017
[3] Quarterly Bulletin of Statistics Estonia 2/2018

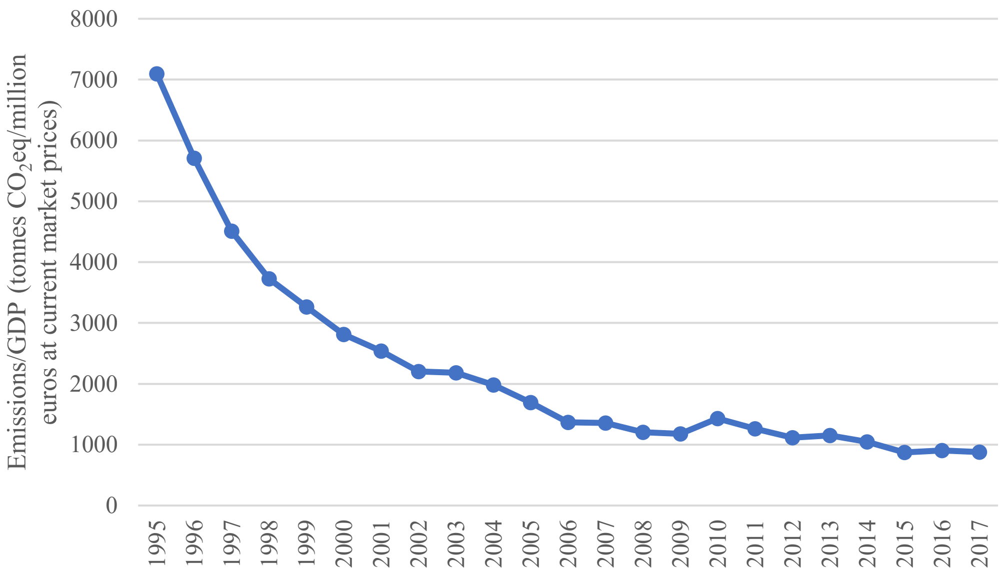

Figure 2.2. GHG emissions per GDP 1995 to 2017

The energy sector is by far the largest producer of GHG emissions in Estonia. In 2017, the sector accounted for 88.76% of Estonia's total GHG emissions (Figure 2.3).

The second largest sector is agriculture, which accounted for 6.61% of total emissions in 2017. Emissions from the industrial processes and product use as well as waste sectors accounted for 3.06% and 1.57% of total emissions, respectively.

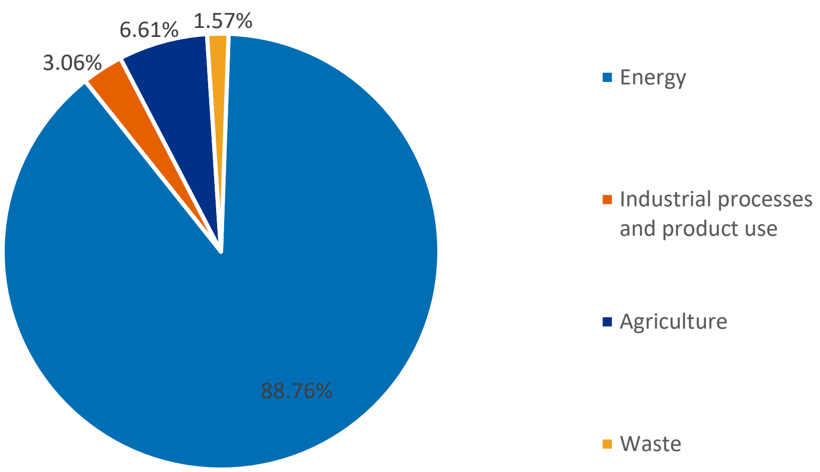

Figure 2.3 GHG emissions by sector in 2017, %

The LULUCF sector, acting as the only possible sink of GHG emissions in Estonia, plays an important role in the national carbon cycle. In 2017, the LULUCF sector acted as a CO_2 sink, with a total uptake of 1,792.74 kt CO_2 eq. Uptake of CO_2 has increased by 20.36% compared to the base year (1990).

In 2017, the most important GHG in Estonia was carbon dioxide (CO_2), contributing 89.34% to total national GHG emissions expressed in CO_2 eq. (including indirect CO_2), followed by methane (CH_4), 5.13%, and nitrous oxide (N_2O), 4.39%. Fluorocarbons (so-called 'F-gases') account for about 1.14% of total emissions.

Emissions of CO_2 (with indirect CO_2) decreased by 49.7% from 37,066.77 kt in 1990 to 18,654.47 kt in 2017, especially CO_2 emissions from Energy sub-sector Public electricity and heat production, which is the major source of CO_2 in Estonia.

Methane is the second most significant contributor to greenhouse gas emissions in Estonia after CO_2. Emissions of CH_4 decreased by 43.5% from 1,895.51 kt CO_2 eq. in 1990 to 1,071kt CO_2 eq. in 2017, the downturn was especially noticeable in the Agriculture sub-sector Enteric fermentation, which is a major source of CH_4 in Estonia.

Emissions of N_2O decreased by 37.67% from 1,469.23 kt CO_2 eq. in 1990 to 915.73 kt CO_2 eq. in 2017, especially N_2O emissions from Agriculture sub-sector Agricultural soils, which is the main contributor of N_2O emissions in Estonia.

Emissions of the F-gases (HFCs, PFCs and SF_6) increased from 0 kt CO_2 eq. in 1990 to 238.68 kt CO_2 eq. in 2017, especially HFC emissions from Refrigeration and air conditioning, which is the major source of halocarbons in Estonia. A key driver behind the growing emission trend in Refrigeration and air conditioning sector has been the substitution of ozone depleting substances with HFCs. The second largest source is Foam blowing agents which showed relatively steady increase of emissions until 2007. In 2001 one of two big Estonian producers of one component foam replaced HFC-134a with HFC-152a, followed by the other producer starting from 2007. Due to much lower GWP of HFC-152a the emissions decreased suddenly in the corresponding years.

NF_3 emissions do not occur in Estonia.

Table 2.1. Greenhouse gas emissions in Estonia – annual contributions of the various GHGs

		CO_2 emissions excluding net CO_2 from LULUCF	CH_4 emissions excluding CH_4 from LULUCF	N_2O emissions excluding N_2O from LULUCF	HFCs	PFCs	SF_6	Total (excluding LULUCF)
1990	kt	37,066.77	1,895.51	1,469.23	NO	NO	NO	40,431.51
	%	91.68%	4.69%	3.63%	–	–	–	100.00%
1995	kt	18,201.62	1,258.76	766.64	28.45	NO	3.07	20,258.55
	%	89.85%	6.21%	3.78%	0.14%	–	0.02%	100.00%
2000	kt	15,359.84	1,235.69	682.33	79.15	NO	2.61	17,359.62
	%	88.48%	7.12%	3.93%	0.46%	–	0.02%	100.00%
2005	kt	17,131.67	1,208.09	727.48	134.96	NO	1.03	19,203.24
	%	89.21%	6.29%	3.79%	0.70%	–	0.01%	100.00%
2010	kt	19,015.59	1,216.20	804.62	175.54	NO	1.72	21,213.67
	%	89.64%	5.73%	3.79%	0.83%	–	0.01%	100.00%
2015	kt	15,891.01	1,089.14	921.11	223.21	NO	2.24	18,126.70
	%	87.67%	6.01%	5.08%	1.23%	–	0.01%	100.00%
2016	kt	17,477.49	1,065.17	884.22	235.58	NO	2.52	19,664.97
	%	88.88%	5.42%	4.50%	1.20%	–	0.01%	100.00%
2017	kt	18,654.47	1,071.00	915.73	236.24	NO	2.44	20,879.88
	%	89.34%	5.13%	4.39%	1.13%	–	0.01%	100.00%

2.1.2. Greenhouse gas emissions by sector

Energy

Estonia's emissions from the Energy sector are divided into the following categories: Fuel combustion, including Energy industries; Manufacturing industries and construction; Transport; Other sectors; Other; and Fugitive emissions from fuels.

The Energy sector is the main source of GHG emissions in Estonia. In 2017 the sector contributed 88.8% of all emissions, totaling 18,532.35 kt CO_2 eq. 99.9% of emissions in the sector originated from fuel combustion – just 0.1% were from fugitive emissions.

Energy related CO_2 emissions varied mainly in relation to the economic trend, the energy supply structure and climate conditions. The decrease of GHG emissions between 1990 and 1993 is related to major structural changes in the economy after Estonia regained its independence from the Soviet Union. A small increase of emissions in 1994 is related to the growing energy demand in the transport sector. After that, the emissions from the Energy sector were quite steady (slight decrease until 2002). In 2003 the emissions increased mainly due to the export of the oil shale-based electricity. The big increase of emissions between 2006 and 2007 is related to the overall economic upturn and the decrease of emissions between 2007 and 2009 to the overall economic downfall. Since 2009 the GHG emissions are strongly related to the volume of exported electricity that is mainly produced from oil shale.

Emissions from the Energy sector decreased by 49.1% compared to 1990 (incl. Energy industries – 49.8%; Manufacturing industries and construction – 74.8%; Transport – 1.4%; Other sectors – 66.6%; and Fugitive emissions from fuels – 67.7%; emissions from the sector Other increased 28.3%). There has been a drastic decrease in the consumption of fuels and energy in energy industries (closing of factories), agriculture (reorganisation and dissolution of collective farms), households (energy saving) etc. The overall progression of GHG emissions in the Energy sector in CO_2 equivalent is presented in Figure 2.4.

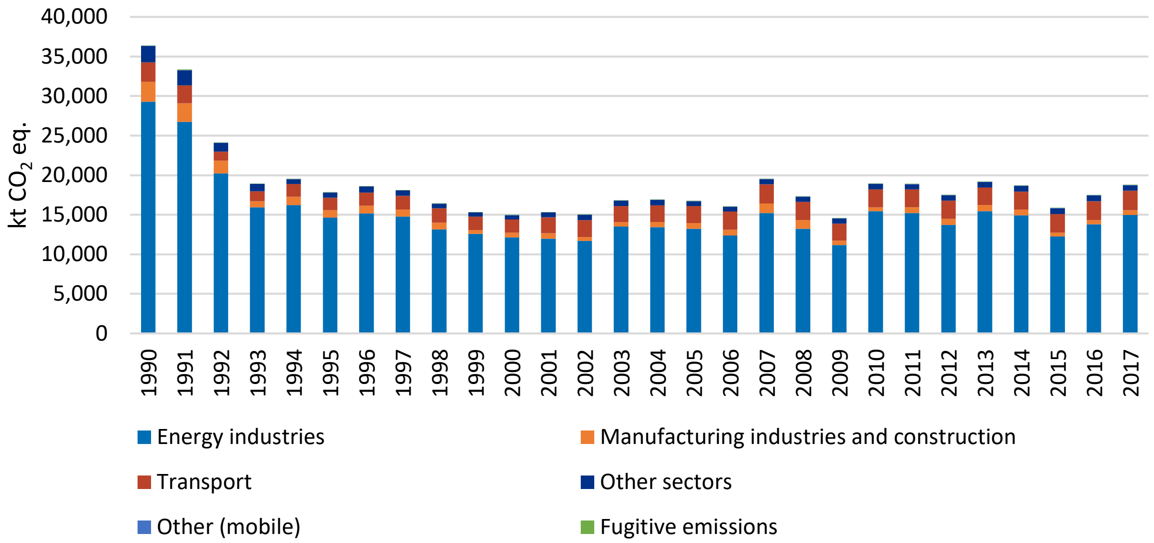

Figure 2.4. Trend in emissions from Energy sector 1990–2017, kt CO_2 eq.

Industrial processes and product use

Estonia's GHG emissions from the Industrial processes and product sector are divided into the following categories:

- Mineral industry (emissions from cement, lime, glass production and other process uses of carbonates);
- Chemical industry (historically ammonia and carbamide were produced);
- Metal industry (production of secondary lead)
- Non-energy products from fuels and solvent use (CO_2 emissions from lubricant and paraffin wax use and urea based catalysts for motor vehicles, as well as NMVOC emissions from solvent use and road paving with asphalt and indirect CO_2 emissions calculated from these NMVOC emissions;
- Product uses as substitutes for ODS (HFC emissions from refrigeration and air conditioning, foam blowing, fire protection and aerosols);
- Other product manufacture

In addition, NOx, CO and SO_2 emissions from Pulp and paper are reported under 2.H Other production. The non-fuel based CO_2 emissions from pulp and paper industry are estimated to be negligible in Estonia. All N_2O emissions from the pulp and paper and food industry are reported as fuel based emissions under CRF 1.

In 2017 the Industrial processes and product use sector contributed 3.06% of all GHG emissions in Estonia, totaling 639.53 kt CO_2 eq. with indirect CO_2 and 624.53 kt CO_2 eq. without indirect CO_2. The most significant emission sources were CO_2 emissions from cement production at 47.97%, and HFC emissions from refrigeration and air conditioning at 36.94% of total emissions from the sector (with indirect CO_2). Compared to 2016, the emissions from Industrial processes and product use (with indirect CO_2) increased by 27.75% in 2017. This increase in emissions is caused by greater output of mineral industry.

Industrial CO_2 emissions have fluctuated strongly during years 1990–2017. Increase in 2017 emissions was largely caused by increase of cement production. Decrease in mineral (and cement) industry output was the main driver in overall decrease of industrial CO_2 emissions from 2014 to 2016. CO_2 emissions raised in 2012 and 2013, because a power plant temporarily used large amounts of limestone for flue gas desulphurisation. In 2009 the industrial processes sector was affected by the recession. Decline in production was mainly due to insufficient demand on both the domestic and external markets. The sudden increase in emissions in 2007 was mainly caused by an increase in cement production, as the only cement factory renovated its third kiln. The decrease in emissions in 2002 and 2003 was caused by the reduction in ammonia production, as the only ammonia factory in the country was being reconstructed. The decrease in emissions during the early 1990s was caused by the transition from a planned economy to a market economy after 1991 when Estonia regained its independence. This led to lower industrial production and to an overall decrease in emissions from industrial processes between 1991 and 1993. In 1994 the economy began to recover and production increased. The total emissions of HFCs have increased significantly since 1993, especially HFC emissions from refrigeration and air-conditioning equipment, which is the major source of halocarbons in Estonia.

The share of emissions by category and overall progression of GHG emissions in the Industrial processes and product use sector in CO_2 eq. is presented in Figure 2.5.

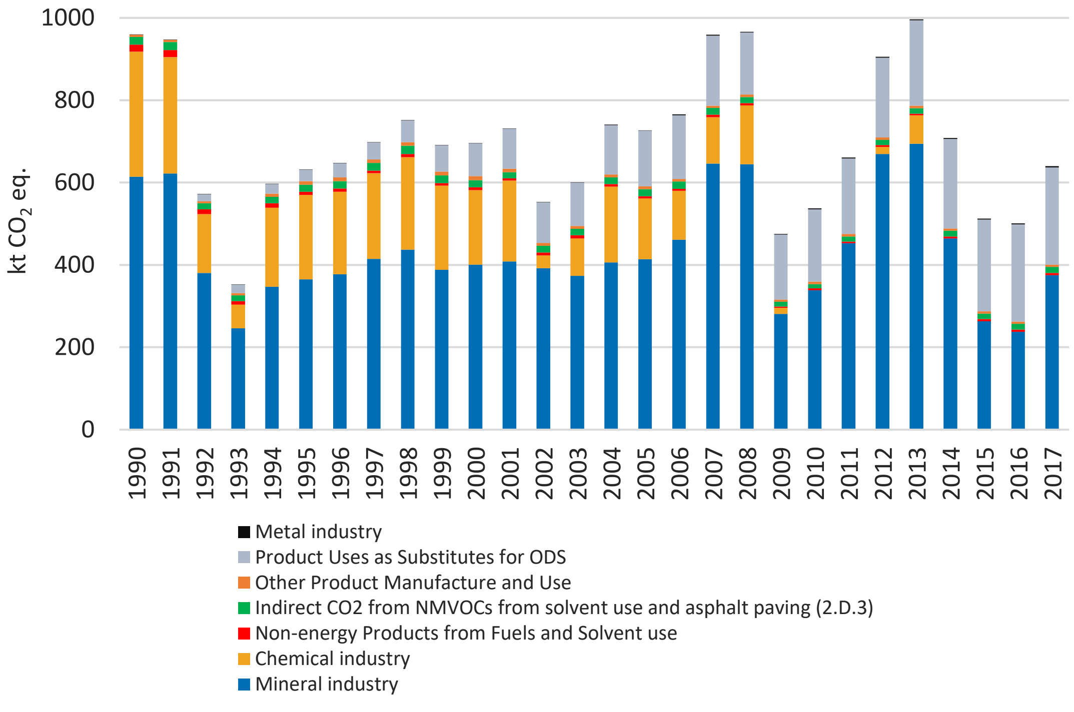

Figure 2.5. Trend in emissions from Industrial processes and product use sector, 1990–2017, kt CO_2 eq.

Agriculture

Agricultural GHG emissions in Estonia consist of CH_4 emissions from Enteric fermentation of domestic livestock, N_2O emissions from Manure management systems, direct and indirect N_2O emissions from Agricultural soils, CO_2 emissions from Liming and Urea application to agricultural soils. Direct N_2O emissions include emissions from synthetic fertilizers, emissions from animal waste, compost and sludge applied to agricultural soil, emissions from crop residues and cultivation of organic soils, mineralization associated with loss or gain of soil organic matter and emissions from urine and dung deposited by grazing animals. Indirect N_2O emissions include emissions due to atmospheric deposition and leaching and run-off.

The total GHG emissions reported in the Agricultural sector of Estonia were 1,379.3 kt CO_2 eq. in 2017. The sector contributed about 6.6%[4] to the total CO_2 eq. emissions in Estonia. In 2017 the emissions from enteric fermentation increased 1.3% and from manure management 3.2% compared to the previous year due to a rise in the numbers of cattle and swine. The dairy industry has suffered a decline in production due to economic sanctions imposed by Russia on EU starting from August 2014. Consequently, the number of dairy cattle in 2017 fell 9.6% in comparison with 2014, though the same number has increased by 0.3% compared to 2016. The number of swine has fallen 19.2% by 2017 compared to 2014 in Estonia as a result of the outbreak of African swine fever in the region in 2015. However, compared to 2016 the number of swine decreased 8.7% in 2017.

Emissions from agricultural soils and enteric fermentation of livestock were the major contributors to the total emissions recorded in the sector – 50% and 39% respectively.

As a result of the markets of the former Soviet Union collapsing in the early 1990's, Estonia was left with a large excess supply of agricultural produce. Western markets remained closed to Estonian agricultural products, mostly for two reasons – high customs barriers and non-compliance of our products with the requirements and practices abroad. Producer prices in Estonia fell to a level up to 50% lower than prices on world markets and became insufficient to cover production costs[5]. All of which led to rapid decline of agricultural production in Estonia and which explains why the emissions from the Agricultural sector have declined by 48.9% by 2017 compared with the base year (1990). Between 2002–2008, the most important driving force for Estonian agriculture was the EU accession and the application of accompanying supporting EU's common agricultural policy which significant effect appeared a few years before joining[6]. The positive impact on the agricultural production manifested years preceding the EU accession, is reflected in the turnover of a downward GHG emissions trend that began in the 1990's.

The overall progression of GHG emissions in the Agriculture sector is presented in Figure 2.6.

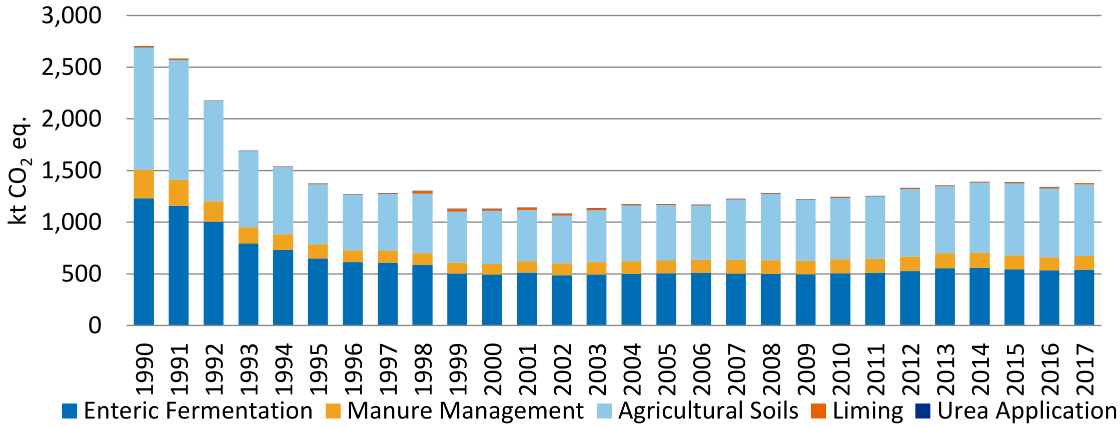

Figure 2.6. Trend in emissions from Agriculture sector, 1990–2017, kt CO_2 eq.

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[4] GHG emissions related to LULUCF sector are not included.
[5] http://www.estonica.org/en/The_rural_economy_in_Estonia_until_2001/Crisis_in_agriculture_in_the_1990s/ .
[6] Estonian Universtity of Life Sciences. (2011). *Maaelu arengu aruanne.*

Land use, land-use change and forestry

The LULUCF sector, acting as the only possible sink of greenhouse gas emissions in Estonia, plays an important role in the national carbon cycle. Emissions and removals from the LULUCF sector are divided into the following categories: Forest land; Cropland; Grassland; Wetlands (peatland); Settlements; Other land and Harvested wood products (HWP). Each category, except HWP, is further divided into 'land remaining' and 'land converted to' subcategories.

The share of LULUCF sector emissions and removals by each land use category during the time period 1990–2017 is presented in Figure 2.7. In 2017 the LULUCF sector acted as a CO_2 sink, totaling uptake of 1 792.74 kt CO_2 equivalent. Compared to the base year (1990), uptake of CO_2 in LULUCF sector has increased by 20.4% and compared to the previous year (2016), decreased by 34.7%. The main drivers behind the LULUCF sector sink are harvest rates and Harvested wood products. A key driver behind the harvest trend has been the socio-economic situation in Estonia.

The majority of CO_2 removals in the LULUCF sector comes from the biomass increment in Forest land remaining forest land and Land converted to forest land subcategories. In 2017, forest land and HWP were the only net sink categories.

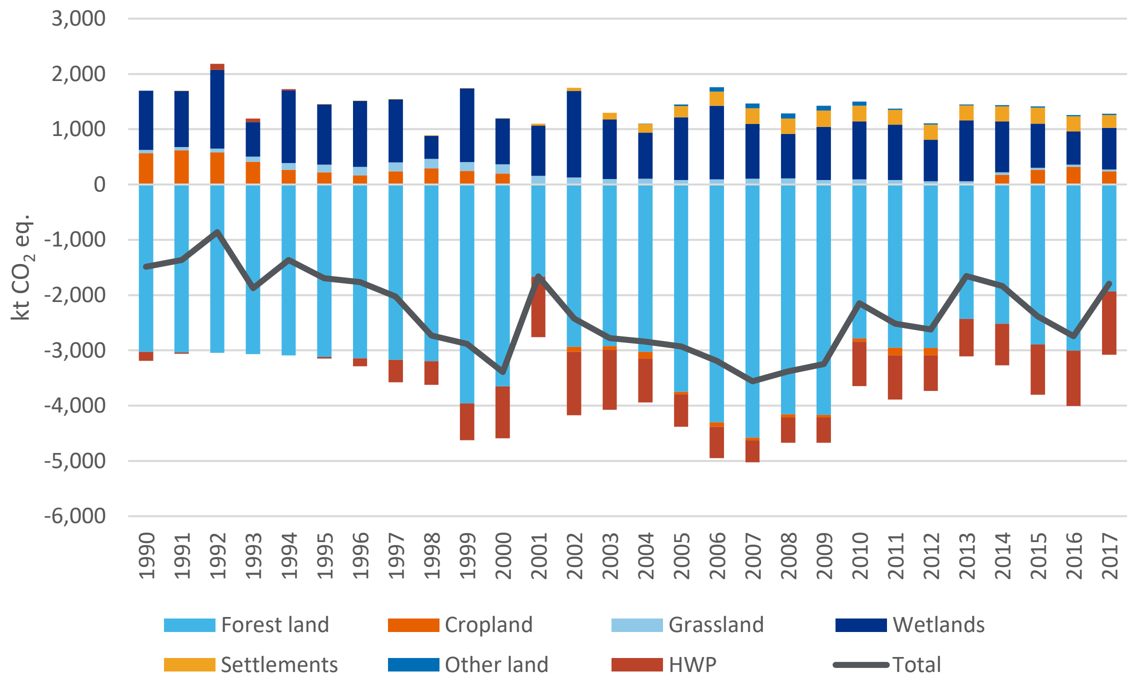

Figure 2.7 Trend in emissions from land use, land-use change and forestry sector 1990–2017, kt CO_2 eq.

Waste

Estonia's GHG emissions from Waste sector covers solid waste disposal sites which include solid municipal and industrial waste. The Waste sector also covers GHG emissions which include both CH_4 and N_2O emissions from waste incineration without energy recovery and open burning of waste, biological treatment of solid waste and wastewater treatment and discharge from domestic and industrial sector. CO_2 emission is reported from non-biogenic incineration without energy recovery.

CO_2 eq. emissions from the Waste sector were 328.7 kt in 2017 and covered about 1.57% of total GHG emissions. Total CO_2 eq. emissions from the Waste sector in 2017 decreased by 3.4% compared to 2016. In recent years, total emissions have followed a declining trend. Compared to the base year of 1990, the amount of CO_2 eq. emissions in 2017 were 11.2% smaller. Compared to the base year, CO_2 eq. emissions from Solid waste disposal (SWD) have decreased by 1.2%, CO_2 eq. emissions from Waste incineration and Open burning of waste by 57.2%, and from Wastewater treatment and discharge by 42.4%. On the other hand, CO_2 eq. emissions from Biological treatment of solid waste have, compared to the base year of 1990, increased by 2391.9%.

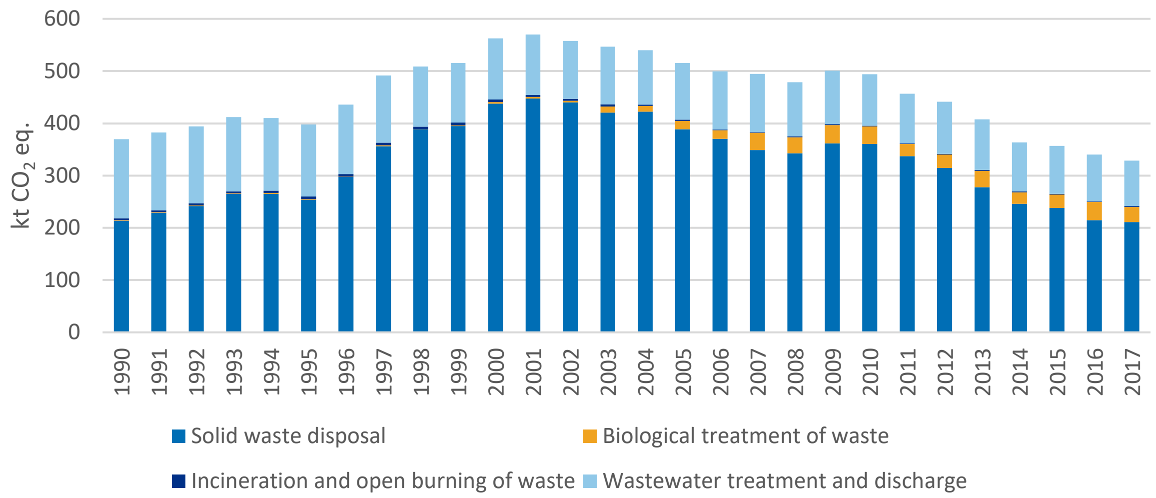

Figure 2.8 Trends of GHG emissions in the waste sector by source categories in 1990–2017, kt CO_2 eq.

As seen from the Figure 2.8, GHG emissions from Waste sector are in decreasing trend. The lowest CO_2 eq. emissions occurred in 2017, which was mainly connected to decreasing amount of waste deposited on landfills. Low CO_2 eq. emissions in 1995 are related to decrease CH_4 emissions originating from paper and sludge disposal. The highest CO_2 eq. emission in 2000–2001 is related to significant increase in emissions mainly from Solid waste disposal. Increasing trend of emission until 2001 is linked to the high amount deposited organics and food waste which were deposited due to low rate of waste sorting. Emissions from waste incineration have been marginal during the whole period compared to other activities involved. The decrease of GHG emissions from Waste sector after 2004 is connected with the increasing amount of CH_4 recovery from landfills. Emissions decrease starting from 2008 is connected with the financial crisis during 2007–2008. Financial crisis did not affect the Waste sector immediately, because companies had a prepared raw material reserve. The total CO_2 eq. in 2011 decreased significantly compared to previous years, mainly because of the change in the national currency, which raised prices in the country and therefore reduced consumption habits and waste generation. Also, the opening of Iru waste incineration plant in 2013 had a decreasing effect on the amount of deposited waste trend since 2010.

2.1.3. Information on indirect GHG emissions

Air pollutant emissions reported in the CRF and NIR are based on the data reported in UNECE/CLRTAP inventories by the Estonian Environment Agency. The emissions are mainly calculated by using actual emissions data reported by the companies as well as by using the EMEP/EEA Guidebook 2016. Figure 2.9 shows indirect GHG emission trends in 1990 to 2017.

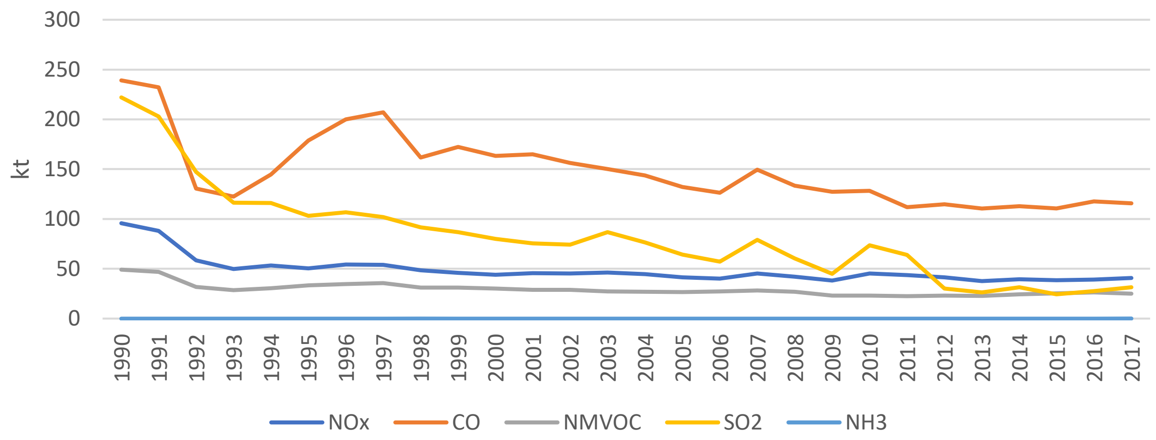

Figure 2.9 Estonia's indirect GHG emissions by gas 1990–2017 reported in the CRF, kt

2.1.4. Accuracy/Uncertainty of the data

The uncertainty estimate of the 2019 inventory to the UNFCCC Secretariat has been done according to the Tier 1 method presented by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006). Tier 1 method combines the uncertainty in activity rates and emission factors, for each source category and greenhouse gas, and then aggregates these uncertainties, for all source categories and greenhouse gases, to obtain the total uncertainty for the inventory.

In many cases, uncertainty values have been assigned based on default uncertainty estimates according to IPCC Guidelines or expert judgement because there is a lack of information. For each source, uncertainties are quantified for emission factors and activity data.

Uncertainties are estimated for direct greenhouse gases, e.g. CO_2, CH_4, N_2O and F-gases. The uncertainty analysis was done for the sectors: Energy, Industrial processes and product use, Agriculture, LULUCF and Waste sector. Table 2.2 shows the estimated uncertainties for total greenhouse gas emissions in 2017 and the trend (with and without LULUCF).

Table 2.2 Uncertainty in total 2019 inventory submission

	Combined as % of total national emissions in 2017	Introduced into the trend in total national emissions
	Uncertainty [%]	
Without LULUCF	4.89	2.11
With LULUCF	9.03	3.95

2.2. National inventory arrangements

2.2.1. Institutional arrangements

Single national entity with overall responsibility for the Estonian greenhouse gas inventory is Ministry of the Environment (MoE). In 2018 a change in the national inventory system was made when MoE appointed the Estonian Environmental Research Centre (EERC) to be the institution to have the overall responsibility of maintaining the national system, coordinating the inventory preparation process as a whole, being responsible for the final quality control and quality assurance and submitting the final inventory to the European Commission (EC) and to the UNFCCC on behalf of the MoE. The inventory will continue to be produced in collaboration between the MoE, EERC and Estonian Environment Agency (EstEA) as until now.

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The MoE is responsible for:

- entering into formal agreements with the inventory coordinator (EERC); and
- making the greenhouse gas inventory available to the public.

EERC is responsible for:

- maintaining the national inventory system;
- coordinating the inventory preparation process as a whole;
- compiling the National Inventory Report according to the parts submitted by the inventory compilers;
- coordinating the implementation of the QA/QC plan and final QA/QC of the inventory;
- sending the final inventory to the MoE and approving the inventory before the official submissions;
- reporting the greenhouse gas inventory to the EC and to the UNFCCC, including the National Inventory Report and CRF tables on behalf of MoE;
- coordinating cooperation between the inventory compilers, the EC and UNFCCC Secretariat;
- coordinating the UNFCCC inventory reviews and communication with the expert review team, including responses to the review findings.
- informing the inventory compilers of the requirements of the national system and ensuring that existing information in national institutions is considered and used in the inventory where appropriate;

- informing the inventory compilers of new or revised guidelines; and
- the overall archiving system.

The EERC is responsible for preparing the estimates for the Energy, Industrial processes and product use, Agriculture and Waste sectors. The Forest Department of the Estonian Environment Agency is responsible for LULUCF and KP LULUCF estimates. Sectoral experts collect activity data, estimate emissions and/or removals, implement QC procedures and record the results, fill in sectoral data to the CRF Reporter and prepare the sectoral parts of the NIR. These experts are also responsible for archiving activity data, estimates and all other relevant information according to the archiving system.

In addition, the GHG inventory team cooperates with the team in charge of the preparation of the atmospheric pollutant emission inventory to the CLRTAP Convention by having annual meetings between the two teams to find possibilities to make the information coherent between the two reports. Sectoral experts meet bilaterally time to time with the aim of reducing differences in the estimates between the two inventories.

Financial resources for inventory compilation are applied from Environmental Investment Centre and from State Budget.

The three core institutions: MoE, EERC and EstEA work together to fulfill the requirements for the national system. The overview of the allocation of responsibilities is shown in Figure 2.10.

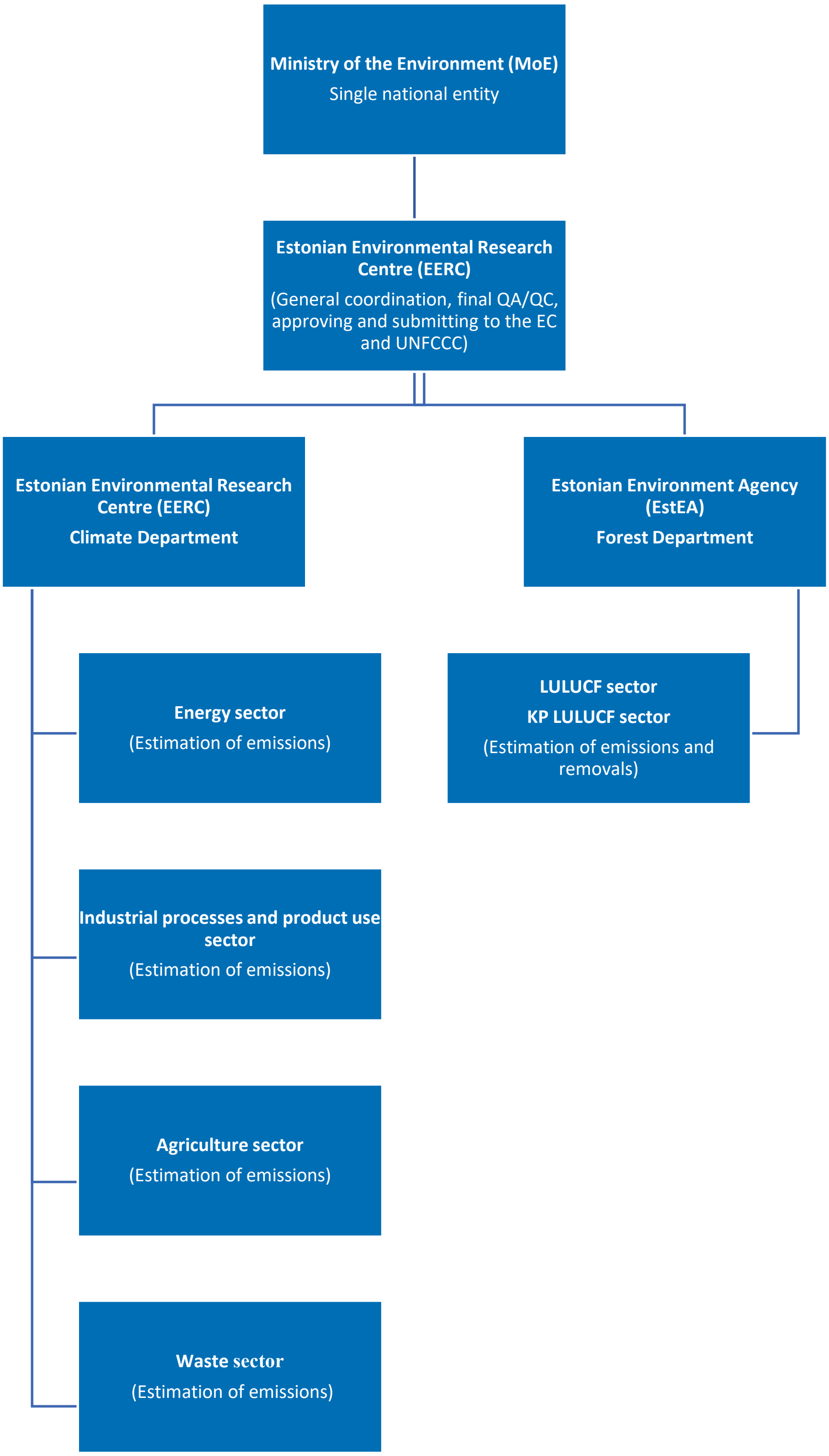

Figure 2.10 National System for GHG inventory in Estonia

Legal arrangements

In accordance with §143 of the Atmospheric Air Protection Act (RT I, 05.07.2016, 1), activities for the reduction of climate change are organised by the Ministry of the Environment on the basis of the requirements for the restriction of the limit values of emissions of greenhouse gases provided by the UNFCCC, the Kyoto Protocol and the European Union legislation.

In accordance with §6 of the Statutes of the Ministry of the Environment (RT I 2009, 63, 412), the MoE is responsible for climate change related tasks and according to §23 section 8, the Climate Department task is to organize, develop and implement climate change mitigation and adaptation policies. In accordance with the Statutes of the Climate Department of the MoE, the department is responsible for organizing and coordinating GHG emission reporting activities under the UNFCCC, the Kyoto Protocol and the European Union legislation. In the beginning of 2018 with an aim to improve/optimize the inventory compiling process in Estonia, MoE decided to appoint the Estonian Environmental Research Centre to be the overall coordinator of the GHG inventories.

The Estonian Environmental Research Centre is a state-owned organization established for general interest, all of the shares in which are held by the Republic of Estonia. The EERC belongs to the government area of the Ministry of the Environment. Any changes to and the approval of the statutes of the EERC are the responsibility of the Ministry of Environment.

As of 2018 according to §1.8 of the Statues of the Estonian Environmental Research Centre, EERC as a state-owned company guarantees the organisation and the timely submissions of the GHG inventories to the EC and to the UNFCCC. Statues of the EERC was amended in the beginning of 2018 according to decision made by the Minister of the Environment as it is the competence of the Minister of the Environment to amend the Statutes of the EERC. Also, EERC management supervision is carried out by the body 100% appointed by the Minister of the Environment.

EERC compiles the GHG inventory on the basis of contract agreements with the MoE.

The Estonian Environment Agency (EstEA), institution that is responsible for the LULUCF estimates, is a state authority administered by MoE, which was formed as a result of the merger of the Estonian Meteorological and Hydrological Institute (EMHI) and the Estonian Environment Information Centre (EEIC) in 2013. In accordance with §9 section 9 of the Statute of the EstEA, the tasks of the Forest Department include planning, organizing and carrying out statistical forest inventories, monitoring land use, land-use changes and carbon cycle and fulfilling national and international reporting obligations.

The Statistics Estonia collects and coordinates the production of official statistics on the basis of the Official Statistics Act § 9[7].

2.2.2. Inventory process

The UNFCCC, the Kyoto Protocol and the European Union (EU) GHG monitoring mechanism requires Estonia to submit annually a National Inventory Report (NIR) and Common Reporting Format (CRF) tables. The annual submission contains emission estimates for the years between 1990 and the year before last year.

Estonia's national GHG inventory system is designed and operated according to the guidelines for national systems under article 5, paragraph 1, of the Kyoto Protocol to ensure the transparency, consistency, comparability, completeness and accuracy of inventories. Inventory activities include planning, preparation and management of the inventories.

The EERC and the MoE have developed an inventory production plan that sets out the schedule for inventory preparation. The schedule, which is annually reviewed, forms part of Estonia's QA/QC plan and must be followed by all core institutions.

[7] Official Statistics Act: https://www.riigiteataja.ee/en/eli/ee/Riigikogu/act/506012015002/consolide

Since the submission of the third biennial report under the UNFCCC, the "Regulation of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action[1]" (Governance Regulation) has entered into force (December 2018). The Governance Regulation fully integrates the provisions of the existing EU Monitoring Mechanism Regulation (MMR) while bringing them in line with the provisions of the Paris Climate Agreement. Under the EU MMR, the annual inventory must be submitted to the Commission by 15 January. Member States may then complement and update their submissions by 15 March. The official GHG inventory is submitted to the UNFCCC Secretariat by 15 April.

The methodologies, activity data collection and emission factors are consistent with the 2006 IPCC Guidelines for National GHG Inventories (IPCC 2006 GL).

The inventory process for the next inventory cycle starts with an examination of previous years and an analysis of the available datasets in order to improve the inventory through new knowledge and the activity data developed. Activity data is mainly based on official statistics and data from companies and the National Forest Inventory. The emission factors are national values, values recommended in the IPCC GL or values taken from other countries' GHG inventories.

Sectoral experts collect activity data, estimate emissions and/or removals, implement QC procedures and record the results, fill in sectoral data to the CRF Reporter and prepare the sectoral parts of the NIR. These experts are also responsible for archiving activity data, estimates and all other relevant information according to the archiving system. The EERC compiles the NIR according to the parts submitted by the inventory experts, evaluates the overall uncertainty of the inventory totals and performs key category analysis.

The uncertainty estimate of the 2017 inventory has been done according to the Tier 1 method presented by the IPCC 2006 GL. Tier 1 method combines the uncertainty in activity rates and emission factors, for each source category and GHG, and then aggregates these uncertainties, for all source categories and GHG-s, to obtain the total uncertainty for the inventory. In many cases uncertainty values have been assigned based on default uncertainty estimates according to IPCC guidelines or expert judgement, because there is a lack of the information. For each source, uncertainties are quantified for emission factors and activity data.

Key categories are those of emissions/removals, which have a significant influence on the total inventory in terms of the absolute level of emissions or trends in emissions (or both). Estonia uses the Tier 2 method to identify key categories, and emission categories are sorted according to their contribution to emission levels or trends. The key categories are those that together represent 90% of the inventory level or trend.

The results of key category analysis are important because they guide decisions on methodological choice. The goal is to screen the long list of category-gas contributions and find those that are most important in terms of the emissions level or trend. The list of key categories forms the basis of discussions with the sectoral experts on the quality of the estimates and possible need for improvement.

Recalculations are made if errors, overlaps or inconsistencies in the time series are identified, when a new source or sink is considered or if more accurate knowledge becomes available. The driving forces in applying recalculations to Estonia's GHG inventory are the implementation of the guidance given in IPCC 2006 GL and the recommendations from the UNFCCC inventory reviews. In order to ensure the consistency of the emission inventory, recalculations are carried out on the whole time series, as far as possible.

All institutions involved in compiling the GHG inventory keep close contact with one another. Several cooperation meetings are held annually to discuss and agree on methodological issues, problems that have arisen and improvements that need to be implemented.

2.2.3. Quality management

The starting point in accomplishing a high-quality GHG inventory is consideration of expectations and inventory requirements. The quality requirements set for annual inventories are continuous improvement, transparency, consistency, comparability, completeness, accuracy and timeliness. The setting of concrete annual quality objectives is based on these requirements.

EERC, in collaboration with the expert organizations responsible for the inventory calculation sectors, set yearly quality objectives for the whole inventory at the inventory planning stage and design the QC procedures needed for achieving these objectives. In addition, the expert organizations set their own, sector and/or category specified quality objectives and prepare their QC plans.

The next step is development of the QA/QC plan and implementing the appropriate quality control measures (e.g. routine checks, documentation) focused on meeting the quality objectives set and fulfilling the requirements. In addition, QA procedures are planned and implemented. In the improvement phase of the inventory, conclusions are made on the basis of the realized QA/QC process and its results.

The Estonia's QA/QC plan consist of seven parts: (1) production plan; (2) annual meetings; (3) QA/QC checks; (4) QA results documentation form; (5) archiving structure; (6) response tables to the review process and (7) a list of planned activities and improvements.

All institutions involved in the inventory process (MoE, EERC and EstEA) are responsible for implementing QC procedures to meet the data quality objectives. EERC as the inventory coordinatoris responsible for overall QC and is in charge of checking on an annual basis that the appropriate QC procedures are implemented internally in EERC and EstEA. EERC is also responsible for QC of the data of the emission inventory. EERC as the inventory coordinator is responsible for the overall QA of the national system, including the UNFCCC reviews and any national reviews undertaken.

The inventory meetings with participants from all institutes participating in the inventory preparation are held three times a year and the bilateral quality meetings between the quality coordinator (EERC) and the expert organizations are held whenever necessary.

Quality control procedures

The QC procedures used in Estonia's GHG inventory comply with 2006 IPCC Guidelines. General inventory QC procedures[8] include routine checks of the integrity, correctness and completeness of data, identification of errors and deficiencies, documentation and archiving of inventory data and quality control actions. Once the experts have implemented the QC procedures, they complete the QA/QC checklist for each source/sink category, which provides a record of the procedures performed. The QA/QC checklists are part of Estonia's QA/QC plan. Also, assessment of completeness is evaluated.

[8] IPCC 2006 Guidelines, Volume 1, Chapter 6: Quality Assurance/Quality Control and Verification, pages 6.10–6.11, table 6.1.

EERC checks the QC checklists completed by EERC and EstEA. When EERC disagrees with the information provided in the checklists then the errors are discussed and changes are made if necessary.

In addition to the general inventory QC procedures, Estonia applied category-specific QC procedures on some source/sink categories in the 2019 submission, focusing on key categories and on those categories in which significant methodological changes and/or data revisions occurred. More detailed information can be found under sectoral chapters in the NIR.

After the sectoral experts have completed entering data to the CRF Reporter, EERC carries out some general (including visual) checks on the data entered. When the CRF tables are finalized, the experts will start preparing the sectoral chapters of the NIR. These parts are sent to the compiler (EERC) who adds the introduction part and puts the draft NIR together. The compiler arranges the different chapters into one uniform document and makes sure that the structure of the report follows the UNFCCC guidelines. All figures on emissions and removals in tables and text are checked to make sure that they are consistent with those reported in the CRF. The sectoral experts and the inventory compiler also check that all methodological changes, recalculations, trends in emission and removals are well explained.

In addition, the QA/QC of Member States' submissions conducted under the European Union GHG monitoring mechanism (e.g. completeness checks, consistency checks and comparison across Member States) produces valuable information on errors and deficiencies, and the information is taken into account before Estonia submits its final annual inventory to the UNFCCC.

When the draft NIR is completed it is sent to the MoE to the Climate, Forestry, Environmental Management and Water Department to ensure that the submitted data is officially valid.

Quality assurance procedures

The objective of QA implementation is to involve reviewers that can conduct an unbiased review of the inventory and who may have a different technical perspective. It is important to use QA reviewers who have not been involved in preparing the inventory. These reviewers should preferably be independent experts from other agencies or national experts or groups not closely connected to national inventory compilation.

Estonia's GHG inventory is checked annually by one or more independent experts. From the 2009 submission to 2012 submission all data collected by institutions involved in the inventory process was checked by an independent expert from Tallinn University of Technology. In the 2013–2018 submission the inventory was reviewed in parts by the EERC, TUT, University of Tartu, Estonian University of Life Sciences (EULS) and other national experts. The 2019 submission was checked by experts from TUT, Tallinn University and other national experts. The findings of the independent experts are looked through by experts (in collaboration with the EERC) and adjustments carried out as a result, if necessary.

The draft NIR is uploaded to the MoE website www.envir.ee where all interested parties have the opportunity to comment on it. The public reviews of the draft document offer a broader range of researchers and practitioners in non-governmental organizations, industry and academia, as well as the general public, the opportunity to contribute to the final document. The comments received during this process are reviewed and, as appropriate, incorporated into the NIR.

The inventory is also checked by different Ministries and institutions. The inventory will be sent to the Ministry of Economic Affairs and Communications, to Forest, Environmental

Management and Water Departments in MoE, to Ministry of Rural Affairs, and to Statistics Estonia. During the in-country review in 2012, UNFCCC review team encouraged Estonia to strengthen its QA procedures by involving Statistics Estonia in the quality checking of the inventory. Taking into account the recommendation, starting from the 2013 submission, inventory is annually sent to Statistics Estonia for quality checking.

UNFCCC reviews are part of QA. The reviews are performed by a team of experts (sectoral experts and generalist) from other countries. They examine the data and methods that Estonia is using and check the documentation, archiving system and national system. In conclusion, they report whether Estonia's overall performance is in accordance with current guidelines. The review report indicates the specific areas in which the inventory is in need of improvements. Due to Insufficient resources from the core budget to organize the 2017 review cycle fully in accordance with relevant mandates Estonia's 2017 GHG inventory was not reviewed by the UNFCCC experts. Estonia's 2018 GHG inventory was a subject of an in-country review performed by the UNFCCC experts.

For a more detailed description of the QA/QC system, please see Estonia's National Inventory Report.

2.2.4. Changes in national inventory arrangements since BR3

In 2018 a change in the national inventory system was made when Ministry of the Environment (MoE) as a single national entity appointed the Estonian Environmental Research Centre (EERC) to be the institution to have the overall responsibility of maintaining the national system, coordinating the inventory preparation process as a whole, being responsible for the final quality control and quality assurance and submitting the final inventory to the European Commission (EC) and to the UNFCCC on behalf of the MoE. As of 2018 according to §1.8 of the Statues of the EERC as a state-owned company guarantees the organisation and the timely submissions of the GHG inventories to the EC and to the UNFCCC. Statues of the EERC was amended in the beginning of 2018 according to the decision made by the Minister of the Environment as it is the competence of the Minister of the Environment to amend the Statutes of the EERC. Also, EERC management supervision is carried out by the body 100% appointed by the Minister of the Environment.

3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

3.1. The European Union and its Member States target under the Convention

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels, in order to contribute to achieving the ultimate objective of the UNFCCC: 'to stabilise GHG concentrations at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system', or, in other words, to limit the global temperature increase to less than 2°C compared to temperature levels before industrialization (FCCC/CP/2010/7/Add.1).

The definition of the Convention target for 2020 is documented in the revised note provided by the UNFCCC Secretariat on the 'Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention' (FCCC/SB/2011/INF.1/Rev.1 of 7 June 2011). EU provided additional information relating to its quantified economy wide emission reduction target in a submission as part of the process of clarifying the developed country Parties' targets in 2012 (FCCC/AWGLCA/2012/MISC.1).

The EU's accounting rules for the target under the UNFCCC are more ambitious than the rules under the Kyoto Protocol, for example, including outgoing flights, and adding an annual compliance cycle for emissions under the Effort Sharing Decision (ESD) or higher Clean Development Mechanism quality standards under the EU Emissions Trading System (EU ETS) (FCCC/TP/2013/7). Accordingly, the following assumptions and conditions apply to the EU's -20% commitment under the UNFCCC:

- The EU Convention pledge does not include emissions/removals from Land Use, Land Use Change and Forestry; however, this sector is estimated to be a net sink over the relevant period. EU GHG inventories include information on emissions and removals from LULUCF in accordance with relevant reporting commitments under the UNFCCC. Accounting for LULUCF activities only takes place under the Kyoto Protocol[9];
- The target covers the gases CO_2, CH_4, N_2O, HFCs, PFCs and SF_6;
- The target refers to 1990 as a single base year for all covered gases and all Member States. Emissions from outgoing flights are included in the target,
- A limited number of CERs, ERUs and units from new market-based mechanisms may be used to achieve the target (see section 3.2.2 in BRIV of the EU): in the ETS, the use of international credits was allowed up to specific levels set in the EU ETS Directive, amounting to over 1500 million CER and ERU entitlements in the period up to 2020). Quality standards also apply to the use of international credits in the EU ETS, including not allowing the use of credits from LULUCF projects and certain industrial gas projects. International credits will no longer be used for EU ETS compliance in the system's fourth trading period (2021-2030). In the ESD sectors, the annual use of international credits is currently limited to up to 3 % of each Member State's ESD emissions in 2005, with a limited number of Member States being permitted to use an

[9] The LULUCF Decision (Decision 529/2013) requires to prepare and maintain annual LULUCF accounts according to the rules set out in the Kyoto Protocol; however, these accounts do not contribute to the achievement of the EU Convention pledge.

additional 1% from projects in Least Developed Countries (LDCs) or Small Island Developing States (SIDS), subject to conditions; from 2021 onwards, as with the EU ETS, international credits will no longer be used for compliance under the ESD.

- The Global Warming Potentials (GWPs) used to aggregate GHG emissions up to 2020 under EU legislation were those based on the Second Assessment Report of the IPCC when the target was submitted. For the implementation until 2020, GWPs from the IPCC AR4 will be used consistently with the UNFCCC reporting guidelines for GHG inventories.

In 2009 the EU established internal rules under its "2020 climate and energy package" - these underpin the EU implementation of the target under the Convention. The EU's *2020 climate and energy package* introduces a clear approach to achieving the 20% reduction of total GHG emissions from 1990 levels, which is eq. to a 14% reduction compared to 2005 levels. This 14% reduction objective is divided between two sub-targets, eq. to a split of the reduction effort between EU emissions trading system (ETS) and Effort Sharing Decision (ESD) sectors[10]. These two sub-targets are:

- a 21 % reduction target compared to 2005 for emissions covered by the ETS (including outgoing flights);
- a 10 % reduction target compared to 2005 for ESD sectors, shared between the 28 Member States (MS) through individual national GHG targets.

Under the revised *EU ETS Directive*[11] now in phase three, one single EU ETS cap is covering the EU MS and the three participating non-EU MS (Norway, Iceland and Liechtenstein) i.e. there are no further differentiated caps by country. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020; these decrease by 1.74% annually, starting from the average level of allowances issued by MS for the second trading period (2008–2012). Also, phase three covers more sectors and gases.

The ESD (Decision No 406/2009/EC) establishes GHG emission limits for MS to be achieved by 2020 through binding annual targets between 2013 and 2020 (Annual Emission Allocations – AEA). The ESD covers emissions from all sources outside the EU ETS, except for de minimis aviation emissions, international maritime emissions, and emissions and removals from land use, land-use change and forestry (LULUCF). It thus includes a diverse range of small-scale emitters in a wide range of sectors: transport (cars, trucks), buildings (in particular heating), services, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste.

According to the ESD, each MS must define and implement national policies and measures to limit the GHG emissions covered by the ESD. The inclusion of the ESD within the EU's *2020 climate and energy package* ensures that the abatement potential from ESD sectors contribute to the delivery of the EU-wide target of reducing GHG emissions by 20% below 1990 levels by 2020. For Estonia, the GHG emissions from ESD sectors have to be limited at least by 11% by the end of the period of 2013–2020 compared to 2005. Table 3.1 below includes Estonia's target path for Annual Emissions Allocation for the year 2013 to 2020.

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[10] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015

[11] Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the GHG emission allowance trading scheme of the Community.

Table 3.1. Estonia's target path for Annual Emissions Allocation for the year 2013 to 2020 (kt) calculated applying global warming potential values from the fourth IPCC assessment report[12]

	2013	2014	2015	2016	2017	2018	2019	2020
Estonia's annual emission allocations	6,296.988	6,321.312	6,345.636	6,369.960	5,928.965	5,960.550	5,992.135	6,023.720

It is up to each Member State to decide how these targets will be achieved, but domestic measures are needed to fulfil the targets.
The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation (525/2013)[13]. The use of flexible mechanisms is possible under the EU ETS and the ESD.

The ESD allows MS to make use of flexibility provisions for meeting their annual targets, with certain limitations. There is an annual limit of 3% for the use of project-based credits for each MS. If these are not used in any specific year, the unused part for that year can be transferred to other MS or be banked for own use until 2020.

Description of EU's quantified economy-wide emissions reduction target is provided in Table 3.2 and CTF table 2.

Table 3.2. Key facts of the EU's economy-wide emission reduction target

Parameters	Target
Base Year	1990
Target Year	2020
Emission Reduction target	-20 % in 2020 compared to 1990
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors with the exception of LULUCF, as measured by the full annual inventory including international aviation (outgoing flights).
Land Use, Land-Use Change, and Forestry (LULUCF)	Accounted under KP joint EU target does not include LULUCF
Use of international credits (JI and CDM)	Possible subject to quantitative and qualitative limits

3.2. Other emission reduction targets

A further target has been pledged to the Convention through the EU's Nationally Determined Contribution submitted under the Paris Agreement and has been adopted by the EU under the 2030 Climate and Energy Framework[14]. The emission reduction target is a pledge to reduce emissions by at least 40% (compared to 1990 levels) by 2030, enabling the EU to move towards a low-carbon economy and implement its commitments under the Paris Agreement. In order to achieve this target:

- ETS sectors will have to cut emissions by 43% (compared to 2005) by 2030. This has been agreed under the Revised EU ETS Directive (2018/410)[15].

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017D1471&from=EN
[13] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0525&from=EN
[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015
[15] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0410&from=EN

- The 2030 Climate and Energy Framework together with the Revised Renewable Energy Directive (2018/2001) and Energy Efficiency Directive (2018/2002) set a binding renewable energy target (at least 32% of final energy consumption) and a headline target for energy efficiency (at least 32.5% of final energy consumption) by 2030.
- ESD sectors will need to cut emissions by 30% (compared to 2005) by 2030 – this has been translated into individual binding targets for the Member States., that has been agreed under the Effort Sharing Regulation (ESR) (2018/842)[16]. While the ESR does not cover the LULUCF sector as such, it allows the Member States to use up to 280 million credits from the land-use sector over the entire period 2021-2030 to comply with their national targets.
- Emissions and removals from the LULUCF sector are included for the first time in the EU climate target through the so-called LULUCF Regulation (2018/841)[17]. Each Member State will have to ensure that the LULUCF sector does not create debits, once specific accounting rules are applied. This is known as the "no debit" rule.

Beyond this period and beyond this goal, on 28 November 2018, the European Commission presented its strategic vision out to 2050. Under the Long-Term Strategy (LTS), the European Commission called for a climate-neutral Europe by 2050. The EU expects to adopt and submit an ambitious strategy by early 2020 to the United Nations Framework Convention on Climate Change (UNFCCC) as requested under the Paris Agreement. Estonia supports the setting of a long-term climate neutrality target across the European Union (EU) by 2050, if supported by adequate transitional measures and taking into account Member State and sector specificities and different baselines

In Table 3.3 all relevant GHG reduction targets for the EU and their key facts are displayed in an overview. On the left, the table includes the international commitments under the Kyoto Protocol, the UNFCCC and the Paris Agreement. On the right, the EU commitments under the Climate and Energy Package and the Climate and Energy Framework are included.

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0842&from=EN
[17] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0841&from=EN

Table 3.3. Overview of international commitments and EU domestic legislation

	International commitments				EU domestic legislation				
					Climate and Energy Package		Climate and Energy Framework		
	Kyoto Protocol		UNFCCC	Paris Agreement	EU ETS	ESD	EU ETS	ESR	LULUCF
Target year of period	First commitment period (2008-2012)	Second commitment period (2013-2020)	2020	2030	2013-2020		2021 – 2030		
Base year	1990	1990, but subject to flexibility rules.	1990	1990	1990 for overall emission reduction target; 2005 for renewable energy and energy efficiency target; as well as for targets broken down into ETS and non-ETS emissions		2005		Subject to accounting rules
Emission reduction target	-8 %	-20 %	-20 %	At least -40%	-21 % compared to 2005 for ETS emissions	Annual targets by MS. In 2020 -10 % compared to 2005 for non-ETS emissions	-43% for EU ETS sectors	-30% for ESR sectors (translated into individual binding targets for MSs)	No-debit target based on accounting rules
Further targets	–	–	Conditional target of -30 % if other Parties take on adequate commitments	–	Renewable Energy Directive: 20 % share of renewable energy of gross final energy consumption; Energy Efficiency Directive: Increase energy efficiency by 20 %		A binding renewable energy target for the EU for 2030 of at least 32% of final energy consumption, including a review clause by 2023 for an upward revision of the EU level target. A headline target of at least 32.5% for energy efficiency to be achieved collectively by the EU in 2030, with an upward revision clause by 2023.		
Aviation	Domestic aviation included. International aviation excluded.		Aviation in the scope of the EU ETS included. In practice total outgoing flight emissions considered		Outgoing flights included	Excluded	Outgoing flights included	Excluded	Not applicable

	International commitments				EU domestic legislation				
					Climate and Energy Package		Climate and Energy Framework		
	Kyoto Protocol		UNFCCC	Paris Agreement	EU ETS	ESD	EU ETS	ESR	LULUCF
Use of international credits	Use of KP flexible mechanisms subject to KP rules	Use of KP flexible mechanisms subject to KP rules	Subject to quantitative and qualitative limits	No contribution from international credits	Subject to quantitative and qualitative limits	Subject to quantitative and qualitative limits.	No contribution from international credits		
Carry-over of units from preceding periods	Not applicable	Subject to KP rules including those agreed in the Doha Amendment	Not applicable	Not applicable	EU ETS allowances can be banked into subsequent ETS trading periods since the second trading period	No carry-over from previous period			
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, N_2O, CF_4 and C_2F_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, N_2O, CF_4 and C_2F_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O
Sectors included	Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to KP accounting rules for CP1	Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to KP accounting rules for CP2	Energy, IPPU, agriculture, waste, aviation in the scope of the EU ETS	Energy, IPPU, Agriculture, Waste, LULUCF	Power & heat generation, energy-intensive industry sectors, aviation (Annex 1 of ETS directive)	Transport (except aviation), buildings, non-ETS industry, agriculture (except forestry) and waste	As under Climate and Energy Package	As under Climate and Energy Package. [18]	Land-use, land-use change and forestry
GWPs used	IPCC SAR	IPCC AR4							

[18] The ESR allows the use of land-use credits under certain conditions and up to a total limit over the period 2021-2030 as a flexibility option.

3.3. National GHG targets

The national reform programme *Estonia 2020* was approved by the Government in April 2011 and is updated yearly. The last update was done in May 2019[19]. The programme sets 3 main targets regarding GHG emissions and environmental economy and energy:

1. As stipulated in the Effort Sharding Decision[20] Estonia's GHG emissions covered by the ESD should not exceed the GHG level of 11% growth by 2020 compared to 2005.
2. 25% share of renewable energy in final energy consumption by 2020.
3. Keep the final energy consumption on the 2010 level (about 118 PJ).

The target of reaching the 25% share of renewable energy in final energy consumption was already reached in 2011 (25.5%). The share of renewable energy in final energy consumption was 29.2% in 2017.

The Parliament of Estonia has adopted (5 April 2017) the strategy for moving towards long-term emission reduction target which is set to reduce the emission of greenhouse gases by about 70% by 2030 and by 80% by 2050 in comparison with the emission levels of 1990. Additional information on the Estonia's long term *Low Carbon Development Strategy 2050* (GPCP 2050) is provided in Chapter 4.1.

Currently the GPCP 2050 is under review as stated in paragraph 36 of the document, taking into account Paris Agreement objectives, IPCC special reports from 2018 and 2019 and European Commission strategic vision document „Clean Planet for all" and Green Deal proposals.

Estonia's agreed target by 2030 for reducing emissions in sectors covered under the Effort Sharing Regulation is -13% compared to 2005.

3.3.1 Monitoring on progress

For the monitoring of GHG emissions EU Member States are reporting according to the EU Monitoring Mechanism Regulation (Regulation (EU) No 525/2013) to the European Commission annually the greenhouse gas inventories and other relevant data. Monitoring, reporting and verification of the ESD targets mainly takes place through the submission of the national GHG inventories.

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

Also, development plan of the area of government of the Ministry of the Environment 2019-2022 covers all activities and measures of the Ministry and its area of government. the development plan of the area of government of the Ministry of the Environment describes the bases and strategic framework of the organization's activity and contribution of government

[19] https://www.riigikantselei.ee/sites/default/files/content-editors/Failid/eesti2020/ee2020_2019-2020_30.05.2019.pdf
[20] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009D0406&from=EN

agencies to the Environmental field of activity through three sub-areas, with the following objectives:

1) the environment and biodiversity protection;
2) guaranteed sustainable and efficient use of the environment;
3) the organization's management is efficiently organized and the resource is used optimally.

Under the objective of sustainable and efficient use of the environment the action 2.1 Reducing greenhouse gas emissions (mitigating climate change) states the objective: "Climate change has been mitigated by reducing greenhouse gas emissions and limiting the growth of emissions in the sectors which do not fall under the Emission Trading System (EU ETS)". The implementation of this action is monitored with a target metric- Total greenhouse gases emissions in sectors outside the EU ETS, (million tonnes of CO_2 equivalents).
Every year the annual performance report on implementation of the area of government of the Ministry of the Environment is submitted to the Ministry of the Finance. This report is thereafter also evaluated by the National Audit Office of Estonia. The report consists of the evaluation of x-1 year and also is forward-looking to the whole period the development plan has been set for. Fulfilling the actions are monitored and evaluated every year. For every different action it is indicated in the report whether the target metric was met and the reasoning must also be provided (for both, meeting and not meeting the metric).

4. PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION

This chapter provides information on the Estonian *Low Carbon Development Strategy* as well as national studies and key policies and measures implemented or under discussion to reduce GHG emissions. The information is presented separately for the 'With Measures' scenario (WEM) and the 'With Additional Measures (WAM)' scenario. Both scenarios are used in the GHG projections presented in chapter 5.

Emissions/removals in the LULUCF sector are not included in the EU target under the Convention. They are therefore not included in CTF Table 4 and CTF Table 4(a) is left empty. However, mitigation actions in the LULUCF sector are described in Chapter 4.4.4 below and presented in CTF Table 3. Also, projections for the LULUCF sector are presented in Chapter 5.

4.1. Cross-cutting policies and measures

The two main overarching policies are the EU ETS and the ESD, both establishing EU internal rules under the "2020 climate and energy package" which underpin the implementation of the target under the Convention.

4.1.1. 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 EU ETS is a cornerstone of the EU's policy to combat climate change and its key tool for reducing GHG emissions cost-effectively. It was established by Directive 2003/87/EC (the Emissions Trading Directive) and entered into force on 1 January 2005.

Between 2013 and 2018, EU emissions in the sectors covered by the EU ETS have decreased by 11.8%. [21] To increase the pace of emissions cuts in phase 4, the overall number of emission allowances will decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% during the period between 2013-2020. This increase implies a steady reduction of some 48 million allowances annually, compared to 38 million currently, and is consistent with a 43% reduction in GHG emissions from ETS covered sectors by 2030, compared to 2005 levels.

Estonia's first National Allocation Plan (NAP) for the EU ETS for 2005–2007 included 43 installations. The first NAP for GHG emission allowances provided the right to emit 56.7 million tons of carbon dioxide from 2005–2007. The NAP2 for the period 2008-2012 provided the right to emit 66.51 Mt of CO_2 eq. (13.3 Mt/a). This quantity included a reserve of 3.47 Mt of CO_2 eq. for new entrants and a JI reserve of 0.99 Mt of CO_2 eq.

The EU ETS is now in its third phase of 2013–2020. Compared to the previous phase, the main changes include:

- A single, EU-wide cap on emissions (previous system included national caps).

[21] The cut-off date for data used is 28 June 2019. The decrease pertains to verified emissions from EU ETS stationary installations (power sector and industry).

- Covering more sectors and gases: CO_2 from power and heat generation, energy-intensive industry sectors and commercial aviation; N_2O production of nitric, adipic and glyoxylic acids and glyoxal and PFC aluminium production.

Auctioning method for allocating allowances (instead of free allocation), and harmonised allocation rules apply to the allowances still given away for free according to Article 10a of the EU ETS Directive.

- 300 million allowances have been set aside in the New Entrants Reserve to fund the deployment of innovative renewable energy technologies and carbon capture and storage through the NER 300 programme.

The share of Estonia's EU ETS emissions from all sectors is very high, comprising about 66% from total emission in 2015. As of year 2017 Estonia had 46 installations.

Articles 10c of the EU Emissions Trading Directive (Directive 2003/87/EC as amended by Directive 2009/29/EC) allow several Member States (incl. Estonia) to allocate limited number of emission allowances free of charge. These Articles are covering district heating and high efficiency cogeneration for economically justifiable demand in respect of the production of heating or cooling and existing power plants, provided that the funds are used to modernize the energy system. In June 2012 the EC concluded that provisions of Estonia's development plan for the electricity sector allocating free allowances are in line with EU state aid rules. During the transition period (2013-2019) Estonia is permitted to allocate 18 million of free allowances to electricity producers included in the EU ETS.

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

The Effort Sharing Decision (2013-2020), covers direct emissions from the non-ETS sectors such as buildings, transport (excluding aviation), waste and agriculture (excluding land use, land use change and forestry) for the period 2013-2020. It sets binding national emission targets for 2020, expressed as percentage changes from 2005 levels, and a trajectory of annual limits between 2013 and 2020 for each Member State. By 2020, these national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered compared with 2005 levels. By 2020, Estonia's ESD emissions are projected to have dropped to 5682.61 kt CO_2 eq. (WAM), and 5751.27 CO_2 eq. (WEM). As the ESD reduction target is set for the whole period of 2013-2020 therefore, it is expected that Estonia will meet its reduction targets up to 2020 (Table 3.1 and 4.1).

Table 4.1. Non-ETS emissions and Assigned Emission Allocations, kt CO_2-eq

Year	Non-ETS Emissions kt CO_2 eq.	Annual emission allocation kt CO_2 eq.
2013	5,753.0	6,296.99
2014	6,083.1	6,321.31
2015	6144.4	6,345.64
2016	6,218.0	6,369.96
2017	6,205.0	5,928.97

The progress of Member States in meeting the emission reduction targets set in the Effort Sharing Decision is assessed under the Monitoring Mechanism Regulation (Regulation No 525/2013), and also as part of the European Semester[22].

The two main developments since the BR3 are that the Effort Sharing Regulation[23] on binding annual emission reductions by Member States from 2021 to 2030 and the LULUCF Regulation[24] were adopted in 2018 as part of the Energy Union strategy and the EU's implementation of the Paris Agreement. The Effort Sharing Regulation sets national emission reduction targets for 2030 and keeps the same flexibilities and annual compliance in 2021-2030 as currently under the decision. There is a new option for some Member States to use a limited amount of allowances from the EU ETS. There are also some flexibilities with the new LULUCF Regulation, which defines for the first time an EU target for the Land Use, Land Use Change and Forestry sector, the so-called "no-debit rule"[25]

4.1.3. 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.

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 CO_2 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

[22] The European Semester is the EU's annual cycle of economic policy guidance and surveillance: http://ec.europa.eu/economy_finance/economic_governance/the_european_semester/index_en.htm
[23] https://eur-lex.europa.eu/eli/reg/2018/842/oj
[24] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG
[25] https://ec.europa.eu/clima/policies/forests/lulucf_en

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 sequestrate 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.

4.2. Sectoral policies and measures

4.2.1. Energy sector

The Government of Estonia approved the *Estonian Energy Development Plan until 2030 (EEDP 2030)* on 19 October 2017. The development plan is aimed at ensuring an energy supply that is available to consumers at a reasonable price and effort and with an acceptable environmental condition while observing the terms and conditions established in the long-term energy and climate policy of the EU. The most beneficial economic competitiveness aspects must be observed for the purposes of the implementation of *EEDP 2030*. The plan also drafts the benchmarks for renewable energy and energy efficiency operational programmes and the vision for the renovation of buildings.

The *EEDP 2030* also includes plans for regional cooperation, particularly with Latvia and Lithuania in terms of security of energy supply.

Electricity supply

The major national-level document aimed at the electricity sector is the *EEDP 2030*. The plan foresees a significant decrease in electricity production from oil shale and an increase in the proportion of other sources of energy.

The plan 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. Also, the capacity of wind turbines (mainly wind farms) could be increased significantly, compared to when the development plant came into effect.

Regarding options for electricity generation, the plan considers four main development scenarios. The projected annual increase rate of the peak load is 1.6–3.8%, the average taken as 2.3% per annum. As for consumption, it is projected the electricity consumption (with transmission and distribution losses) will be at 10 TWh in 2030 if today's trends continue.

All scenarios include the following common elements for generation:

- the currently used oil shale-based units with fluidised bed boilers are still in operation;
- at least 200 MW of cogeneration units firing various fuels;
- some old units of oil shale pulverised combustion with desulphurisation equipment.

According to the *EEDP 2030* new electricity production units have to be competitive in the open electricity market without any subsidies. The support schemes for new production units are set in Electricity Market Act (RT I, 12.12.2018, 13) and are primarily aimed at renewable energy, combined heat and power (CHP) production and complying to the criteria of local production units.

The *EEDP 2030* measures estimated in the projections of the electricity supply are the following:

1) **Support for renewable and efficient CHP based electricity production** – The support rates are presented in Table 4.2.
2) **Investments for construction of wind parks** – It is estimated that by 2040 the production of wind power should be approximately 6 000 GWh. The wind parks are built in a competitive open market and through the support schemes of the Electricity Market Act.

The projected effects of the measures related to electricity production are presented in Table 4.3.

Table 4.2. 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

Level of subsidy	Conditions for receiving the subsidy
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 4.3. Projected effects of the WEM measures in electricity supply, kt CO_2 eq.

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.					
	2016	2020	2025	2030	2035	2040
Support for renewable and efficient CHP based electricity production	514.45	548,31	572.08	565.01	552.29	463,63
Investments for construction of wind parks	219.44	219.44	603.78	861.70	858.41	860.68

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 *EEDP 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%, the share of imported fuels less than 30% and the use of primary energy less than 19 TWh per year by 2030.

Regarding biomass, a large amount of the primary energy arising from fuelwood (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 CHP's 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 (RT I, 03.03.2017, 12) 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 local governments 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 *EEDP 2030* WEM measures that have an effect on GHG emissions in Heat supply sector are the following:

1) **Development of the heat economy:**
    - **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.

- **The 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 *EEDP 2030* WAM measures that have an effect on GHG emissions in Heat supply sector are the following:

1) **Additional development of the heat economy:**
   - **Additional renovation of boilerhouses** – This measure includes additional implementation of the measure "Renovation of boilerhouses". This means that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.
   - **Additional renovation of heat networks** – This measure includes additional implementation of the measure "Renovation of heat networks". This means that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.
   - **Additional transition of consumers to local and place heating** – This measure includes additional implementation of the measure "Transition of consumers to local and place heating". This means that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.

The projected effects of the measures in heat production are presented in Table 4.4 and Table 4.5.

Table 4.4. Projected effects of the measures in heat production in the WEM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.					
	2016	2020	2025	2030	2035	2040
Renovation of boilerhouses	22.50	34.69	134.68	165.07	108.73	115.51
Renovation of heat networks	16.68	25.65	99.76	122.36	99.54	112.04
Transition of consumers to local and place heating	6.80	10.51	41.01	50.38	26.50	25.94

WAM measures show further GHG reduction when additional funding for the renovation of boiler houses and heat networks as well as transitioning consumers to local and place heating becomes available

Table 4.5. Projected effects of the measures in heat production in the WAM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.					
	2016	2020	2025	2030	2035	2040
Additional renovation of boilerhouses	18.24	32.98	128.58	157.39	103.19	109.47
Additional renovation of heat networks	49.71	89.91	349.17	428.50	213.54	204.03
Additional transition of consumers to local and place heating	13.34	24.19	93.66	115.16	66.67	67.78

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 (RT I, 12.11.2019, 5), large companies are mandated to have regular energy audits.

Energy consumption ─ Other sectors (Commercial/institutional and residential sectors)

Measures from the *EEDP 2030*, which are taken into account in the Residential and Commercial/Institutional sector are mainly related to energy conservation through reconstruction of buildings. In the sectors, the main measures having an effect on GHG emissions, that are already in place and therefore included in the WEM scenario[26]:

1) **Reconstruction of public and commercial buildings** – reconstruction of 10% of the existing buildings to energy efficiency class D by the year 2030.
2) **Reconstruction of private houses and apartment buildings** – reconstruction of 10% of existing private houses to energy efficiency class E and 15% of existing apartment buildings to energy efficiency class E by the year 2030.
3) **Implementation of the minimum requirements for nearly zero energy buildings** the requirements will be implemented as required by the Directive 2010/31/EU on the energy performance of buildings.
4) **Investments in the renovation of street lighting infrastructure-** the aim of the programme is to increase the efficiency of the use of electricity in street lighting.

Few additional measures are still under discussion or waiting additional funds and henceforth are reported as WAM. These measures include[26]:

1) **Additional reconstruction of public and commercial buildings** – reconstruction of 20% of the existing buildings to energy efficiency class C by the year 2030.
2) **Additional reconstruction of private houses and apartment buildings –** 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.

The projected effects of the measures are presented in Table 4.6 and Table 4.7.

[26] Effects of PaMs for the years 2020, 2025, 2030, 2035 and 2040 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 eq. is available.

Table 4.6. Projected effects of the measures in Other sectors in the WEM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.					
	2016	2020	2025	2030	2035	2040
Reconstruction of public and commercial buildings	0.6	0.7	1.1	1.4	1.7	1.6
Reconstruction of private houses and apartment buildings	1.4	1.9	2.4	3.3	3.8	3.7
Investments in the renovation of street lighting infrastructure	0	1.4	1.2	1.1	1.1	1.4
Implementation of the minimum requirements for nearly zero energy buildings	0.0	6.0	7.6	10.3	12.0	11.6

WAM measures show further GHG reduction when additional funding for the reconstruction of public, commercial buildings, private houses and apartment buildings become available. The measure "Investments through European cohesion fund to street lighting reconstruction programme" has been implemented since 2007 and the historical emission reduction and cost of implementation (through Green Investment Scheme) has been included, the emission reduction resulting from a follow up is not taken into account in the projections as it currently under development.

Table 4.7. Projected effects of the measures in Other sectors in the WAM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.					
	2016	2020	2025	2030	2035	2040
Additional reconstruction of public and commercial buildings	0.0	2.1	3.3	4.5	5.2	5.9
Additional reconstruction of private houses and apartment buildings	0.0	26.6	53.1	72.3	83.6	93.8

Transport

The Estonian Parliament approved the Transport Development Plan 2014–2020 in February 2014. 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 favored 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.

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 for 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 sector** – The main target of this measure is to achieve the 10% share of biofuels in transport sector by 2020 and 14% by 2030,

(Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources).

2) **Promoting economical driving –** Includes promoting eco-driving.

3) **Spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system:**

   - **Improvement of the traffic system –** Includes updating parking policies in cities, planning land use to reduce the use of private cars, restructuring the streets in cities, etc.

   - **Reducing forced movements with personal vehicles–** Includes developing telecommunication and also developing short-term rental cars systems.

4) **Development of convenient and modern public transport –** Includes improving the availability of public transport, developing ticket systems and new services.

5) **Increasing fuel economy in transport** – Includes developing a support system for energy efficient cars, hybrid buses, hybrid trolleys, electrical buses etc.

6) **Road usage fees for heavy duty vehicles** – Based on time.

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

1) **Additional promotion of economical driving –** This measure includes additional implementation of the measure "Promotion of economical driving". This means that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.

2) **Additional spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system:**

   - **Development of light traffic routes -** Increasing the share of the use of light traffic routes.

   - **Additional improvement of the traffic system –** This measure includes additional implementation of the measure "Improvement of the traffic system". This means that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.

   - **Ride sharing -** Includes promotion of ride sharing and short-term rental car systems.

   - **Urban parking policy -** Renewal of urban parking requirements (development of optimal parking space requirements in planning and standards) and reduction of subsidisation of car parking spaces.

   - **Remote work and e-services -** Includes developing e-services and also promotion of remote work.

3) **Additional development of convenient and modern public transport** – This measure includes additional implementation of the measure "Development of convenient and modern public transport". This means that additional investments are planned to facilitate additional energy efficiency and additional GHG savings.

4) **Electric car purchase support -** Support for the purchase of electric cars is targeted at companies with high transport needs and individuals.

5) **Road usage fees for heavy-duty vehicles** – Based on mileage, location, environmental aspects, etc.

6) **Vehicle tyres and aerodynamics -** 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.

7) **Developing the railroad infrastructure (includes the building of Rail Baltic)** – The expected cost of Rail Baltic is 22.4 million euros annually. This measure also includes raising the speed limit to 160 km/h in Tallinn-Narva and Tapa-Tartu directions.

8) **The railroad electrification -** Electrification of existing railway and extension of its use (including the addition of convenient passenger trains).

9) **Ferry traffic electrification -** Includes the electrification of the ferry traffic between the Estonian mainland and the islands.

The projected effects of the measures are presented in Table 4.8 and Table 4.9.

Table 4.8. Projected effects of the measures in the transport sector in the WEM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.					
	2016	2020	2025	2030	2035	2040
Increasing the share of biofuels in transport	2.2	242.0	295.9	370.3	385.5	398.9
Promotion of economical driving	10.4	36.3	62.5	88.3	88.3	88.3
Spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system	15.6	54.9	94.0	133.3	133.3	133.3
Development of convenient and modern public transport	6.3	22.2	38.0	53.8	53.8	53.8
Increasing fuel economy in transport	11.6	40.8	69.9	99.0	99.0	99.0
Road usage fees for heavy duty vehicles (based on time, location, environmental aspects, etc.)	0.0	94.6	181.7	268.3	301.0	301.0

WAM measures show an estimated GHG mitigation impact, should additional funding appear for promoting economical driving, improvement of the traffic system, development of light traffic routes, ride sharing, urban parking policy, remote work and e-services, developing convenient and modern public transport road usage fees for heavy duty vehicles, vehicle tyres and aerodynamics, developing the railroad infrastructure and ferry traffic electrification. The measure “The railroad electrification” is not included in the projections as it is currently under development.

Table 4.9. Projected effects of the measures in transport sector in the WAM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.[1]					
	2016	2020	2025	2030	2035	2040
Electric car purchase support	0.0	0	42.9	78.9	78.9	40.4
Additional promotion of economical driving	0.0	0	28.7	51.0	73.7	96.0
Additional spatial and land-use measures for urban transport energy savings to increase and improve the efficiency of the transport system	0.0	0	175.0	284.6	284.6	284.6
Additional development of convenient and modern public transport	0.0	0	60.9	99.1	99.1	99.1
Road usage fees for heavy duty vehicles (based on mileage, location, environmental aspects, etc.)	0.0	0	20.2	19.8	19.8	19.8
Vehicle tyres and aerodynamics	0.0	0	28.4	46.1	46.1	46.1
Developing the railroad infrastructure (includes the building of Rail Baltic)	0.0	0.0	0.0	77.7	77.9	77.9
Ferry traffic electrification	0.0	0.0	24.4	24.4	24.4	24.4
The railroad electrification	NE	NE	NE	NE	NE	NE

[1]NE – not estimated: GHG estimates of mitigation impact is not available due to the lack of quantifiable activity data under the reported measures.

A study carried out in 2018 to find cost-effective mitigation measures includes **Public transport conversion to biomethane and electricity** measure affecting GHG emissions in transport sector This measure is under discussion aiming to introduce electric buses in urban areas and gas buses using biomethane in rural areas.Measure is not included in the transport sector's projections.

4.2.2. Industrial processes and product use

For IPPU sector, Estonia is reporting one measure of **Prohibitions, restrictions and obligations under Regulation (EU) No 517/2014 on fluorinated GHGs and Directive 2006/40/EC relating to emissions from air conditioning systems in motor vehicles**. The effect of this measure is the same on WEM as well as WAM scenario. Please see the effects in Table 4.10.

Consumption and emissions of fluorinated GHGs are phased-down by Regulation (EU) No 517/2014 which came into force in 2015. Directive 2006/40/EC prohibits since 01.01.2017 the sale of new passenger cars, pick-up trucks and vans with EU type approval which have refrigerant with global warming potential (GWP) over 150 in air conditioner. Estonia has not imposed significantly stricter requirements than in Regulation (EU) No 517/2014 and in Directive 2006/40/EC.

The beforementioned measure is further supported by project-based promotion of alternative natural and low-GWP refrigerants in Estonia, considering the bans and duties from the Regulation (EU) No. 517/2014 on fluorinated greenhouse gases

Project-based promotion of alternative refrigerants consists of three activities:

- ensuring up-to-date educational possibilities for refrigeration engineers to work with new refrigeration technologies and refrigerants;

- discouraging investments in technologies based on high-GWP refrigerants that are or will be subjects of strict restrictions;
- ensuring recovery, recycling and reclamation of such high-GWP refrigerants already placed on market; to ensure awareness of target groups on the restrictions and duties resulting from Regulation (EU) No. 517/2014.

These activities are supporting and boosting effects of Regulation (EU) No. 517/2014 and national legislation. Some activities already are ongoing but their effect cannot yet be estimated separately from effects of Regulation (EU) No. 517/2014.

Table 4.10. Projected effects of implementing theProhibitions, restrictions and obligations under Regulation (EU) No 517/2014 on fluorinated GHGs and Directive 2006/40/EC relating to emissions from air conditioning systems in motor vehicles, kt CO_2 eq

	2016	2020	2025	2030	2035	2040
Reduction of HFC emissions	0.0	2.6	48.2	101.8	131.2	154.3

Additional measure on road transport – developing the railroad infrastructure (includes the building of Rail Baltic) – affecting subsector 2.D.3 Other – Urea based catalysts for motor vehicles. This measure is used in WAM scenario for IPPU. According to the WAM scenario diesel fuel consumption is decreased and consumption of urea based diesel exhaust fluid also. More information on this measure and cross sectoral parameters are presented Chapters 4.2.1 and 4.2.6.

4.2.3. Agriculture sector

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 *Estonian Rural Development Plan 2014–2020* (*ERDP*). Most of the same priorities and measures are also referred in the *Climate Change Mitigation and Adaptation Action Plan in Agriculture sector 2012–2020* and in the *Estonian Organic Farming Development Plan 2014–2020* strive to limit and reduce GHG emissions in the agricultural sector.

One of the *ERDP* priority area 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 2020. 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.

Following measures of the *ERDP* contribute to GHG emission reduction:

1) **Knowledge transfer and awareness —** The general objective of the measure is to develop and enhance the technical, economic and environmental knowledge of the enterprisers and their employees in agriculture, food and forest sector to improve the bioeconomy and adapt new challenges to use resources sustainably. The measure aims to promote the organization of educational training, presentations, awareness-raising activities, organizing workshops or visits to enterprises and long-term programs.
2) **Advisory services, farm management and farm relief services —** 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 for the agriculture sector. Advisory services include inter alia environmental and climatic topics. More specific objectives are to guarantee advisory services in the important areas for Estonia, develop a countrywide common system of advisory services and to educate consultants to ensure their relevant and up-to-date knowledge and to improve the quality of advisory services.

3) **Agri-environmental measure and its sub-measures**:
   - **Support for environment-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.

   1. **Support for regional water protection** ─ The objectives are to prevent and reduce water nitrogen pollution to preserve the water quality by decreasing agricultural soil leaching.
   2. **Support for regional soil protection** ─ 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.
   3. **Support for environment-friendly gardening** ─ The general objective is to promote the use of environment-friendly practices in gardening. One of the more specific aims is to decrease leaching.
   4. **Support for growing plants of local 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 conditions) and therefore gives a good basis for developing new breeds and supports organic farming.
   5. **Support for farming endangered animal breeds** ─ The objective is to ensure the preservation of animal breeds which are endangered and considered important for cultural heritage and genetic diversity.
   6. **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.

4) **Organic production measure** ─ The objectives of the measure are to support and increase the competitiveness of organic production, preserve and improve biodiversity and landscape diversity, preserve and enhance soil fertility and water quality, and improve animal well-being. The measure helps to reduce GHG emissions by using organic fertilizers instead of mineral fertilizers, improving livestock management and activities improving grazing land or grassland management. Additionally, emission per hectare is lower compared to conventional production.

5) **Animal welfare measure** ─ The measure should reduce animal stress level, e.g. by having more space per animal. Having less stress enables animal to achieve better feed digestibility which reduces emissions from enteric fermentation. The objectives are to improve livestock health and well-being by providing intrinsic living conditions and

promote activities improving grazing land or grassland management.

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 2007) 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.

The objective of the *Estonian Dairy Strategy* to increase the volume of milk production by a third compared to 2011 is not a mitigation measure by nature and will affect the GHG emission balance by increasing CH_4 and N_2O emissions from animal husbandry. For this reason, the *Estonian Dairy Strategy* has been shown as an informative item.

Some of the objectives under the *Estonian Sheep Farming Development Plan 2018–2023* influence GHG emissions, such as homogenizing the quality of sheep meat, simplification of the realization of sheep meat and rising its consumption. The feeding ration that may enable achieve the homogenizing the quality of sheep meat goal affects enteric fermentation and composition of manure and is associated with CH_4 and N_2O emissions. In contrary to the positive effect of homogenization quality of sheep meat for reducing GHG emissions, the simplification of realization and rising consumption of the sheep meat would increase the emissions.

A summary of Agriculture sector policies and measures is presented in Table 4.11. GHG estimates under mitigation impact are not available for any of the policies nor measures due to the lack of quantifiable activity data under each measure.

Table 4.11. Policies and measures in Agriculture sector

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.[1]			
	2020	2025	2030	2035
Knowledge transfer and awareness	NE	NE	NE	NE
Advisory services, farm management and farm relief services	NE	NE	NE	NE
Agri-environmental measure and its sub-measures	NE	NE	NE	NE
Organic production measure	NE	NE	NE	NE
Animal welfare measure	NE	NE	NE	NE

[1]NE – not estimated: GHG estimates of mitigation impact is not available due to the lack of quantifiable activity data under the reported measures.

National studies on finding cost-effective GHG mitigation measures and reaching climate neutrality in Estonia made in 2018 and 2019 include following measures which are under discussion and henceforth reported as planned and thus are not used in calculations of GHG emission projections:

1. **Enhancing the quality of feed of dairy cows;**
2. **Increase the proportion of grazing on grassland;**
3. **No-till farming;**
4. **Cover crops;**
5. **Site-specific fertilization;**
6. **Replacement of mineral fertilizers by organic fertilizers;**
7. **Neutralization of acid soils;**
8. **Improving manure management;**
9. **Audits in large agricultural holdings;**
10. **Studies and pilot projects.**

4.2.4. Land use, land-use change and forestry sector

The *Forest Act* (RT I, 29.06.2018, 33) provides the legal framework for the management of forests in Estonia. The main objective of the act is to ensure the protection and sustainable management of forests as an ecosystem. The *Forest Act* includes Reforestation measure that aims to support the regeneration of forest after felling or natural disturbances. According to the *Forest Act*, the forest owner is obliged to assure regeneration of forest no later than 5 years after felling or natural disturbances. Supporting fast reforestation after felling is beneficial to achieving continuous carbon sequestration on forest land and therefore maintaining the level of GHG removals by forests in Estonia.

The *Estonian Forestry Development Programme until 2020 (EFDP 2020)*, approved by the Parliament in 2011, is the official sustainable development strategy for the Estonian forest sector. The programme determines objectives and describes measures and tools for achieving them for the period 2011–2020. The main objective of the development plan is to ensure productivity and viability as well as to assure multiple and efficient use of forests. One of the aims is to increase the annual increment along with carbon sequestration in forests by implementing appropriate forest management activities like regeneration, cleanings and thinnings. In Table 4.12 the main indicators and target levels are presented for the current situation and for 2020.

Table 4.12. Indicators and target levels set in *EFDP 2020*

Indicator	Baseline level	Target level
Growing stock	442 million m^3 (NFI 2008)	450 million m^3
Increment	12.1 million m^3/yr (NFI 2008)	12.5 million m^3/yr
Annual volume and area of regeneration fellings	5.85 million m^3 22,400 ha/yr (NFI 2000–2008)	10.1 million m^3 34,500 ha/yr (2011–2020)
Annual area of cleanings	22,200 ha/yr (STAT 2009)	32,400 ha/yr
Annual area of thinnings	14,200 ha/yr (NFI 2007)	34,500 ha/yr
Woody biomass used in energy production	22 PJ/yr (2009)	30 PJ/yr

According to the *EFDP 2020,* the state has set a goal to enhance the use of wood because the age structure of Estonian forests supports more cutting (12–15 million m^3 per year), and not using forest resources would be an unreasonable waste of renewables.

Achieving the objectives of the *EFDP 2020* is supported by the *ERDP*, through which most of the private forestry support measures are co-financed. The objective of the *ERDP* is to support Estonian rural development in a manner that is complementary to other measures of the EU Common Agricultural Policy, Cohesion Policy and the European Common Fisheries Policy. Additionally, Estonian Ministry of Rural Affairs wants to help raise the competitiveness of agriculture, improve the sustainable management of natural resources and improve climate action through the implementation of the development plan. *ERDP* is implemented through measures, which are based on the needs and objectives identified during the preparation of the development plan. In total, it is intended to implement over 20 (sub) measures within the framework of the development plan.

The LULUCF sector's role as a sink or source of GHGs in the future will mainly be determined by forest management practices – the intensity of forest fellings, also usage of peat soils and practices applied in cropland and grassland.

In December 2017, the Ministry of the Environment started the preparation of the new Forestry Development Programme 2021-2030, by forming a working group to compile the terms of reference (ToR) of the development programme. The task of the working group is to identify the problems that need to be solved in forestry and to set up the ToR. Upon completion of the ToR, the Ministry of the Environment will coordinate it with stakeholders and other ministries. The preparation of the new development programme will take into account the sectoral guidelines for the forestry sector set in the GPCP 2050. The Forestry Development Programme 2021-2030 will be submitted to the Riigikogu for adoption in May 2020.

Measures related to forest management

EFDP 2020 (renewed in January 2016) and the *ERDP* comprise the following measures that target sustainable use of forest, inter alia increase of forest carbon pools:

1) **Increasing forest increment and ability to sequestrate carbon through timely regeneration of forests for climate change mitigation** – the overall objective of the measure is to support activities related to timely regeneration of forests in order to mitigate climate change.
2) **Promotion of regeneration of forests in managed private forests with the tree species suitable for the habitat type** – the measure grants the supply of tree species suitable for the habitat type to promote efficient and fast regeneration of private forests.
3) **Improving forest health condition and preventing the spreading of dangerous forest detractors** – the measure provides support for monitoring and restoration of forests in order to improve forest health condition and prevent damage caused by fire, pests and storms.
4) **Reducing the environmental impact related to the use of fossil fuels and non-renewable natural resources by increasing timber production and use in Estonia** – the objective of the measure is to encourage timber production and use in Estonia through supported activities.
5) **Natura 2000 support for private forest land** – protected areas, special conservation areas and species protection sites on forest land will help to preserve forest carbon stock from those areas. The measure aims to maintain biological and landscape diversity in Natura 2000 areas covered with forests, which means support for private forest areas.

6) **Maintaining biological processes and preserving population of species that are common to Estonia.**
7) **Improvement of forest economic and ecological vitality** – the overall objective of supporting forestry as an integral part of rural life, is sustainable and effective forest management which promotes raising vitality of forests by improving its species composition or implementing other silvicultural techniques, maintaining and renewing forest biological diversity, integral ecosystem and protection function by helping to preserve forest's multifunctional role and its spiritual and cultural heritage.

Measures related to Grassland, Wetland and Grazing land management

ERDP measures related to Grassland, Wetland and Grazing land management that has a GHG mitigation impact is **Ensuring the favourable conservation status of habitats**. This measure aims to improve the conservation status of at least 14 habitat types in Estonia due to the applied protection measures. The immediate outcome of the activity of the measure is 10,000 hectares 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.

A summary of LULUCF sector policies and measures is presented in Table 4.13. GHG estimates under mitigation impact are not available for any of the policies nor measures due to the lack of quantifiable activity data under each measure.

Table 4.13. Policies and measures in LULUCF sector

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.[1]			
	2020	2025	2030	2035
Increasing forest increment and ability to sequestrate carbon through timely regeneration of forests for climate change mitigation	NE	NE	NE	NE
Promotion of regeneration of forests in managed private forests with the tree species suitable for the habitat type	NE	NE	NE	NE
Improving forest health condition and preventing the spreading of dangerous forest detractors	NE	NE	NE	NE
Reducing the environmental impact related to the use of fossil fuels and non-renewable natural resources by increasing timber production and use in Estonia	NE	NE	NE	NE
Natura 2000 support for private forest land	NE	NE	NE	NE
Maintaining biological processes and preserving population of species that are common to Estonia	NE	NE	NE	NE
Improvement of forest economic and ecological viality	NE	NE	NE	NE
Ensuring the favourable conservation status of habitats	NE	NE	NE	NE

[1]NE – not estimated: GHG estimates of mitigation impact is not available due to the lack of quantifiable activity data under the reported measures.

4.2.5. Waste sector

General waste related requirements and rules are stipulated under *Waste Act (*RT I, 12.12.2018, 40) 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, 12.12.2018, 40) includes the measure of **limiting the percentage of biodegradable waste going to landfill and increasing the reuse and recycling of waste**

materials. The focus of the measure will be to increase the volume of municipal waste recycled, including the reduction of biodegradable waste, and to develop a national waste collection network with a more efficient reporting system. Consistent guidance on recycling and re-use of waste and a simple expanding waste management system will help to increase the amount of separate collection and reduce the proportion of biodegradable waste in landfill. Establishing a national network for the collection and treatment of biodegradable waste is particularly important to reduce GHG emissions from solid waste disposal.

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)*. 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.

To meet the requirements of the directive 2009/98/EC, the *Waste Act* stipulates that by 1st of January 2020, 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 reusing and recycling of waste materials was 27% in 2011, which increased to 35% by 2014.

The obligation of establishing a waste management regulation and approving and updating waste management plan are local government functions established by the *Local Government Organization Act* (RT I, 05.02.2019, 8). Most of the approved waste management plans prohibit incineration of waste.

The *National Environmental Strategy until 2030* includes a policy of r**educing landfilling waste** – 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*.

The objective of the *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 the following target levels for 2020 (Table 4.14).

Table 4.14. Target levels in NWMP

NWMP	Target level 2020
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 NWMP comprises following measures to limit and reduce GHG emissions:

1) **Promoting the prevention and reduction of waste generated, incl. reducing the hazard of waste –** the overall objective of the measure is to improve the resource efficiency of Estonia's economy and promoting waste prevention to reduce the negative impact on environment and human health. The state is supporting the prevention of waste by dissemination of information. A variety of initiatives, implementation of environmental management tools, additional research projects and investment and

completion of the necessary legal regulations will help to implement this measure. Measure helps to reduce GHG emissions in solid waste disposal subsection.

2) **Reducing environmental risks arising from waste, improvement of monitoring and supervision** – the overall objective of the measure is to improve hazardous waste treatment options and reducing environmental risks arising from waste disposal. Landfills closed for waste deposit have to be conditioned in accordance with the requirements. Strengthening the supervision of waste management will help to reduce illegal waste disposal. In 2013 there were 5 operating mixed municipal waste landfills. This measure is supporting the previously mentioned measures.

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, the large-scale depositing of mixed municipal waste in landfills is decreasing. In Iru's *Air pollutants emissions reduction action plan 2013–2030* it is estimated that the 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. The transition to a circular economy requires changes 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.

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 primary raw materials or developing waste management and recycling, reducing the need to produce new products and materials.

By the end of 2021, Estonia aims to develop a circular development strategic document and action plan, led by the Ministry of the Environment, to accelerate the transition towards a more circular Estonia. The development document and action plan are planned in cooperation with all parties involved. The development paper and action plan are divided into the following steps:

1. Studies: Development of Circular Economy Indicators and Mapping the Current Situation of the Estonian Circular Economy (2019-2020)
2. Development of a circular development paper and action plan (2020-2021)

3. Involving stakeholders throughout the process

The Circular Economy Programme supports the implementation of circular economy solutions through the Environmental Investment Center. 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 wider use.

Projected effects of one WEM scenario measure was possible to be quantified Table 4.15. GHG estimates under mitigation impact are not available for the other measures due to the lack of quantifiable activity data under each measure. Limiting the percentage of biodegradable waste going to landfill and increasing the reuse and recycling of waste materials is an integral part of projecting emissions from Solid waste disposal, Composting and Open burning of waste subsector, therefore the effects of the measures are presented as aggregated kt CO_2 eq. not by subsectors.

Table 4.15. Projected effects of the measures in the Waste sector WEM scenario, kt CO_2 eq

Name of policy or measure	Total GHG estimate of mitigation impact, kt CO_2 eq.[1]					
	2016	2020	2025	2030	2035	2040
Limiting the percentage of biodegradable waste going to landfill and increasing the reuse and recycling of waste materials.*	0	4.69	29.55	59.95	73.27	71.72
Reducing landfilling waste	NE	NE	NE	NE	NE	NE
Promoting the prevention and reduction of waste generated, including reducing the hazard of waste	NE	NE	NE	NE	NE	NE
Reducing environmental risks arising from waste, improvement of monitoring and supervision	NE	NE	NE	NE	NE	NE

*Projected effect is calculated as a sum in Solid waste disposal, Open burning of waste and Biological treatment of solid waste sectors

[1] NE – not estimated: GHG estimates of mitigation impact is not available due to the lack of quantifiable activity data under the reported measures.

4.2.6. Sectoral cross-cutting measures and parameters

This section gives an overview of different cross-cutting policies and measures to reduce GHG emissions in Estonia.

Cross-cutting priority in *ERDP* for both LULUCF and Agriculture sectors is **Fostering carbon conservation and sequestration in agriculture and forestry** with the 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 2020. The priority is supported by the regulation on Good agricultural and environmental conditions of the 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 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.

The cross-cutting measures with potential for GHG reduction in both LULUCF and Agriculture sector are the following:

1. **Natura 2000 support for agricultural land** (*ERDP*). The overall objective of Natura 2000 support for agricultural land 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 79/409/EEC 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.

2. **EU** *Common Agricultural Policy* (**CAP) Greening measure** (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 the crop diversification, the maintenance of permanent grassland and the existence of ecological focus areas

Also, ERDP Agri-environmental measure includes cross-cutting Agriculture and LULUCF sub-measures that pursue to limit and reduce GHG emissions and enhance carbon sequestration. Additional information on this measure is provided in Chapter 4.2.3.

3. **Support for growing plants of local varieties**
4. **Support for regional soil protection**
5. **Support for the maintenance of semi-natural habitats**

Cross-cutting priority in *ERDP* for both Energy and Agriculture sectors is **Facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw material for purposes of the bio-economy**. The main requirement underlined within this priority is to support the production of heat and electricity from biogas.

The cross-cutting measures with potential for GHG reduction in both Energy and Agriculture sector are the following:

1. **Investments into diversification of non-agricultural economic activity in rural regions** (ERDP). Under this measure investments for producing renewable (bio-, solar, wind) energy are supported to gain increase in renewable energy. Input of bioenergy production can be of agricultural origin, e.g. manure or crop residues. The measure is aiming to benefit a wider society, e.g. to produce bioenergy for sale.
2. **Investments into improved performance of agricultural holdings** (ERDP). 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.

Following cross-cutting measures are still under discussion and henceforth reported as planned and thus are not used in calculations of GHG emission projections:

1. **Convert cropland on organic soils to permanent grassland** (a measure of Agriculture and LULUCF sectors);
2. **Producing bioenergy and increasing its share in agriculture** (a measure of Agriculture, Transport and Energy sectors);

3. **Investments into energy saving of greenhouses and vegetable warehouses and dissemination of renewable energy** (a measure of Agriculture and Energy sectors).

Parameters

Cross-sectoral parameter between Waste and IPPU is population projection.

There are several cross sectoral parameters between IPPU and Energy sector:

1. Estonia's cement industry projected production capacity ─ The production capacity used in IPPU sector corresponds with the fuel consumption for the same industry in the Energy sector.
2. Presumption that the chemical industry will not consume natural gas as feedstock in future.

The projected trend of diesel fuel consumption in road transport was taken into account when projecting WEM and WAM scenario emissions from urea catalysts in used by vehicles with diesel engines (IPPU subcategory 2.D.3 Other in GHG inventory).

4.3. Information on changes in domestic institutional arrangements

In 2018 a change in the national system was made when MoE as a single national entity appointed the EERC to be the institution to have the responsibility of compiling of Biennial report and being responsible for submitting the final report to the UNFCCC on behalf of the MoE.

4.4. Assessment of the economic and social consequences of response measures

The EU has established processes that assess the economic and social consequences of climate policy measures to ensure that all relevant possible impacts are taken into account,

For the development of new policy initiatives through legislative proposals by the European Commission, an impact assessment system has been established in which all proposals are examined before any legislation is passed. It is based on an integrated approach which analyses both benefits and costs, and addresses all significant economic, social and environmental impacts of possible new initiatives (for details please refer to Section 4.10 of the EU 1BR as well as Chapter 15 of the EU National Inventory Report 2019).

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

Since 2009 Estonia has contributed to the Eastern Europe Energy Efficiency and Environment Partnership Fund. The E5P Fund has supported energy efficiency and environmental sustainability projects mainly in Ukraine, but since 2013 the activities of the Fund have been extended also to Georgia, Moldova and Armenia and in 2018 also to Belarus.

4.5. Estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry activities

Table 4.16 is presenting the GHG emissions of Estonia in 1990 and 2017, in which emission data is based on the Estonia's 2019 submission. For information on the use of units from the market-based mechanisms and land use, land-use change and forestry activities please refer to Chapter 3.2.

Table 4.16. Estonia's GHG emissions by sector in 1990 and in 2017

Sector	kt CO_2 eq		Change from base year to latest reported year (per cent)
	1990	2017	
Energy	36,397.39	36,397.39	-49.08
IPPU	963.29	963.29	-33.61
Agriculture	2,700.91	2,700.91	-48.93
Waste	369.93	369.93	-11.15
Total (excluding LULUCF, with indirect CO_2)	40,431.51	20,879.88	-48.36
LULUCF	- 1,489.54	- 1,489.54	50.36
Total (incl. LULUCF, with indirect CO_2)	38,941.97	19,087.14	-50.99

5. PROJECTIONS

The projections of emissions and removals of greenhouse gases described in this chapter have been developed for Estonia's National Energy and Climate Plan (prepared according to the EU Governance Regulation[27]) and are compiled in accordance with the requirements of the EU decision on monitoring of greenhouse gases (EU Regulation 525/2013). 'With Existing Measures' (WEM) and 'With Additional Measures' (WAM) scenario GHG projections have been calculated for the period of 2017–2040. The reference year 2016 used in projections is consistent with *Estonia's 2018 submission to the UNFCCC on 27th of September 2018*. The GHG emission trends and drivers prior to 2017 have been described under Chapter 2 . For giving a visual overview of the GHG trends per sector, a graph under each projected sector was provided.

The WEM scenario evaluates future GHG emission 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 WAM scenario.

5.1. Methodology

Key assumptions used in the projections

The key underlying assumptions used in the projections are presented in Table 5.1.

Table 5.1. Key assumptions used in projections

Parameter used	Reference year (2016)	2020	2025	2030	2035	2040
Population,WEM = WAM, thousands	1,316	1,318	1,312	1,306	1,295	1,284
Gross domestic product (GDP), real growth rate, WEM = WAM, %	2.1	3.0	2.6	1.9	1.4	1.4
Gross domestic product (GDP), constant prices, WEM = WAM, constant EUR million	18 268	20 819	23 872	26 630	28 851	30 890
EU ETS carbon price, WEM=WAM,EUR/EUA	5.5	26.0	23.0	34.7	43.5	51.7
International (wholesale) fuel import prices: Electricity Coal, WEM=WAM, EUR/GJ	2.23	2.64	3.16	3.79	4.01	4.18
International (wholesale) fuel import prices: Natural gas, WEM=WAM, EUR/GJ	7.52	8.91	9.64	10.49	11.20	11.58
Final energy consumption: Industry, WEM=WAM, TJ	8,716	7,632	8,090	8,548	8,749	8,950
Final energy consumption: Transport WEM, TJ	32,353	32,928	35,661	37,603	39,092	40,410
Final energy consumption: Transport WAM, TJ	32,353	31,918	29,515	26,560	27,667	29,264
Final energy consumption: Residential WEM, TJ	19,157	18,629	18,629	18,629	18,629	18,629
Final energy consumption: Residential WAM, TJ	19,157	18,629	14,530	12,854	11,922	11,177

[27] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1999&from=EN

Parameter used	Reference year (2016)	2020	2025	2030	2035	2040
Final energy consumption: Agriculture/Forestry, WEM=WAM, TJ	3,835	3,911	4,146	4,380	4,483	4,586
Final energy consumption: Services WEM, TJ	2,188	1,371	1,368	1,364	1,349	1,334
Final energy consumption: Services WAM, TJ	2,188	1,309	1,272	1,235	1,199	1,162
Final energy consumption: Other, WEM=WAM, TJ	653	532	532	532	532	532
Final energy demand for road transport WEM, TJ	30,869	31,626	34,359	36,301	37,790	39,108
Final energy demand for road transport WAM, TJ	30,869	30,616	28,533	25,578	26,685	28,282
Livestock: Total cattle, thousands	248	264	274	285	296	296
Livestock: Sheep, thousands	91	98	108	118	129	129
Livestock: Swine, thousands	266	317	337	357	357	357
Livestock: Poultry, thousands	2,395	2,763	2,763	2,763	2,763	2,763
Nitrogen in crop residues returned to soils, kt	23,251	29,123	29,123	29,123	29,123	29,123
Application of synthetic fertilizers, kt of N	35.8	37.1	39	39,7	39.7	39.7
Area of cultivated organic soils, 1000 ha	30	30	30	30	30	30
Municipal solid waste (MSW) generation, WEM=WAM, kt MSW[1]	891,957	606,523	607,389	608,104	608,626	609,045
Municipal solid waste (MSW) going to landfills, WEM=WAM, kt MSW[1]	33.2	12.9	14.8	16.8	19.4	19.2
Share of CH4 recovery in total CH4 generation from landfills	22.3	19.7	21.0	27.1	33.0	38

[1]The generation includes MSW as well as biogenic other waste (separately collected waste, waste from companies/ industries etc)

5.1.1. Energy sector

The Balmorel model was used for the electricity generation projections in the Public heat and 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. In addition, for EU ETS carbon price projections for the period 2020-2040, a combination of Thomson Reuters EU ETS carbon price (2020-2025) and European Commission´s recommended EU ETS carbon price (2030-2040) was used. For international crude oil, gas and coal prices European Commission´s recommended projection parameters were used as input. Also, Ministry of Economic Affairs and Communications´ renewable energy (hydro, wind, solar and biomass) projections 2020-2030 for national energy and climate plans were used as input to the projections. The projected future usage of fuel based on the model was applied while using the emission calculations of the 2006 IPCC Guidelines. Balmorel also incorporated projections for both WEM and WAM scenario fuel consumption for electricity generation which are based on the corresponding policies and measures.

The projections for heat generation in the Public heat and electricity generation sector are based primarily on the reconstruction rate of the buildings. The projections in the heat production are based on the analysis of past fuel consumption trends of the sector and *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 the input of shale oil companies. The companies provided their future development plans of the expansion of the shale oil production. 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 the analysis of past fuel consumption trends of the sectors and scenarios created in *EEDP 2030*. The emissions are calculated based on the methodology of the 2006 IPCC Guidelines.

Transport sector (excluding international aviation and marine bunkering)

The projections in the Transport sector are based on the thorough analysis of *transport and mobility scenarios* in *EEDP 2030* along with expert judgements as well as emission factor data from 2006 IPCC Guidelines and country-specific emission factors.

The projections are based on the 2018 National GHG Inventory, the presumptions were confirmed by a group of experts. The activity data of the WAM measures are taken from the study carried out in 2018 to find cost-effective mitigation measures, which is based on the *Transportation Development Plan 2014-2020* and *EEDP 2030*. The projections for the WEM scenario are also in line with Regulation (EC) No 443/2009, which stipulates that by the year 2021, the average emissions target for a new passenger car is 95 gCO_2/km and with Regulation (EU) No 510/2011 147 g CO_2/km for light-duty vehicles.

5.1.2. Industrial processes and product use sector

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. Due to the specific character of the sector, top-down assessments are used only in 2.F.1.d Mobile air conditioning, 2.F.2 Foam producing and 2.D subcategories: 2.D.1 Lubricant use, 2.D.2 Paraffin wax use and 2.D.3 Other - Urea based catalysts for motor vehicles. Otherwise, bottom-up data gathering, companies' production forecasts, GDP and population projections 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.

According to the chemical industry's operators information, there are no plans to restore production in near future.

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 in line with GDP projections and corresponds to projected GDP growth.

Consumption of paraffin waxes is affected by GDP growth and slight population decline and is projected to stay roughly at current level.

Indirect CO_2 emissions from Solvent use sector, affected both by GDP growth and population decline, are projected to decrease a little because of statistical corrections in solvent use levels and trending use of water based paints.

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 is consistent with projections of the Transport sector (see Chapter 5.2.2);
3. the average diesel fuel consumption of vehicles is based on COPERT model.
4. previous year's trend in vehicle sales (data from Estonian Road Administration).

Emissions of fluorinated gases are projected according GHG inventory's calculation methods. Emissions from each group of HFC-containing equipment are projected separately. Forthcoming 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. Also, some importers of pre-charged air conditioning equipment and standalone refrigeration equipment were interviewed. Their intentions were included into calculations.

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 contain 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);

3. Rapidly diminishing amounts of HFC-s placed onto market (due to quota system) after 2023 probably cause extreme price increase and deficit of higher GWP refrigerants especially.

As ongoing promotion of alternative and low-GWP refrigerants is planned it was assumed that majority of commercial and industrial refrigeration is switching to alternative refrigerants (CO_2 and NH_3 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 trend of foam production and use in 2014–2017, real GDP growth rate and population size. Projection of emissions from 2.F.4 Aerosols is based on trend of medical aerosol use in 2014–2017 and population size.

SF_6 emissions (from 2.G Other product manufacture and use) are not regulated by the Regulation (EU) No. 517/2014. SF_6 emissions were calculated according the methods of GHG inventory while taking into account plans on equipment replacement by the electrical network operators in Estonia. The projection is also linked to real GDP growth rate.

Regarding N_2O – consumption data was provided by wholesalers who explained that sales either stay at current level or decline slowly.

5.1.3. Agriculture sector

Estonia's agricultural GHG emissions and its projections consist of CH_4 emissions from enteric fermentation of domestic livestock, CH_4 and N_2O emissions from manure management systems, direct and indirect N_2O emissions from agricultural soils and CO_2 emissions from liming and urea fertilization. Direct N_2O emissions include emissions from synthetic and organic fertilizers applied to agricultural soil, 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 N_2O 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. Projected values of agricultural output and fertilizer use are the expert judgements of the officials of the Ministry of Rural Affairs of Estonia.

As a result of the EU new Common Agricultural Policy (CAP) on the abolition of milk quotas and the growth of global food demand in many regions of the world, milk production is presumed to increase in Estonia. Pursuant to the *Estonian Dairy Strategy 2012–2020,* milk production may increase by a third, which means that the number of dairy cows must be increased and it is also presumed that the average milk yield may increase up to 19% by the year 2020. CO_2 emissions from liming are foreseen to increase during the whole projected time series 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 amounts of lime fertilizers projected in *GPCP 2050*.

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. Expert judgement on projected livestock numbers is based on the following assumptions. Since 2010 there has been a general increasing trend in the number of cattle which is expected to continue as the agricultural producers have made considerable investments in the sector. However, upward trend turned into temporary downtrend in 2015 and 2016 due to the economic sanctions imposed by Russia on EU starting from August 2014. Eventually, there was a slight rise in the number of cattle in 2017, which may indicate that the crisis might have passed its lowpoint. Global demand for meat- and dairy products along with suitable climatic conditions favour cattle production in Estonia to expand. With the supporting mechanisms of Common Agricultural Policy 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 according to historical yearly 5% growth rate. The population of rabbits is expected to remain at today's level. The population of fur animals is expected to rise again after the enlargement of the cages´ size by 2017. The number is expected to rise until 2020 and then projected to remain at the stable level. The number of pigs is anticipated to rise distinctly at the antecedent level of the outbreak of African swine fever of 2014 by 2035 and will remain at the same level by 2040. The number of poultry production is expected to stay at today´s level. Projected values of livestock population are presented in Table 5.1.

Average milk yield per cow should increase until 2025. Projected values for the period 2025–2030 are in accordance with projections in *GPCP 2050*. Milk fat (%) for the projected period until 2040 was assumed to be the same as in 2017 (3.94%).

Main activity data for the calculation of CH_4 and N_2O 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 listed projected parameters (Table 5.1) were used: livestock population, milk yield (kg/head/year) and AWMS systems. Estonia-specific VS and N excretion values of dairy cows have been calculated on the basis of projected milk yields.

Projected N_2O 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.

As a result of the increasing global food demand, it is foreseen that Estonia's crops production is going to increase compared to 2017, which will probably raise the use of synthetic fertilizers in Estonia. The projected data on crop production and the data on the use of synthetic N fertilizers are presented in Table 5.1.

5.1.4. Land use, land-use change and forestry sector

Land Use, Land-Use Change and Forestry (LULUCF) sector comprises Forest land, Cropland, Grassland, Wetlands and Settlements, therefore there are several cross-cutting as well as land category based strategic documents and policies addressing the LULUCF sector.

About half of Estonian's territory is covered with forest, of which 10% is strictly protected. Forestry is of great importance for the Estonian economy and environment, therefore forest policies have a major effect on the development of the LULUCF sector as a whole.

Estimates of CO_2, N_2O and CH_4 projections for Cropland, Grassland, Wetlands, Settlements and Other land were calculated as an average of:

a) linear forecast over whole time series 1990–2016;
b) average of time series 1990–2016;
c) average of time series 2000–2016;
d) estimation of reference years.

Regarding Forest land and Harvested wood products projections methodology has changed compared to the last report (2017). It is due to the fact that LULUCF regulation 2018/841[28] stipulate that the forest reference level shall be consistent with the national projections reported under *Regulation (EU) No 525/2013*. General approach for estimating the forest reference level is based on forest management planning regulation and felling coupe calculations with the 2000-2009 reference period. Additional information is provided in the *National Forestry Accounting Plan 2021-2025*[29].

The LULUCF sector emissions were quite volatile during last decades. Year 2005 is the starting point of the current trend of all relevant factors. Both, intensive felling period and afforestation of agricultural areas, stopped at this time. The main reason for the use of multiple averages in projection calculations is to reduce the sudden or abnormal trends and tendencies.

5.1.5. Waste sector

GHG emissions emitted from the Waste sector include CO_2, CH_4 and N_2O. CO_2 is emitted from the Waste incineration category. The main share of CH_4 from the Waste sector comes from Solid waste disposal on land. CH_4 and N_2O emitted from Wastewater treatment and discharge, Biological treatment and Waste incineration.

CH_4 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 (Eurostat) and the annual 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 the 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 2013 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 annual real GDP growth rate (the Ministry of Finance). This is 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*) and that there will be additional biodegradable waste from industrial sources (calculated under Solid waste disposal subcategory). An expert judgement of increasing amount of biologically treated sludge has been included to calculations (*GPCP2050*).

Only a 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 burning without energy recovery nor will open burning take place after 2030. 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.

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[28] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0841&from=EN

[29] National Forestry Accounting Plan 2021-2025 [www]
https://www.envir.ee/sites/default/files/national_forestry_accounting_plan_2021-2025_estonia.pdf

Projections of GHG emissions in Wastewater treatment and discharge subcategory account population projection (Eurostat) 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 2016-2040.

The projection of memo item Long-term storage of C in waste disposal sites is conducted using the same parameters as in subcategory Solid waste disposal on land.

5.2. Projections

5.2.1. Energy sector

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 Energy sector's projected emissions in the WEM scenario are presented in Table 5.2 and Figure 5.1. In the WEM scenario, the emissions are projected to decrease by 46.1% from 2016 to 2040. The largest decrease occurs in the Energy industries sector.

The electricity producing plants in Estonia mainly use oil shale. Due to the phasing out of direct oil shale combustion in these plants, the building of a more effective oil shale combustion plant, and the introduction of new shale oil production plants is taking place. The EU ETS carbon price rise in 2019 has accelerated this trend, which caused oil shale pulverized combustion plants to a halt. Total GHG emissions from the Energy industries sector are projected to decrease by 60.7% by 2040 compared to 2016.

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 30.3% by 2040 compared to 2016. 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 increase by 8.2%, mainly due to the increased mileage of passenger cars. At the same time, the share of biofuels and electricity in transport sector is expected to increase from 0.5% in 2016 to 14.0% in 2040 in the WEM scenario.

The emissions in Other sectors (Commercial/institutional, Residential and Agriculture/Forestry/Fishing/Fish farms) are expected to decrease by 4.4% in 2040 compared to 2016. GHG emissions from other sources are projected to decrease by 18.2% by 2040 compared to 2016. For the Agriculture/Forestry/Fishing and Other subsector, only the WEM scenario is projected, as there are no additional policies or measures defined. Due to the usage of natural gas, the Fugitive emissions are expected to increase by 3.8% by 2040 compared to 2016.

Table 5.2. Total projected WEM scenario GHG emissions from Energy sector, kt

Energy WEM	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Energy industries	CO_2	13,747.67	9,646.25	10,405.61	6,229.57	6,136.45	5,361.56
	CH_4	1.68	0.82	0.91	0.91	0.95	0.95
	N_2O	0.12	0.16	0.17	0.14	0.15	0.14
	Total CO_2 eq	13,825.81	9,713.89	10,477.68	6,295.40	6,205.06	5,428.15
Manufacturing and construction	CO_2	515.86	578.30	612.99	647.69	662.94	678.18
	CH_4	0.11	0.03	0.03	0.03	0.03	0.03
	N_2O	0.02	0.01	0.01	0.01	0.01	0.01
	Total CO_2 eq	523.14	581.26	616.13	651.01	666.33	681.66
Transport	CO_2	2,347.21	2,160.66	2,305.86	2,372.97	2,466.28	2,548.82
	CH_4	0.15	0.12	0.13	0.14	0.14	0.15
	N2O	0.09	0.06	0.06	0.06	0.06	0.07
	Total CO_2 eq	2,376.91	2,180.97	2,327.18	2,395.05	2,489.25	2,572.37
Other sectors	CO_2	558.85	541.57	536.80	544.03	549.57	559.22
	CH_4	5.09	4.82	4.86	4.87	4.87	4.86
	N_2O	0.16	0.07	0.07	0.07	0.07	0.07
	Total CO_2 eq	733.31	682.17	678.59	686.10	691.80	701.15
Other	CO_2	47.51	38.97	38.97	38.97	38.97	38.97
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00
	Total CO_2 eq	48.51	39.69	39.69	39.69	39.69	39.69
Fugitive emissions	CO_2	0.03	0.03	0.03	0.03	0.03	0.03
	CH_4	0.68	0.71	0.71	0.71	0.71	0.71
	Total CO_2 eq	17.08	17.73	17.73	17.73	17.73	17.73
Energy total	**CO_2**	**17,217.13**	**12,965.77**	**13,900.27**	**9,833.28**	**9,854.24**	**9,186.78**
	CH_4	**7.72**	**6.49**	**6.64**	**6.65**	**6.70**	**6.70**
	N_2O	**0.38**	**0.29**	**0.30**	**0.29**	**0.30**	**0.29**
	Total CO_2 eq	**17,524.76**	**13,215.70**	**14,157.01**	**10,084.98**	**10,109.86**	**9,440.75**

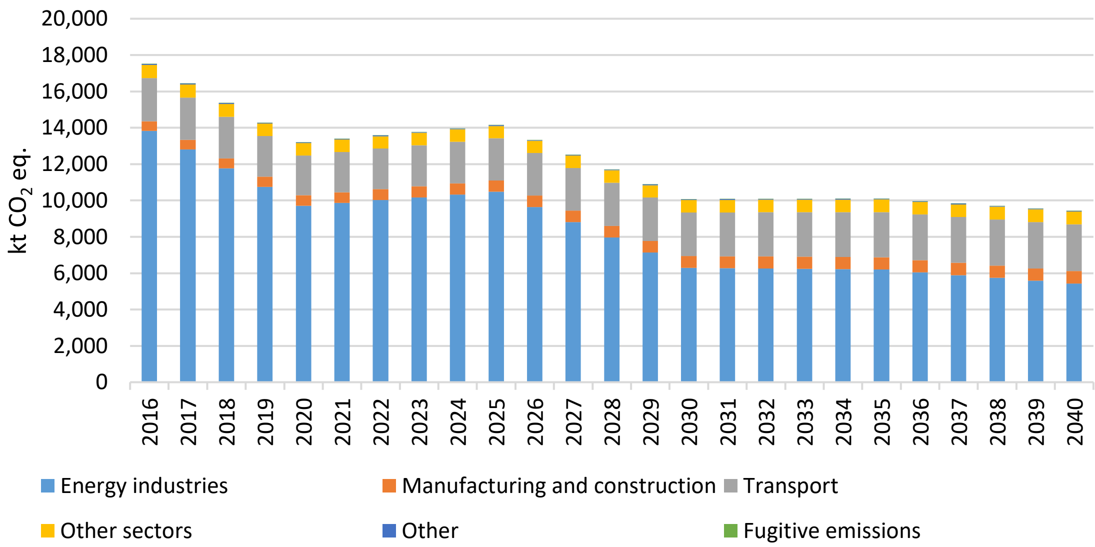


Figure 5.1. Total projected WEM scenario GHG emissions from Energy sector, kt CO2 eq

The projected emissions of the Energy sector in the WAM scenario are presented in Table 5.3 and Figure 5.2. In the WAM scenario, the emissions are projected to decrease by 55.9% in the period of 2016–2040. 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 67.2% in the period of 2016–2040.

The emissions of the Transport sector are projected to decrease by 20.7% by 2040 compared to 2016 in the WAM scenario. The larger decrease compared to the WEM scenario is caused by 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.

Table 5.3. Total projected WAM scenario GHG emissions from Energy sector, kt

Energy WAM	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Energy industries	CO_2	13,747.67	9,506.11	9,482.97	5,201.07	5,312.20	4,484.30
	CH_4	1.68	0.81	0.84	0.78	0.71	0.62
	N_2O	0.12	0.16	0.16	0.12	0.12	0.10
	Total CO_2 eq	13,825.81	9,574.51	9,551.40	5,257.52	5,365.45	4,528.88
Manufacturing and construction	CO_2	515.86	578.30	612.99	647.69	662.94	678.18
	CH_4	0.11	0.03	0.03	0.03	0.03	0.03
	N_2O	0.02	0.01	0.01	0.01	0.01	0.01
	Total CO_2 eq	523.14	581.26	616.13	651.01	666.33	681.66
Transport	CO_2	2,347.21	2,094.8	1,927.9	1,696.88	1,766.27	1,866.28
	CH_4	0.15	0.11	0.10	0.09	0.10	0.11
	N_2O	0.09	0.06	0.05	0.05	0.05	0.05
	Total CO_2 eq	2,376.91	2,114.66	1,946.55	1,714.05	1,784.17	1,884.94
Other sectors	CO_2	558.85	538.21	497.93	492.67	490.36	492.05
	CH_4	5.09	4.82	3.80	3.36	3.13	2.92
	N_2O	0.16	0.07	0.05	0.05	0.05	0.04
	Total CO_2 eq	733.31	678.80	608.85	591.18	581.95	577.84
Other	CO_2	47.51	38.97	38.97	38.97	38.97	38.97
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00
	Total CO_2 eq	48.51	39.69	39.69	39.69	39.69	39.69
Fugitive emissions	CO_2	0.03	0.03	0.03	0.03	0.03	0.03
	CH_4	0.68	0.71	0.71	0.71	0.71	0.71
	N_2O	17.08	17.73	17.73	17.73	17.73	17.73
Energy total	**CO_2**	**17,217.13**	**12,756.45**	**12,560.79**	**8,077.31**	**8,270.77**	**7,559.81**
	CH_4	**7.72**	**6.49**	**5.47**	**4.98**	**4.68**	**4.39**
	N_2O	**0.38**	**0.30**	**0.28**	**0.23**	**0.23**	**0.21**
	Total CO_2 eq	**17,524.76**	**13,006.65**	**12,780.35**	**8,271.17**	**8,455.33**	**7,730.73**

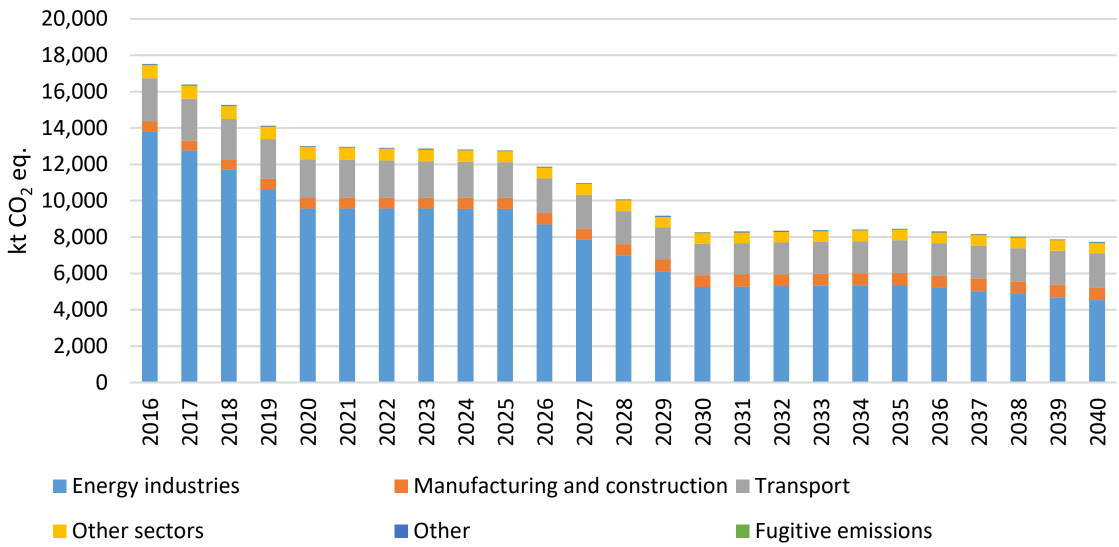


Figure 5.2. Total projected WAM scenario GHG emissions from Energy sector, kt CO_2 eq

Transport (excluding international aviation and marine bunkering)

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 rise about 8.2% in 2040 compared to 2016. The emissions in the Road transportation are projected to increase in the future. Domestic aviation and Railways sector emissions are expected to stay at the same level during the period of 2016–2040. Domestic navigation emissions are projected to decrease due to decreased fuel consumption. The total projected GHG emissions in the WEM scenario are presented in Table 5.4 and Figure 5.3.

Table 5.4. Total projected WEM scenario GHG emissions from Transport sector, kt

Transport WEM	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Domestic aviation	CO_2	1.40	3.83	3.83	3.83	3.83	3.83
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00
	Total CO_2 eq	1.41	3.87	3.87	3.87	3.87	3.87
Road transportation	CO_2	2,239.03	2,062.39	2,207.59	2,274.70	2,368.01	2,450.55
	CH_4	0.15	0.11	0.12	0.13	0.14	0.14
	N_2O	0.07	0.04	0.04	0.04	0.04	0.04
	Total CO_2 eq	2,262.52	2,075.66	2,221.87	2,289.74	2,383.95	2,467.06
Railways	CO_2	47.01	55.85	55.85	55.85	55.85	55.85
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.02	0.02	0.02	0.02	0.02	0.02
	Total CO_2 eq	52.58	62.45	62.45	62.45	62.45	62.45
Domestic navigation	CO_2	59.77	38.59	38.59	38.59	38.59	38.59
	CH_4	0.01	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00

Transport WEM	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
	Total CO_2 eq	60.40	39.00	39.00	39.00	39.00	39.00
Other transportation	CO_2	NO	NO	NO	NO	NO	NO
	CH_4	NO	NO	NO	NO	NO	NO
	N_2O	NO	NO	NO	NO	NO	NO
	Total CO_2 eq	NO	NO	NO	NO	NO	NO
Transportation total	**CO_2**	**2,347.21**	**2,160.66**	**2,305.86**	**2,372.97**	**2,466.28**	**2,548.82**
	CH_4	**0.15**	**0.12**	**0.13**	**0.14**	**0.14**	**0.15**
	N_2O	**0.09**	**0.06**	**0.06**	**0.06**	**0.06**	**0.07**
	Total CO_2 eq	**2,376.91**	**2,180.97**	**2,327.18**	**2,395.05**	**2,489.25**	**2,572.37**

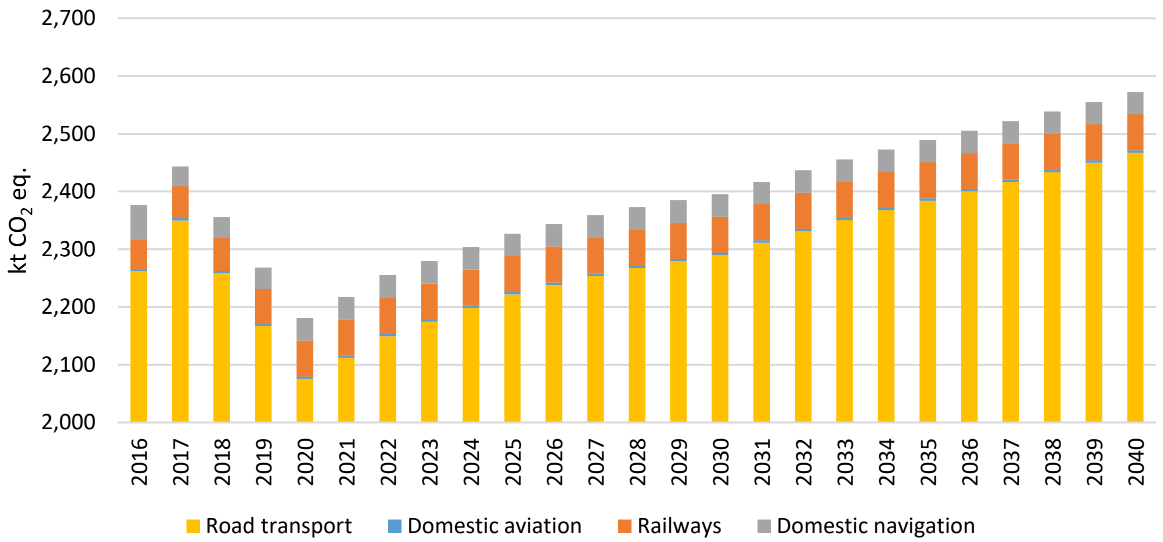


Figure 5.3. Total projected WEM scenario GHG emissions from Transport sector, kt CO_2 eq

The emissions in the Transport sector in the WAM scenario are expected to decrease significantly (20.7%) in 2040 compared to 2016. Domestic aviation and the Railways emissions are expected to stay approximately at the same level (as in the WEM scenario) during the period of 2016–2040. 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 20.3% in 2040 compared to 2016 – a total of 458.51 kt CO_2 eq., which is the result of additional measures, thus a lower demand for private transport. The total projected GHG emissions in the WAM scenario are presented in Table 5.5 and Figure 5.4.

Table 5.5. Total projected WAM scenario GHG emissions from Transport sector, kt

Transport WAM	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Domestic aviation	CO_2	1.40	3.83	3.83	3.83	3.83	3.83
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00
	Total CO_2 eq	1.41	3.87	3.87	3.87	3.87	3.87
Road transportation	CO_2	2,239.03	1,996.55	1,854.01	1,622.99	1,692.39	1,792.39
	CH_4	0.15	0.11	0.10	0.09	0.09	0.10
	N_2O	0.07	0.03	0.03	0.03	0.03	0.03
	Total CO_2 eq	2,262.52	2,009.36	1,865.62	1,633.12	1,703.25	1,804.01
Railways	CO_2	47.01	55.85	55.85	55.85	55.85	55.85
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.02	0.02	0.02	0.02	0.02	0.02
	Total CO_2 eq	52.58	62.45	62.45	62.45	62.45	62.45
Domestic navigation	CO_2	59.77	38.59	38.59	38.59	14.20	14.20
	CH_4	0.01	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00
	Total CO_2 eq	60.40	39.00	14.61	14.61	14.61	14.61
Other transportation	CO_2	NO	NO	NO	NO	NO	NO
	CH_4	NO	NO	NO	NO	NO	NO
	N_2O	NO	NO	NO	NO	NO	NO
	Total CO_2 eq	NO	NO	NO	NO	NO	NO
Transportation total	**CO_2**	**2,347.21**	**2,094.82**	**1,927.90**	**1,696.88**	**1,766.27**	**1,866.28**
	CH_4	**0.15**	**0.11**	**0.10**	**0.09**	**0.10**	**0.11**
	N_2O	**0.09**	**0.06**	**0.05**	**0.05**	**0.05**	**0.05**
	Total CO_2 eq	**2,376.91**	**2,114.66**	**1,946.55**	**1,714.05**	**1,784.17**	**1,884.94**

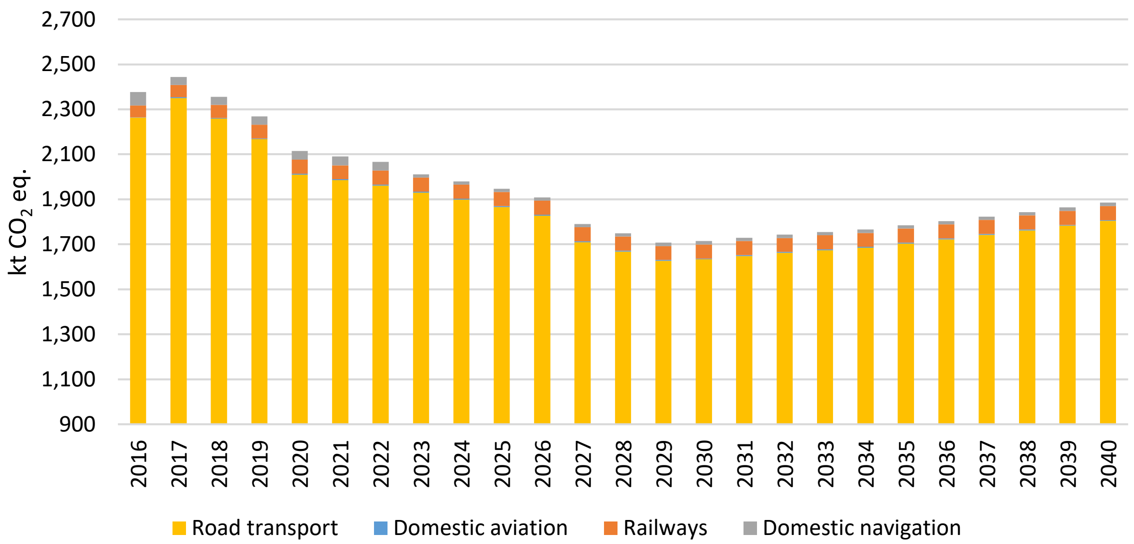


Figure 5.4. Total projected WAM scenario GHG emissions from Transport sector, kt CO_2 eq

5.2.2. Industrial processes and product use sector

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

IPPU WEM scenario projections by subsector are presented in Figure 5.5 and by GHG type in Table 5.6.

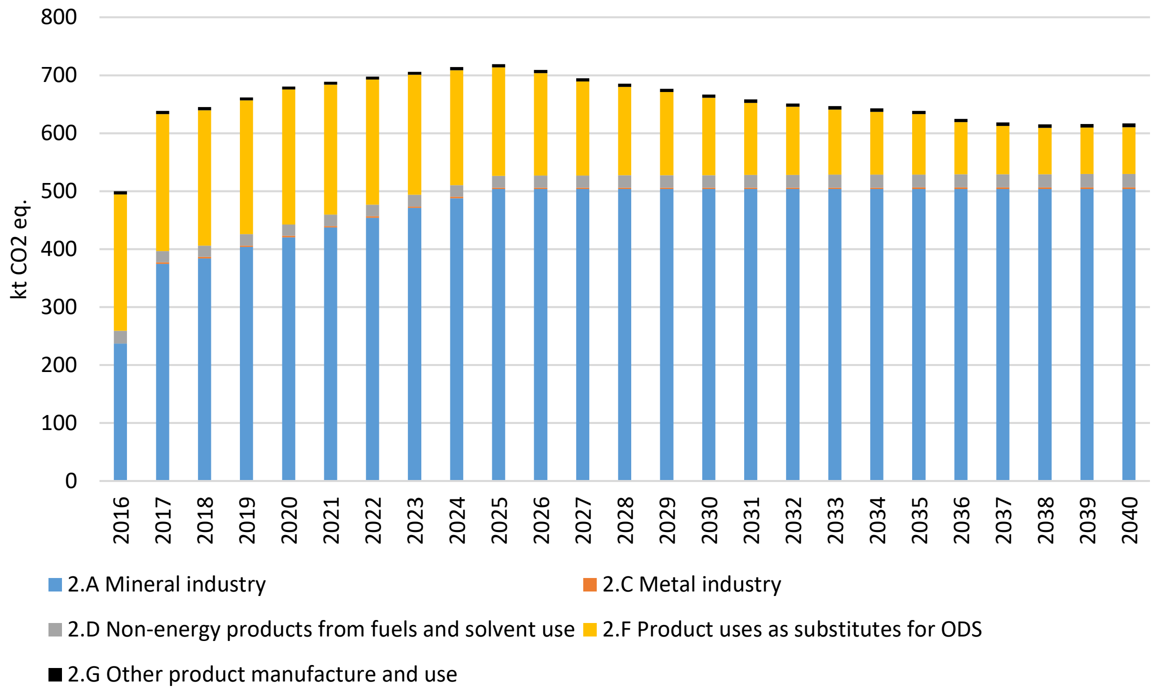


Figure 5.5. Total projected WEM scenario GHG emissions from IPPU sector, kt CO_2 eq.

Table 5.6. Total projected WEM scenario GHG emissions from IPPU, kt

IPPU	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Mineral industry	CO_2	236.95	420.52	503.53	503.53	503.53	503.53
	Total CO_2 eq.	236.95	420.52	503.53	503.53	503.53	503.53
Chemical industry	CO_2	NO	NO	NO	NO	NO	NO
	Total CO_2 eq.	NO	NO	NO	NO	NO	NO
Metal industry	CO_2	NA*	2.46	2.55	2.64	2.72	2.79
	Total CO_2 eq.	NA*	2.46	2.55	2.64	2.72	2.79
Non-energy products from fuels and solvent use	CO_2	5.98	6.07	6.88	7.64	8.38	8.97
	Indirect CO_2	16.37	13.69	13.59	13.87	14.16	14.39
	Total CO_2 eq. (incl. indirect CO_2)	22.35	19.76	20.47	21.51	22.54	23.36
Product uses as substitutes for ODS	HFC-s	0.11	0.11	0.09	0.08	0.07	0.07
	Total CO_2 eq.	235.18	232.56	187.02	133.42	103.96	80.85
Other product manufacture and use	SF_6 kt·10^{-3}	0.11	0.11	0.12	0.13	0.14	0.15
	N_2O	0.01	0.01	0.01	0.01	0.01	0.01
	Total CO_2 eq.	5.66	5.30	5.54	5.78	5.98	6.14

IPPU	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
IPPU total	**CO_2**	**242.93**	**429.05**	**512.96**	**513.81**	**514.63**	**515.29**
	Indirect CO_2	**16.37**	**13.69**	**13.59**	**13.87**	**14.16**	**14.39**
	HFC CO_2 eq.	**235.18**	**232.47**	**186.50**	**132.17**	**101.36**	**77.85**
	N_2O kt	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
	SF_6 CO_2 eq.	**2.54**	**2.56**	**2.79**	**3.01**	**3.20**	**3.35**
	Total CO_2 eq.	**500.15**	**680.59**	**719.12**	**666.88**	**638.72**	**616.67**

*Category Mineral industry; Other process uses of carbonates (CRF 2.A.4.b) is substituted with category Metal industry; Lead production (CRF 2.C.5) in 2019 year´s GHG inventory submission and also projections.

The WAM scenario (Table 5.7) for IPPU is projected because of additional measure – developing the railroad infrastructure (includes the building of Rail Baltic) – affect subsector 2.D.3 Other – Urea based catalysts for motor vehicles. According to the WAM scenario diesel fuel consumption is decreased and consumption of urea based diesel exhaust fluid also.

Table 5.7. Total projected WAM scenario GHG emissions from IPPU, kt

IPPU	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Mineral industry	CO_2	236.95	420.52	503.53	503.53	503.53	503.53
	Total CO_2 eq.	236.95	420.52	503.53	503.53	503.53	503.53
Chemical industry	CO_2	NO	NO	NO	NO	NO	NO
	Total CO_2 eq.	NO	NO	NO	NO	NO	NO
Metal industry	CO_2	NA*	2.46	2.55	2.64	2.72	2.79
	Total CO_2 eq.	NA*	2.46	2.55	2.64	2.72	2.79
Non-energy products from fuels and solvent use	CO_2	5.98	6.07	6.61	7.02	7.62	8.13
	Indirect CO_2	16.37	13.69	13.59	13.87	14.16	14.39
	Total CO_2 eq. (incl. indirect CO_2)	22.35	19.76	20.21	20.89	21.68	22.52
Product uses as substitutes for ODS	HFC-s	0.11	0.11	0.09	0.08	0.07	0.07
	Total CO_2 eq.	235.18	232.56	187.02	133.42	103.96	80.85
Other product manufacture and use	SF_6 kt·10^{-3}	0.11	0.11	0.12	0.13	0.14	0.15
	N_2O	0.01	0.01	0.01	0.01	0.01	0.01
	Total CO_2 eq.	5.66	5.30	5.54	5.78	5.98	6.14
IPPU total	**CO_2**	**242.93**	**429.05**	**512.96**	**513.81**	**514.63**	**515.29**
	Indirect CO_2	**16.37**	**13.69**	**13.59**	**13.87**	**14.16**	**14.39**
	HFC CO_2 eq.	**235.18**	**232.47**	**186.50**	**132.17**	**101.36**	**77.85**
	N_2O kt	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
	SF_6 CO_2 eq.	**2.54**	**2.56**	**2.79**	**3.01**	**3.20**	**3.35**
	Total CO_2 eq.	**500.15**	**680.59**	**718.85**	**666.26**	**637.96**	**615.83**

* Category Mineral industry; Other process uses of carbonates (CRF 2.A.4.b) is substituted with category Metal industry; Lead production (CRF 2.C.5) in 2019 year´s GHG inventory submission and also projections.

When comparing the Table 5.6 and Table 5.7 it can be seen that WAM scenario for diesel fuel consumption (and therefore urea based diesel exhaust fluid consumption reported under category 2.D.3 Other) only marginally decreases projected emissions from 2.D subsector and total emissions from IPPU.

Projected emissions for all other IPPU subsectors will be explained below.

Some smaller producers selling their products in EU plan increasing their production capacities but this does not affect total emissions projections. All the plants are already using best available technologies (BATs) according to current reference documents for BATs (BREFs), therefore no reduction of emissions due to newer technologies is planned today.

The Metal industry´s output has been stable after recovery from economic recession in 2009. As the operators have no plans to increase their production volumes, the emissions are projected to stay at the same level from 2017 until 2040 (in WEM as well as WAM scenarios)

Emissions from non-energy products from fuels and solvent use are projected to increase from 2021 onwards in WEM scenario (17% from 2021 until 2040) and in WAM scenario (14% from 2021 until 2040). This difference in WAM scenario is mainly caused by curbing diesel fuel consumption and urea containing diesel exhaust fluid consumption via additional measure – developing the railroad infrastructure. Emissions from lubricants, paraffin waxes and solvents are projected to increase slightly, ca 0.5 kt CO_2 from each product group from 2017 until 2040. Consumption of these products depends on economic situation of many small industries (linked to real GDP growth rate) and solvent use also depends much on population size. Given the economic growth (Ministry of the Finance) and population growth rate (Eurostat), these emissions are projected to increase slightly. Decrease of emissions from this subcategory in 2020 in comparison to 2016 (Table 5.6 and Table 5.7) is connected to the statistical corrections in solvent use (and indirect CO_2) that was done retrospectively but did not affect 2016 year´s data in 2018 year´s GHG inventory submission.

Emissions of HFC-s (substitutes for ozone-depleting substances (ODS) are projected to be the same in WEM and WAM scenarios. CO_2 eq. of emissions of HFC-s are projected to decrease significantly only after 2025 (20% reduction of emissions in 2025 in comparison to 2016 year´s emissions). Main cause is that in 2020 installation and servicing bans for many refrigeration equipment are applied and their effect is boosted after 2023 when the quota limit of HFCs for whole EU is decreased 2 times relative to 2018-2020 year´s level.

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 2030 emissions from F-gases (in CO_2 eq) are projected to have decreased 43% and in 2035 56%. This will be the result of Regulation (EU) No. 517/2014 and measure consisting of project-based activities to support effects of regulation.

The actual amounts of HFC-s emitted do not decrease as much as their CO_2 eq. because in some equipment only alternative refrigerant is a blend of lower GWP HFC-s.

Emissions of SF_6 reported under CRF subcategory Other Product Manufacture and Use are projected to rise steadily until 2040 when they possibly will be 27% larger than today (according WEM and WAM scenarios). SF_6 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 some SF_6 insulated equipment will exceed their service life and probably need to be replaced.

N_2O emissions from the subcategory Other Product Manufacture and Use are projected to stay at 2017 year´s level until 2040.

5.2.3. Agriculture sector

Since there are no additional measures intended in the Agriculture sector, which effects on GHG emissions were numerically evaluated, then the WAM scenario emissions are equal to the WEM scenario emissions (Table 5.8 and Figure 5.6).

In the WEM scenario total emissions from agriculture sector are projected to grow steadily reaching 1 625 kt CO_2 eq. in 2040 increasing 22% compared to 2016. An upward trend (Figure 5.6) in GHG emissions in the Agriculture sector is contributed by Enteric fermentation, Manure management and Agricultural soils due to the growth in livestock numbers and an increased milk yield, in case of dairy cows. Also, the emissions from Liming subsector are projected to increase. The rise in emissions from agricultural soils is the result of the expected increase in the use of synthetic and lime fertilizers, as well.

Table 5.8. Total projected WEM scenario GHG emissions from Agriculture sector, kt

Agriculture	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Enteric fermentation	CH_4	21.32	23.00	24.56	25.74	26.9	26.89
	Total CO_2 eq.	533.09	575.01	613.93	643.47	672.49	672.22
Manure management	CH_4	2.90	3.32	3.54	3.72	3.81	3.81
	N_2O	0.18	0.19	0.20	0.21	0.21	0.21
	Total CO_2 eq.	126.85	140.53	147.82	153.98	157.87	157.84
Agricultural soils	N_2O	2.22	2.37	2.46	2.52	2.56	2.57
	Total CO_2 eq.	660.16	706.42	733.73	750.93	762.35	764.51
Liming	CO_2	13.33	17.18	20.42	23.66	26.90	30.14
	Total CO_2 eq.	13.33	17.18	20.42	23.66	26.90	30.14
Urea application	CO_2	2.68	0.11	0.11	0.11	0.11	0.11
	Total CO_2 eq.	2.68	0.11	0.11	0.11	0.11	0.11
Agriculture total	**CO_2**	**16.01**	**17.28**	**20.53**	**23.77**	**27.01**	**30.25**
	CH_4	**24.22**	**26.32**	**28.09**	**29.45**	**30.71**	**30.70**
	N_2O	**2.40**	**2.56**	**2.66**	**2.72**	**2.77**	**2.78**
	Total CO_2 eq.	**1,336.11**	**1,439.25**	**1,516.01**	**1,572.14**	**1,619.72**	**1,624.82**

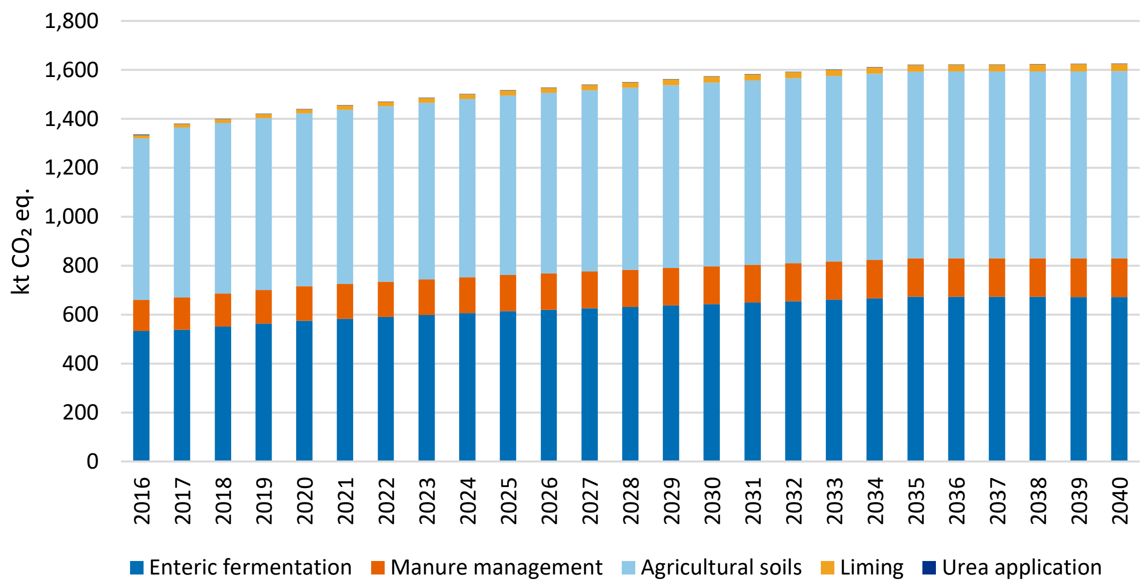


Figure 5.6. Total GHG emissions from Agriculture sector, kt CO_2 eq

5.2.4. Land use, land-use change and forestry sector

LULUCF sector includes emissions and removals of GHG-s from Forest land, Cropland, Grassland, Wetlands, Settlements, Other land and Harvested wood products. There are a number of factors that have affected the use of land during the last 25 years. The most important of these is the land reform, but also accession to the European Union, economic rises and falls.

Table 5.9. Projected land use in the LULUCF sector, thousand hectares

Land use class	2015 (2018 NIR)	2016 (2018 NIR)	2020	2025	2030	2035	2040
Forest land	2,419.1	2,419.2	2,419.2	2,419.2	2,419.2	2,419.2	2,419.2
Cropland	1,049.8	1,049.7	1,049.2	1,048.3	1,047.4	1,046.6	1,045.7
Grassland	281.0	280.6	278.2	276.0	273.7	271.4	269.1
Wetlands	416.7	416.7	416.2	415.5	414.9	414.2	413.6
Settlements	331.0	331.4	335.8	340.8	345.8	350.8	355.8
Other Land	36.3	36.3	35.3	34.1	32.9	31.7	30.5
LULUCF Total	4,533.9	4,533.9	4,533.9	4,533.9	4,533.9	4,533.9	4,533.9

Predicted area of land use by classes is presented in Table 5.9. Forest area has been growing steadily, but for the current projections, the area was considered as a constant in coherence with Forest Reference Level (FRL) calculation rules in accordance to the requirements from the LULUCF Regulation[30]. At the same time, the decrease of arable land took place since the 1990s. This process has been stopped since 2004 after Estonia became a member of the EU and agricultural subsidies were implemented. However, no further increase in arable land is expected. Grasslands should continue to decline in the near future, mainly due to natural afforestation. Infrastructure and settlements area extend continuously, at the expense of all other land use classes. According to *EFDP 2020* regeneration fellings, cleanings and thinnings are expected to increase further. This described management with the fact that Estonia has a significant amount of old aged forests temporarily decreases GHGs sink from forest land (Table 5.10 and Figure 5.7). The LULUCF sector is projected to remain a carbon sink until 2030, after which emissions from the sector are projected. This is mainly due to increased emissions from cropland and the reduction of carbon stored in forests, as the replacement of older forests with younger ones reduces forest reserves. In the coming years, forest reserves will reach a peak and then begin to decline, which is why a reduction in forest land CO_2 sequestration is expected.

Since there are no additional measures intended in the LULUCF sector then the WAM scenario emissions are equal to the WEM scenario emissions.

Table 5.10. Total GHG emissions from LULUCF sector, kt

LULUCF	GHG	2015 (2018 NIR)	2016 (2018 NIR)	2020	2025	2030	2035	2040
Forest Land	CO_2	-2,987.56	-3,149.02	-2,356.81	-1,279.02	-1,610.55	-1,355.33	-863.67
	CH_4	0.0001	0.0002	0.0004	0.0004	0.0004	0.0003	0.0003
	N_2O	0.0022	0.0021	0.0032	0.0036	0.0040	0.0045	0.0049
Cropland	CO_2	639.80	635.48	716.44	817.64	918.85	1,020.05	1,121.25
	N_2O	0.005	0.005	0.007	0.009	0.011	0.013	0.015
Grassland	CO_2	30.77	31.08	28.05	24.27	20.50	16.72	12.94
	CH_4	0.000003	0.000009	0.000199	0.000074	0.000024	0.000024	0.000024

[30] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0841&from=EN

LULUCF	GHG	2015 (2018 NIR)	2016 (2018 NIR)	2020	2025	2030	2035	2040
	N_2O	0.0000003	0.000001	0.000018	0.000007	0.000002	0.000002	0.000002
Wetlands	CO_2	801.99	604.92	565.77	516.84	467.91	418.97	412.65
	CH_4	0.0024	0.0024	0.0022	0.0022	0.0021	0.0020	0.0020
	N_2O	0.0045	0.0045	0.0042	0.0040	0.0039	0.0038	0.0037
Settlements	CO_2	266.19	240.54	277.32	323.29	369.26	415.23	461.19
	N_2O	0.043	0.043	0.050	0.060	0.070	0.081	0.091
Other Land	CO_2	30.34	30.69	34.06	38.27	42.49	46.70	50.91
	N_2O	0.004	0.004	0.007	0.009	0.010	0.012	0.014
HWP	CO_2	-1,058.43	-1,139.54	-688.70	-537.81	-446.54	-442.92	-456.76
Other*	N_2O	0.012	0.012	NE	NE	NE	NE	NE
LULUCF total	**CO_2**	**-2,276.90**	**-2,745.85**	**-1,423.87**	**-96.52**	**-238.10**	**119.41**	**738.51**
	CH_4	**0.003**	**0.003**	**0.003**	**0.003**	**0.002**	**0.002**	**0.002**
	N_2O	**0.071**	**0.072**	**0.071**	**0.086**	**0.100**	**0.114**	**0.129**
	Total CO_2 eq.	**-2,255.74**	**-2,724.44**	**-1 402.56**	**-70.94**	**-208.24**	**153.55**	**776.93**

* Indirect N_2O Emissions from Managed Soils (Nitrogen Leaching and Run-off) are reported as indirect emissions in GHG inventory and their projections have not been estimated.

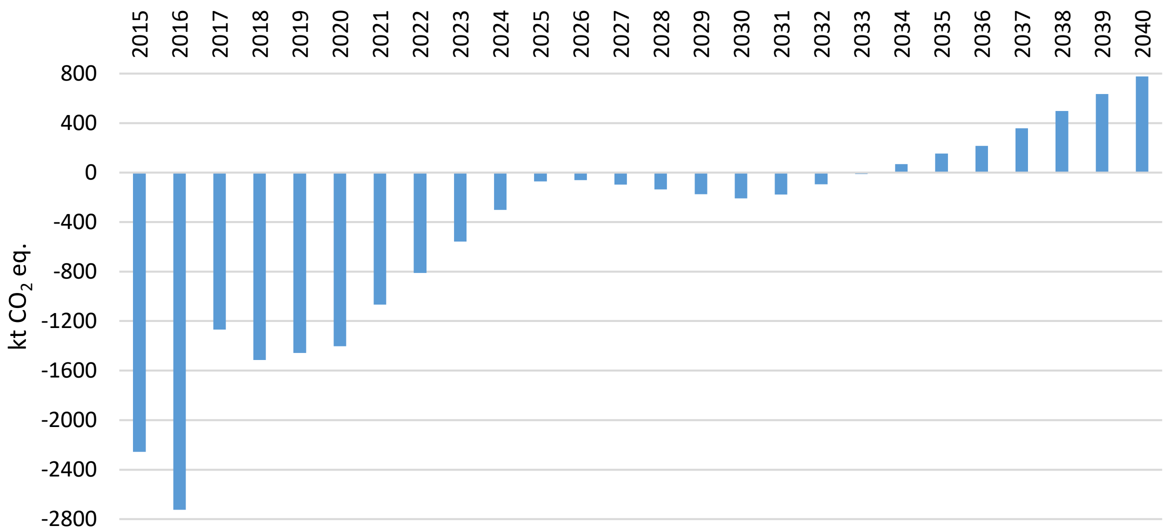


Figure 5.7. Total GHG emissions from LULUCF sector, kt CO_2 eq.

5.2.5. Waste sector

Since there are no additional measures intended in the Waste sector then the WAM scenario emissions are equal to the WEM scenario emissions Table 5.11 and Figure 5.8.

Compared to 2016, 2040 WEM scenario CO_2 eq. projections from Waste sector are decreasing by 40%. Emission decrease is mainly related to the increase of reusing and recycling waste materials (from 35% in 2014 to projected 50% in 2020), decreasing amount of biodegradable waste deposited in landfills (from 48% in 2014 to projected 20% in 2020) and to waste incineration in Iru CHP plant. Increase in GHG emissions from biological treatment of solid waste 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 is connected with the expanding sewerage network.

Table 5.11. Total projected WEM scenario GHG emissions from Waste sector, kt

Waste	GHG	2016 (2018 NIR)	2020	2025	2030	2035	2040
Solid waste disposal on land	CH_4	6.43	6.83	4.89	3.50	2.63	2.08
	Total CO_2 eq.	160.78	170.78	122.28	87.51	65.82	51.93
Biological treatment of solid waste	CH_4	0.81	0.86	0.96	1.05	1.12	1.18
	N_2O	0.05	0.05	0.06	0.06	0.07	0.07
	Total CO_2 eq.	34.92	36.95	41.13	44.90	47.94	50.73
Waste incineration and open burning	CO_2	1.06	1.31	0.70	NO	NO	NO
	CH_4	0.02	0.01	0.01	NO	NO	NO
	N_2O	0.0003	0.0003	0.0001	NO	NO	NO
	Total CO_2 eq.	1.62	1.74	0.93	NO	NO	NO
Wastewater treatment and discharge	CH_4	2.27	2.05	2.04	2.02	2.00	1.99
	N_2O	0.101	0.109	0.109	0.108	0.107	0.107
	Total CO_2 eq.	86.78	83.75	83.35	82.80	82.08	81.38
Other (Burning biogas in a flare)*	CH_4	0.85	NO	NO	NO	NO	NO
	N_2O	0.003	NE	NO	NO	NO	NO
	Total CO_2 eq.	22.13	NE	NO	NO	NO	NO
Waste total	**CO_2**	**1.06**	**1.31**	**0.70**	**NE**	**NE**	**NE**
	CH_4	**10.38**	**9.75**	**7.89**	**6.57**	**5.75**	**5.25**
	N_2O	**0.15**	**0.16**	**0.17**	**0.17**	**0.17**	**0.18**
	Total CO_2 eq.	**306.23**	**293.23**	**247.68**	**215.21**	**195.84**	**184.03**

* Biogas Burnt in a flare is not included in the 2019 GHG inventory and GHG projections. During the ESD review in 2018 it was noted, that there may be errors with the reported amount of flared landfillgas reported under Burning biogas in a flare. After investigation of this topic, it emerged that one landfill reported the amount landfill gas flared based on the maximum capacity of the flare and not the actual amount of landfill gas flared. Based on this information recalculations were made which resulted with significantly lower emissions and based on the UNFCCC 24/CP.19, Paragraph 37(b) the emissions under this subcategorie can be considered insignificant as the biogas burnt in a flare comprised 0.05 kt which is 0.00024 % of total emissions. Therefore Estonia will not continue to report the emissions in the GHG inventory and in projections.

Increase of CO_2 eq. emissions in 2017 compared to 2016 is connected with the recalculations of flared landfill gas done in the 2019 NIR. Please see more information in the 2019 NIR, chapters 7.2.5 and 7.6.

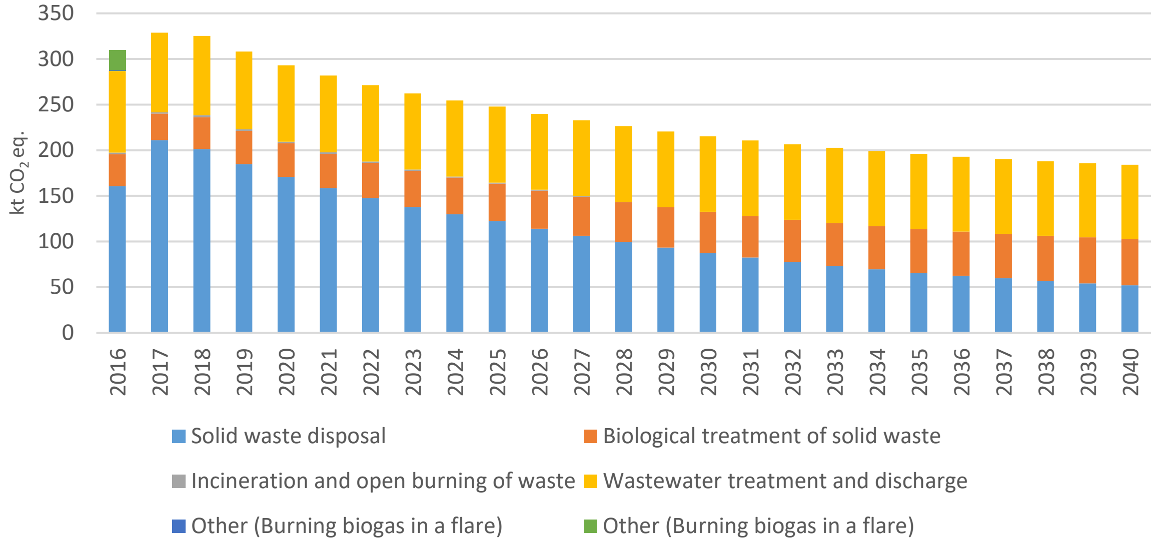


Figure 5.8. Total GHG emissions from Waste sector, kt CO_2 eq.

5.2.6. Total projected GHG emissions of Estonia and the national GHG target

The projected GHG emissions together with the historical GHG emissions from NIR 2019 are presented in Figure 5.9 and Table 5.9. To emphasize, this subchapter includes the 2016 total from NIR 2019 and the 2016 sectoral totals in previous chapters (5.2.1-5.2.5) are the base year for projections and from 2018 NIR.

Estonia's GHG emissions are expected to decrease about 39.7 per cent in the WEM scenario (without LULUCF) and about 48.4 per cent in the WAM scenario (without LULUCF) by 2040 compared to the base year of 2016 from NIR 2019. GHG emissions in WEM scenario (with LULUCF) are expected to decrease about 25.3 per cent and in the WAM scenario (with LULUCF) about 35.4 per cent by 2040 compared to the base year of 2016 from NIR 2019.

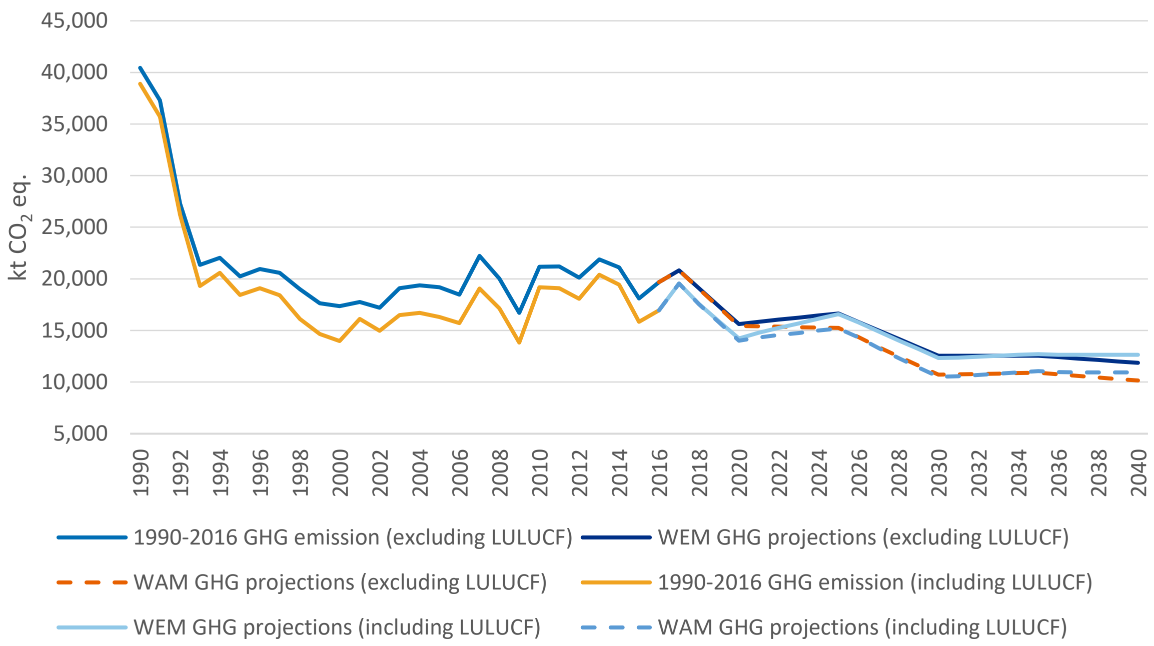


Figure 5.9. Total GHG projections until 2040, kt CO_2 eq.

Substantial sectoral information for historical GHG emission drivers is provided in Chapter 2.1.1 and for GHG projections in the subchapters above.

Table 5.12 Greenhouse gas emissions and projections, kt CO_2 eq.

	GHG emissions from 2019 NIR, kt CO_2 eq								GHG emission projections, (base year 2016 from 2018 NIR), kt CO_2 eq				
	Base year (1990)	1995	2000	2005	2010	2015	2016	2017	2020	2025	2030	2035	2040
CO_2 WEM emissions (excl. LULUCF, including indirect CO_2*)	37,066.8	18,201.6	15,359.8	17,131.7	19,015.6	15,891.0	17,477.5	18,654.5	13427.10	14448.04	10384.72	10410.03	9746.71
CO_2 WAM emissions (excl. LULUCF, including indirect CO_2*)									13217.78	13108.30	8628.14	8825.80	8118.90
CO_2 WEM emissions (incl. LULUCF, including indirect CO_2*)	35,274.6	16,202.1	11,660.8	13,888.5	16,549.1	13,181.0	14,403.6	16,533.3	12003.23	14351.52	10146.62	10529.44	10485.22
CO_2 WAM emissions (incl. LULUCF, including indirect CO_2*)									11793.90	13011.78	8390.04	8945.21	8857.41
CH_4 WEM emissions excl. CH_4 from LULUCF	1,895.5	1,258.8	1,235.7	1,208.1	1,216.2	1,089.1	1,065.2	1,071.0	42.57	42.62	42.67	43.16	42.64
CH_4 WAM emissions excl. CH_4 from LULUCF									42.56	41.46	41.00	41.14	40.33
CH_4 WEM emissions incl. CH4 from LULUCF	1,955.2	1,318.7	1,297.0	1,268.8	1,277.3	1,150.9	1,127.2	1,132.6	42.57	42.63	42.68	43.17	42.65
CH_4 WEM emissions incl. CH4 from LULUCF									42.56	41.46	41.01	41.14	40.33
N_2O WEM emissions excl. N_2O from LULUCF	1,469.2	766.6	682.3	727.5	804.6	921.1	884.2	915.7	3.03	3.14	3.19	3.25	3.25
N_2O WAM emissions excl. N_2O from LULUCF									3.03	3.11	3.14	3.18	3.17
N_2O WEM emissions incl. N_2O from LULUCF	1,712.2	1,010.6	928.4	978.2	1,065.2	1,187.1	1,150.9	1,182.5	3.10	3.23	3.29	3.36	3.38
N_2O WAM emissions incl. N_2O from LULUCF									3.10	3.20	3.24	3.29	3.30
HFCs WEM=WAM	NO	28.5	79.1	135.0	175.5	223.2	235.6	236.2	232.6	187.0	133.4	104.0	80.9
PFCs WEM= WAM	NO	NO	NO	NA,NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF_6 WEM=WAM	NO	3.1	2.6	1.0	1.7	2.2	2.5	2.4	2.6	2.8	3.0	3.2	3.3
NF_3 WEM= WAM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	GHG emissions from 2019 NIR, kt CO_2 eq								GHG emission projections, (base year 2016 from 2018 NIR), kt CO_2 eq				
	Base year (1990)	1995	2000	2005	2010	2015	2016	2017	2020	2025	2030	2035	2040
Total WEM (excluding LULUCF)	40,431.5	20,258.5	17,359.6	19,203.2	21,213.7	18,126.7	19,665.0	20,879.9	15,628.8	16,639.8	12,539.2	12,564.1	11,866.3
Total WAM (excluding LULUCF)									15,419.7	15,262.9	10,724.8	10,908.8	10,155.4
Total WEM (including LULUCF)	38,942.0	18,562.9	13,968.0	16,271.6	19,068.9	15,744.5	16,919.8	19,087.1	14,226.21	16,568.87	12,330.97	12,717.69	12,643.19
Total WAM (including LULUCF)									14,017.2	15,192.0	10,516.5	11,062.4	10,932.3
Energy WEM	36,397.4	17,855.2	14,974.9	16,790.3	18,940.3	15,872.6	17,486.2	18,532.3	13,215.70	14,157.01	10,084.98	10,109.86	9,440.75
Energy WAM									13,006.65	12,780.35	8,271.17	8,455.33	7,730.73
IPPU WEM	963.3	634.2	694.9	725.5	537.0	512.6	500.6	639.5	680.59	719.12	666.88	638.72	616.67
IPPU WAM									680.59	718.85	666.26	637.96	615.83
Agriculture WEM=WAM	2,700.9	1,371.2	1,127.4	1,172.2	1,242.0	1,384.9	1,337.8	1,379.3	1,439.25	1,516.01	1,572.14	1,619.72	1,624.82
LULUCF WEM=WAM	-1,489.5	-1,695.6	-3,391.6	-2,931.7	-2,144.8	-2,382.2	-2,745.2	-1,792.7	-1,402.56	-70.94	-208.24	153.55	776.93
Waste WEM=WAM	369.9	398.0	562.5	515.2	494.3	356.7	340.4	328.7	302.61	293.23	215.21	195.84	184.03

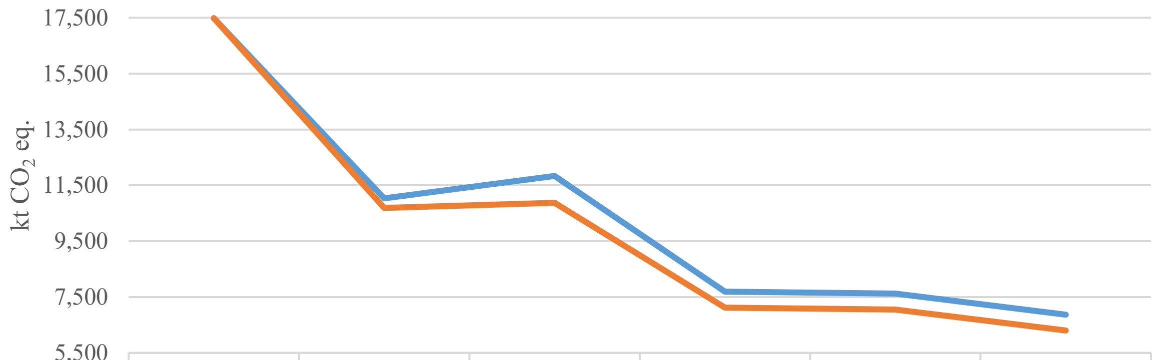
*indirect CO_2 emissions are calculated from NMVOCs reported under IPPU 2.D.3 Solvent use and road paving with asphalt. These emissions are reported under paragraph 4.4.3.2 Solvent use in NIR and in CRF Reporter sectoral table 2(I).A-Hs2.

5.2.7. Sensitivity analysis

SEN in the Energy sector

The Shale Oil Production industry is a growing branch in Estonia. According to the projections, the companies are planning to expand their production approximately 1.4 times in the next twenty years. However, this scenario is optimistic and such a wide expansion might not happen. Therefore, an alternative scenario has been modelled (SEN scenario).

In the SEN scenario, it is expected that instead of three additional solid heat carrier (SHC) technology shale oil production plants, only one will be built in the period of 2020–2040. This could happen if the economic situation is not suitable for shale oil production etc. This means that instead of about 20 million tons of oil shale (geological[31]), 4.1 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 only one additional shale oil plant will be constructed and the missing amount of electricity produced from oil shale gas, that would have been produced by additional three oil shale plants, is imported. The results of the SEN scenario are presented in Figure 5.10.



	2016	2020	2025	2030	2035	2040
WEM	17486.21	11034.7	11829.8	7689.9	7620.6	6868.4
WAM	17486.21	10685.3	10870.0	7119.0	7055.4	6301.4

Figure 5.10. Comparison of Energy sector GHG emissions in WEM and SEN scenarios, kt CO_2 eq.

SEN in Industrial processes and product use sector

Sensitivity analysis for IPPU sector emissions are based on the population and annual real GDP growth rate harmonised values Table 5.13) given by the European Commission (*Recommended parameters for reporting on GHG projections in 2019* 23.07.2019).

[31] 20 million tons of geological oil shale equals approximately 25 million tons of commercial oil shale.

Table 5.13. Recommended parameters by European Commission for reporting on GHG projections in 2019

Indicator	2020	2025	2030	2035	2040
GDP (in market prices), million euros	20.46	22.24	24.02	25.80	27.58
Population in Estonia, million	1.28	1.24	1.20	1.18	1.16

Under SEN scenario (Table 5.14), population and/or GDP growth rate values from Table 5.13 were used in calculations of IPPU categories 2.C Metal industry (GDP), 2.D Non-energy products from fuels and solvent use (GDP and population), 2.F Product uses as substitutes for ODS according (GDP and population) and 2.G Other product manufacture and use (GDP) according to the methodology of the WEM scenario. The methodology for calculating WEM scenario is provided in chapter 5.1.2. The category 2.A is not affected by the change of population or GDP growth rate.

Table 5.14. Comparison of IPPU sector GHG emissions per category, WEM and SEN scenarios, kt CO_2 eq.

Industrial process and product use	2016 (2018 inventory)	2020	2025	2030	2035	2040
2.A Mineral industry WEM	236.95	420.52	503.53	503.53	503.53	503.53
2.C Metal industry WEM	NA*	2.46	2.55	2.64	2.72	2.79
2.C Metal industry SEN		2.45	2.49	2.55	2.61	2.67
2.D Non-energy products from fuels and solvent use WEM	22.35	19.76	20.47	21.51	22.54	23.36
2.D Non-energy products from fuels and solvent use SEN		19.51	19.70	20.28	21.08	21.77
2.F Product uses as substitutes for ODS WEM	235.18	232.56	187.02	133.42	103.96	80.85
2.F Product uses as substitutes for ODS SEN		232.46	186.80	133.08	103.57	80.44
2.G Other product manufacture and use WEM	5.66	5.30	5.54	5.78	5.98	6.14
2.G Other product manufacture and use SEN		5.29	5.48	5.68	5.87	6.01
IPPU total WEM	500.15	680.59	719.12	666.88	638.72	616.67
IPPU total SEN		680.22	718.00	665.11	636.65	614.41
Difference (WEM-SEN)	0%	0.05%	0.16%	0.26%	0.32%	0.37%

* Category Mineral industry; Other process uses of carbonates (CRF 2.A.4.b) is substituted with category Metal industry; Lead production (CRF 2.C.5) in the 2019 GHG inventory submission and also projections.

SEN in Agriculture sector

Sensitivity analysis for Agriculture sector emissions is based on the scenario, where the population of dairy cows will not grow at the rate expected by the projections presented in Table 5.1, instead, the number of dairy cows grows at the rate shown in Table 5.15. The number of dairy cows is the main driver affecting the emissions from Agriculture sector. Moreover, due to the Russian sanctions, we have seen how the decreasing number of dairy cows can influence the sectoral projections. The alternative more pessimistic projected numbers of dairy cows were obtained from the Ministry of Rural Affairs.

Table 5.15. Number of dairy cows used in the sensitivity analysis

Indicator	2020	2025	2030	2035	2040
Livestock: Dairy cows, thousands	87	88	89	89	89

The results of SEN scenario emissions are presented in Table 5.16. The methodology for calculating WEM scenario is provided in Chapter 4.3.4. The results of SEN scenario show that the number of dairy cows is an important factor affecting the amounts of projected emissions.

Table 5.16. Comparison of Agriculture sector GHG emissions per category, WEM and SEN scenarios, kt CO_2 eq.

Agriculture	2016 (2018 inventory)	2020	2025	2030	2035	2040
3.A Enteric fermentation WEM	533.09	575.01	613.93	643.47	672.49	672.22
3.A Enteric fermentation SEN		563.35	589.71	603.11	611.95	611.68
3.B Manure Management WEM	126.85	140.53	147.82	153.98	157.87	157.84
3.B Manure management SEN		138.95	144.54	148.51	149.68	149.65
3.D Agricultural soils WEM	660.16	706.42	733.73	750.93	762.35	764.51
3.D Agricultural soils SEN		703.24	727.18	740.02	745.99	748.15
Agriculture total WEM	1336.11	1439.25	1516.01	1572.14	1619.72	1624.82
Agriculture total SEN		1422.82	1481.96	1515.41	1534.61	1539.72
Difference (WEM-SEN)	0%	-1.2%	-2.3%	-3.7%	-5.5%	-5.5%

SEN in the Waste sector

Sensitivity analysis for Waste sector emissions is based on the scenarios, where population and annual real GDP growth rate (Table 5.17) are based on the harmonised values given by the European Commission (*Recommended parameters for reporting on GHG projections in 2019* 23.07.2019).

Table 5.17. Recommended parameters by European Commission for reporting on GHG projections in 2019

Indicator	2020	2025	2030	2035	2040
Annual real GDP growth rate (in market prices), %	20.46	22.24	24.02	25.80	27.58
Population in Estonia, million	1.28	1.24	1.20	1.18	1.16

Under SEN scenario (Table 5.18), population and GDP growth rate from Table 5.17 were both implemented in calculations. The methodology for calculating WEM scenario is provided in Chapter 4.3.6. The subcategories Waste incineration without energy recovery and Other (Burning Biogas in a flare) are not affected by the change of population and GDP growth rate.

Table 5.18. Comparison of Waste sector GHG emissions per category, WEM and SEN scenarios, kt CO_2 eq

Waste	2016 (2018 inventory)	2020	2025	2030	2035	2040
Solid waste disposal on land WEM	160.78	170.78	122.28	87.51	65.82	51.93
Solid waste disposal on land SEN		180.13	121.88	86.42	60.45	43.63
Biological treatment of solid waste WEM	34.92	36.95	41.13	44.90	47.94	50.73
Biological treatment of solid waste SEN		40.06	42.77	45.48	48.17	48.71
Waste incineration and Open burning WEM	1.62	1.74	0.93	NO	NO	NO
Waste incineration and Open burning* SEN		1.69	0.85	NO	NO	NO
Wastewater treatment and discharge WEM	86.78	83.75	83.35	82.80	82.08	81.38
Wastewater treatment and discharge SEN		81.87	80.55	79.10	78.31	78.16
Other (Burning biogas in a flare)	22.13	NO	NO	NO	NO	NO
Waste total WEM	306.23	293.23	247.68	215.21	195.84	184.03
Waste total SEN		302.57	247.28	214.13	190.46	175.74
Difference (SEN-WEM)		-1%	-19%	-30%	-38%	-43%

* Emissions from waste incineration without energy recovery are not affected by the change of population and GDP growth rate, but the emissions from open burning of waste are.

5.2.8. Comparison of projections between previous BR3 and current BR4

BR4, as well as BR3, have been both compiled by the EERC. Table 5.19 includes some of the main assumptions and results of the previous and current projections. There have been several methodological developments since the previous BR that include using 2016 as the base year and using *EEDP 2030* along with expert judgements instead of *LEAP* model for compiling Transport projections.

Table 5.19. Comparison of projections between previous and current BR

	2015	2020	2025	2030	2035	2040
BR3 Population, thousand people	1,313.3	1,297.4	1,276.0	1,250.7	1,222.9	NE
BR4 Population, thousand people	1,313.3	1,317.9	1,312.1	1,306.2	1,295.0	1,283.7
BR3 Annual GDP growth rates, %	3.3	3.0	2.5	2.5	2.1	NE
BR4 Annual GDP growth rates, %	1.7	3.0	2.6	1.9	1.4	1.4
BR3 WEM total emissions (without LULUCF), kt CO_2 eq.	15,681.3	17,192.2	17,061.5	15,329.8	14,945.0	NE
BR4 WEM total emissions (without LULUCF), kt CO_2 eq.	18,089.7	15,628.8	16,639.8	12,539.2	12,564.1	11,866.3

	2015	2020	2025	2030	2035	2040
BR3 WAM total emissions (without LULUCF), kt CO_2 eq.	15,681.3	16,620.3	15,980.2	13,494.1	12,763.6	NE
BR4 WAM total emissions (without LULUCF), kt CO_2 eq.	18,089.7	15,419.7	15,262.9	10,724.8	10,908.8	10,155.4

5.3. Projection of memo item International bunker fuels

CO_2 emissions from aviation have been included in the EU ETS since 2012. Under the EU ETS, all airlines operating in Europe, European and non-European alike, are required to monitor, report and verify their emissions, and to surrender allowances against those emissions. They receive tradeable allowances covering a certain level of emissions from their flights per year. In October 2016, the International Civil Aviation Organization (ICAO) agreed on a Resolution for a global market-based measure to address CO_2 emissions from international aviation as of 2021. The agreed Resolution sets out the objective and key design elements of the global scheme, as well as a roadmap for the completion of the work on implementing modalities. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) aims to stabilise CO_2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020. Airlines will be required to monitor emissions on all international routes, offset emissions from routes included in the scheme by purchasing eligible emission units generated by projects that reduce emissions in other sectors (e.g. renewable energy). A regular review of the scheme is required under the terms of the agreement. This should allow for continuous improvement, incl. in how the scheme contributes to the goals of the Paris Agreement. Work is ongoing at ICAO to develop the necessary implementation rules and tools to make the scheme operational. Effective and concrete implementation and operationalization of CORSIA will ultimately depend on national measures to be developed and enforced at domestic level. Estonia, like all other EU Member States, will participate in the voluntary Phase I (2021–2026). Participation of states in the will become mandatory in Phase II (as of 2027) and exemptions will then apply for some states.

International Maritime Organization's (IMO) Marine Environment Protection Committee (MEPC) continues to address GHG emissions from international shipping, with work on track for the adoption of an initial IMO strategy on the reduction of GHG emissions from ships in 2018. Considerable efforts to agree such an approach have been made over recent years within both the IMO and the UNFCCC also with a view to ensure a fair contribution of the sector to the objective of the Paris agreement to limit the average increase of the temperatures to +1,5 °C. In 2016 the IMO in its MEPC 70 meeting reached an agreement on a global data collection system as the next step in their action to tackle CO_2 emissions. Also MEPC 70 agreed to develop a Roadmap for addressing CO_2 emissions from international shipping, with initial CO_2 reduction commitments to be agreed in MEPC 72 by April 2018. In 2017 MEPC 71 adopted guidelines for administration verification of ship fuel oil consumption data (Resolution MEPC.292(71)) and guidelines for the development and management of the IMO ship fuel oil consumption database (Resolution MEPC.293(71)).

In June 2013, the EC set out a strategy to progressively integrate maritime emissions into the EU's policy for reducing its domestic GHG emissions consisting of 3 consecutive steps:

1. monitoring, reporting and verification of CO_2 emissions from large ships using EU ports;

2. GHG reduction targets for the maritime transport sector;

3. further measures, incl. market-based measures, in the medium to long term.

EU has already taken the first step: monitoring, reporting and verification of CO_2 emissions from large ships using EU ports. Large ships over 5000 gross tonnes loading/unloading cargo/passengers from 1 January 2018 at EU maritime ports are to monitor and later report their related CO_2 emissions and other relevant information in accordance with their monitoring plan. Monitoring, reporting and verification of information shall be done in conformity with Regulation 2015/757 (as amended by Delegated Regulation 2016/2071).

Historically, the emissions from Aviation bunkering form about 14% of all bunkering emissions. The projected GHG emissions of International bunkering are presented in Table 5.20. The emissions of Aviation bunkering are projected to increase by 132.9% in 2040 compared to 2016. The total GHG emissions of Marine bunkering are also expected to increase by 18.6% in 2040 compared to 2016. Overall, the GHG emissions from International bunkering are expected to increase by 26.8% in 2040 compared to 2016 from the increase of international carriage of passengers.

Table 5.20. Total GHG emissions of International bunkering, kt

International bunkering	GHG	2016 (2018 inventory)	2020	2025	2030	2035	2040
Aviation bunkering	CO_2	64.74	150.81	150.81	150.81	150.81	150.81
	CH_4	0.00	0.00	0.00	0.00	0.00	0.00
	N_2O	0.00	0.00	0.00	0.00	0.00	0.00
	Total kt CO_2 eq	65.32	152.10	152.10	152.10	152.10	152.10
Marine bunkering	CO_2	830.92	985.13	985.13	985.13	985.13	985.13
	CH_4	0.08	0.09	0.09	0.09	0.09	0.09
	N_2O	0.02	0.03	0.03	0.03	0.03	0.03
	Total kt CO_2 eq	839.71	995.53	995.53	995.53	995.53	995.53
International bunkering total	CO_2	895.66	1,135.94	1,135.94	1,135.94	1,135.94	1,135.94
	CH_4	0.08	0.10	0.10	0.10	0.10	0.10
	N_2O	0.02	0.03	0.03	0.03	0.03	0.03
	Total kt CO_2 eq	905.03	1,147.63	1,147.63	1,147.63	1,147.63	1,147.63

5.4. Assessment of the aggregate effect of policies and measures

Policies and measures used in projection calculations are complex and based on the future development plans, legal acts etc. Making historical distribution between climate-related and non-climate-related measures and making a reliable transition to the documents in force today has shown its limitations. Currently, GHG estimates of mitigation impact is not available in all sectors and for all policies and measures due to the lack of quantifiable activity data provided in the national development plans.

Estonia is currently in the process of updating the development plans for the new period starting from 2020.

Estonia is able to provide information on the aggregated CO_2 eq effect of energy, transport, IPPU and for one waste sector policies and measure. The table below (Table 5.21) shows assessment of the significant policies and measures effect forming a "comparison scenario" which is showing the projected situation if Estonia would not implement current policies and measures in "WAM scenario".

Table 5.21. Total effect of implemented and adopted PaMs, kt CO_2 eq.

GHG	2020	2025	2030	2035	2040
CO_2	209.32	1339.74	1756.58	1584.23	1627.81
CH_4	0.01	1.16	1.67	2.02	2.31
N_2O	0.00	0.03	0.05	0.07	0.08
Total CO_2 eq.	209.05	1376.92	1814.42	1655.30	1710.85

6. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT TO DEVELOPING COUNTRIES

Estonia is not one of the Parties listed in Annex II to the Climate Convention; consequently, Estonia is not obliged to fulfil the commitments under Articles 4.3, 4.4 and 4.5 of the Convention. Despite this, Estonia has contributed to climate finance voluntarily. The Government of Estonia is committed to fighting against global climate change, focusing especially on the situation in countries which are most affected by climate change, such as the least developed countries and the Small Island Developing States. Estonia recognises that the need for financing to reach the climate policy objectives is one of many important elements that need to be tackled continuously. Both public and private funding should support investments into programmes and policies aimed at reducing emissions and increasing resilience to climate change.

At COP21 United Nations Climate Change Conference in Paris, a number of climate funding announcements were made by developed countries, including Estonia. Estonia pledged to contribute 1 million euros annually until the year 2020 for financing international climate cooperation by supporting environmentally sustainable development in developing countries through contributing to bilateral projects, multilateral organisations and regional funds. The main focus is planned to be on climate change mitigation and adaptation, for example by supporting renewable energy, energy efficiency, sustainable transport and industry efficiency projects, as well as by strengthening administrative capacity regarding climate action or supporting solutions for adapting to climate change. Living up to our commitment made in Paris during COP21, Estonia is and will keep contributing to climate-oriented cooperation with developing countries.

The climate-related measures designed to achieve these objectives form a part of the State Budget Strategy, based on national objectives and the objectives of sectoral development plans. One of the measures in the State Budget Strategy 2017–2020 to be funded by the revenues from greenhouse gas emissions allowance trading system in 2013–2020 is Estonia's contribution to international climate change cooperation. During the period of 2015–2020, Estonia has decided to channel 5 million euros from the revenues of the auctioning of EU ETS (Emissions Trading System) allowances to International climate cooperation and 100% of the revenues from EU ETS Aviation auctions to funding innovative climate projects and start-ups.

Depending on specific decisions taken in the context of the annual state budget process, it is not impossible that some additional amount might be committed to climate objectives related activities in the official development assistance (ODA) target countries. In 2017 Fiji, Georgia and Moldova were the countries that received climate change related ODA and in 2018 Belarus, Georgia, Kenya, Moldova, Ukraine and Uzbekistan were the countries that received climate change related ODA.

To date, funding from private sector has been mobilized into domestic climate related activities rather than climate cooperation. Estonia involves the private sector in financing climate cooperation in developing countries. For this, we have conducted a feasibility study to identify Estonia's cleantech and green growth sectors with the biggest export potential. In these sectors, the interest to participate in cooperation efforts would consequently be higher. On the basis of the results of the study we plan to have annual calls for projects where the main focus is on Estonian cleantech companies and NGOs which could export their products and know-how to developing countries. The first round of calls for such projects was prepared in 2017 and opened during the third quarter of 2018. More than 10 applications were submitted. Totally 4 projects were selected for financing (cooperation projects with Georgia, Grenada, Myanmar and one IT system for developing countries). Total grant is 600 000 eur per call. Projects are ongoing and more information can provide in the future. There will be more similars open calls in the future.

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Appendix 1 Overview on CTF tables provided with the third EU Biennial Report:

CTF Table 1	Emission trends
CTF Table 2	Description of quantified economy-wide emission reduction target
CTF Table 3	Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects
CTF Table 4	Reporting on progress
CTF Table 4(a)II	Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
CTF Table 4(b)	Reporting on progress
CTF Table 5	Summary of key variables and assumptions used in the projections analysis
CTF Table 6(a)/(c)	Information on updated greenhouse gas projections under a 'with measures' scenario and under a 'with additional measures' scenario
CTF Table 7	Provision of public financial support: summary information from 2017-2018
CTF Table 7(a)	Provision of public financial support: contribution through multilateral channels in 2017-2018
CTF Table 7(b)	Provision of public financial support: contribution through bilateral, regional and other channels in 2017-2018
CTF Table 8	Provision of technology development and transfer support in 2017-2018
CTF Table 9	Provision of capacity-building support in 2017-2018