ESTONIA’S THIRD BIENNIAL REPORT

under the United Nations Framework Convention on Climate Change

December 2017

The Ministry of the Environment (MoE) has responsibility of the preparation and finalization of Estonia's Biennial Report and its submission to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat.

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1. INTRODUCTION

Estonia is pleased to submit its Third Biennial Report (BR3) 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 and the GHG inventory incl. information on 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 (UNFCCC decision 19/CP.18) are enclosed to the BR3 submission (BR3 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.

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

2. INFORMATION ON GHG EMISSIONS AND TRENDS, GHG INVONTORY INCLUDING INFORMATION ON NATIONAL INVENTORY SYSTEM

2.1 Introduction and summary information from the national GHG inventory

This chapter sets out Estonia's GHG emissions and their trends for the period of 1990–2015. It also provides information on Estonia's national inventory arrangements. The GHG data presented is consistent with Estonia's 2017 submission to the UNFCCC Secretariat. 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).

2.1.1 Overall greenhouse gas emission trends

Estonia's total GHG emissions in 2015 were 18,040.48 kt CO_2 eq. (with indirect CO_2), excluding net emissions from LULUCF (land use, land-use change and forestry). Emissions decreased by 55.3% in 1990–2015 (see Table 2.1) but increased by around 5% between 2010 and 2011. Estonia's Kyoto Protocol target was to reduce GHG emissions by 8% during the period of 2008–2012 compared to the level of 1990. Estonia has met its commitments for the first commitment period (2008–2012) under the Kyoto Protocol. Emission trends by sector are given in Figure 2.1.

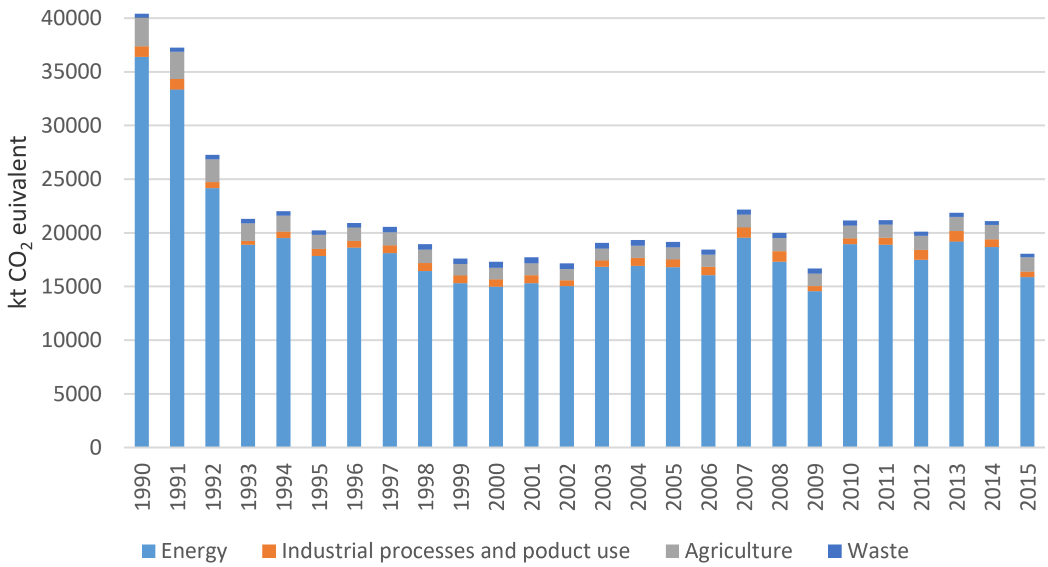

Figure 2.1 Estonia's GHG emissions by sector, 1990–2015, excluding LULUCF, kt CO_2 eq.

The energy sector is by far the largest producer of GHG emissions in Estonia. In 2015, the sector accounted for 87.9% of Estonia's total GHG emissions (Figure 2.2).

The second largest sector is agriculture, which accounted for 7.4% of total emissions in 2015. Emissions from the industrial processes and product use as well as waste sectors accounted for 2.9% and 1.8% of total emissions, respectively.

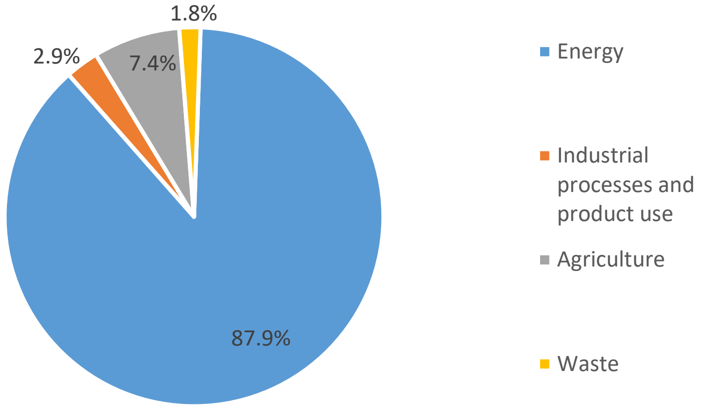

Figure 2.2 GHG emissions by sector in 2015, %

The LULUCF sector, acting as the only possible sink of GHG emissions in Estonia, plays an important role in the national carbon cycle. In 2015, the LULUCF sector acted as a CO_2 sink, with a total uptake of 2,359.2 kt CO_2 eq. (Table 2.1). Uptake of CO_2 has increased by 36% compared to the base year (1990) and by 34% compared to the previous year (2014).

Table 2.1. GHG emissions and removals by sector in 1990, 1995, 2000, 2005 and 2010–2015, kt CO_2 eq.

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015
Energy	36,397.4	17,855.2	14,974.9	16,787.4	18,939.3	18,887.8	17,496.6	19,181.2	18,691.2	15,863.9
Industrial processes and product use (incl. indirect CO_2)	965.7	637.4	697.6	726.4	537.6	660.5	904.4	996.0	707.7	512.9
…Indirect CO_2 (from NMVOCs reported under IPPU 2.D.3 Solvent use and road paving with asphalt)[2]	20.9	20.6	19.2	19.1	18.7	16.5	13.5	12.9	14.0	14.6
Agriculture	2,669.7	1,326.1	1,078.0	1,129.1	1,192.4	1,218.4	1,307.4	1,303.5	1,341.9	1,337.6
Waste	369.9	397.7	562.8	513.9	474.2	416.1	409.6	375.5	340.3	326.1
Total (excl. LULUCF incl. indirect CO_2)	**40,402.7**	**20,216.4**	**17,313.3**	**19,156.6**	**21,143.5**	**21,182.7**	**20,118.1**	**21,856.3**	**21,081.1**	**18,040.5**
Land use, land-use change and forestry	–1,734.7	–1,807.2	–3,396.7	–2,690.9	–1,924.4	–2,078.6	–2,083.6	–1,487.3	–17,54.9	–2,359.2
Total (incl. LULUCF and indirect CO_2)	**38,668.0**	**18,409.2**	**13,916.6**	**16,465.9**	**19,219.1**	**19,104.1**	**18,034.4**	**20,369.0**	**19,326.2**	**15,681.3**

[2] Indirect CO_2 emissions are calculated from NMVOCs reported under IPPU 2.D.3 (CRF) Solvent use and road paving with asphalt

In 2015, the main GHG in Estonia was CO_2, accounting for 88.1% of the total GHG emissions (with indirect CO_2 and without LULUCF) expressed in CO_2 eq., followed by CH_4 with 5.9% and N_2O with 4.8%. Fluorinated gases (the so-called F-gases) collectively accounted for about 1.2% of overall GHG emissions (Figure 2.3).

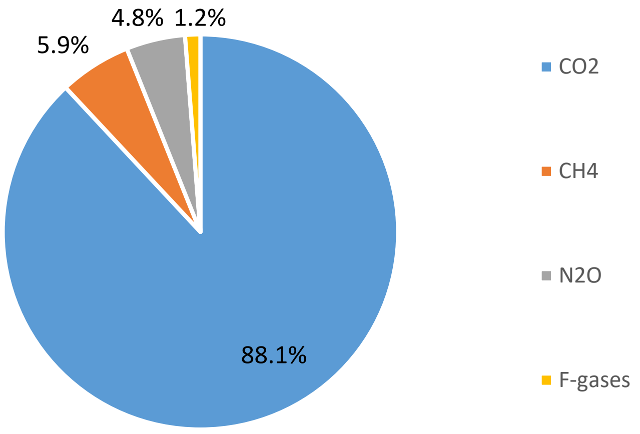

Figure 2.3. GHG emissions by gas in 2015, %

Emissions of CO_2 (with indirect CO_2) decreased by 57.2% from 37,069.2 kt in 1990 to 15,885.4 kt in 2015 (Table 2.2), especially CO_2 emissions from the Energy subsector Public electricity and heat production, which is a major source of CO_2 in Estonia.

Methane is the second most significant contributor to GHG emissions in Estonia after CO_2. Emissions of CH_4 decreased by 44.5% from 1,909.6 kt CO_2 eq. in 1990 to 1,059.1 kt CO_2 eq. in 2015. 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 38.3% from 1,423.9 kt CO_2 eq. in 1990 to 871.0 kt CO_2 eq. in 2015, especially N_2O emissions from the Agriculture sub-sector Agricultural soils, which is the main contributor of N_2O emissions in Estonia.

Emissions of F-gases (HFCs, PFCs and SF_6) increased from 0 kt CO_2 eq. in 1990 to 225.1 kt CO_2 eq. in 2015, especially HFC emissions from Refrigeration and air conditioning, which is a major source of halocarbons in Estonia. A key driver behind the growing emission trend in the Refrigeration and air conditioning sector has been the substitution of ozone depleting substances with HFCs.

Table 2.2. GHG emissions by gas, 1990, 1995, 2000, 2010 and 2010–2015, excluding LULUCF, kt CO_2 eq.

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015
CO_2 emissions incl. indirect CO_2 (excl. net CO_2 from LULUCF)	37,069.2	18,204.8	15,362.6	17,135.8	19,015.1	19,097.0	17,937.9	19,695.6	18,910.2	15,885.4
Indirect CO_2 (from NMVOCs reported under IPPU 2.D.3 Solvent use and road paving with asphalt)*	20.9	20.6	19.2	19.1	12.9	14.0	14.6	15.2	15.7	15.9
CH_4 emissions (excl. CH_4 from LULUCF)	1,909.6	1,263.8	1,238.8	1,208.3	1,196.2	1,127.0	1,146.2	1,138.1	1,106.4	1,059.1
N_2O emissions (excl. N_2O from LULUCF)	1,423.9	716.3	630.2	676.6	754.8	773.6	838.9	813.3	844.9	871.0
HFCs	NO	28.5	79.2	135.0	175.5	183.3	193.2	207.3	217.5	222.8
PFCs	NO	NO	NO	NA,NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	NO	3.1	2.6	1.0	1.7	1.8	1.9	2.0	2.1	2.3
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (excl. LULUCF)	40,402.7	20,216.4	17,313.3	19,156.8	21,143.5	21,182.7	20,118.1	21,856.3	21,081.1	18,040.5
Total (incl. LULUCF)	38,668.0	18,409.2	13,916.6	16,465.8	19,219.1	19,104.1	18,034.4	20,369.0	19,326.2	15,681.3

2.1.2 Greenhouse gas emissions by sector

Energy

Estonia's emissions from the Energy sector are divided into the following categories: Fuel combustion, incl. Energy industries; Manufacturing industries and construction; Transport; Other sectors; Other; and Fugitive emissions from fuels. The share of emissions by category is presented in Figure 2.4.

The Energy sector is the main source of GHG emissions in Estonia. In 2015, the sector contributed 87.9% of all emissions, totalling 15,863.9 kt CO_2 eq. 99.9% of emissions in the sector originated from fuel combustion – only 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 rather steady (slight decrease until 2002). In 2003, the emissions increased mainly due to the export of electricity based on oil shale. The large 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 56.4% compared to 1990 (incl. Energy industries – 58.2%; Manufacturing industries and construction – 80.1%; Transport – 6.2%; Other sectors – 62.6%; Other – 38.3%; and Fugitive emissions from fuels – 69.1%). This major decrease was caused by structural changes in the economy after

1991 when Estonia regained its independence. 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), transport (the proportion of new and environmentally friendly cars has increased and the number of agricultural machines has decreased), households (energy saving) etc. The overall progression of GHG emissions in the Energy sector in CO_2 eq. is presented in Figure 2.4.

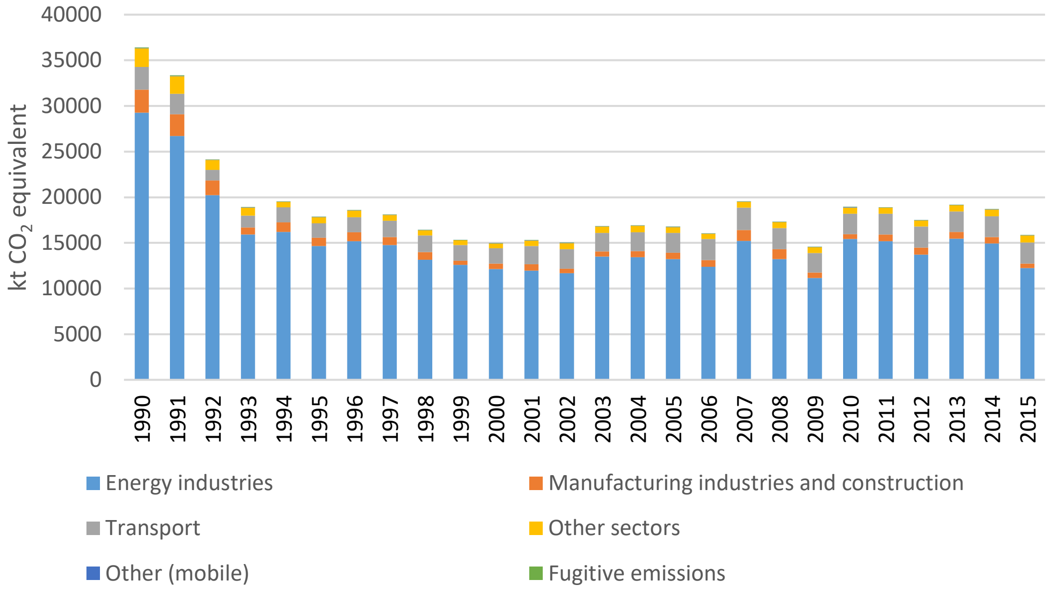

Figure 2.4. Trend in emissions from the Energy sector, 1990–2015, kt CO_2 eq.

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);
- 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);
- Product uses as substitutes for ODS (HFC emissions from refrigeration and air conditioning, foam blowing, fire protection and aerosols); and
- Other product manufacture and use (SF_6 emissions from electrical equipment, SF_6 and PFC emissions from other product use and N_2O emissions from product use).

Additionally, Estonia reports indirect CO_2 emissions calculated from NMVOC emissions under CRF category 2.D.3.

In 2015, the Industrial processes and product use sector contributed 2.84% of all GHG emissions in Estonia, totalling 512.9 kt CO_2 eq. with indirect CO_2 (and 497.0 kt CO_2 eq. without indirect CO_2). The most significant emission sources were CO_2 emissions from cement production at 40% and HFC emissions from refrigeration and air conditioning at 43% of total emissions of the sector (with indirect CO_2). Compared to 2014, the emissions from Industrial processes and product use (with indirect CO_2)

decreased by 27.5% in 2015. This decrease in emissions is caused by the temporary lower output of the mineral industry because of economic slowdown.

Industrial CO_2 emissions have fluctuated strongly since 1990, reaching their lowest level in 1993. 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 less extensive 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 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 sudden increase in emissions in 2007 was mainly caused by an increase in cement production, as the only cement factory had renovated its third kiln. In 2009, the industrial processes sector was affected by the recession. The decline in production was mainly due to insufficient demand on both the domestic and external markets. The increase in emissions in 2011 was caused by an increase in cement production. CO_2 emissions rose in 2012 and 2013, because a power plant temporarily used large amounts of limestone for flue gas desulphurisation.

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

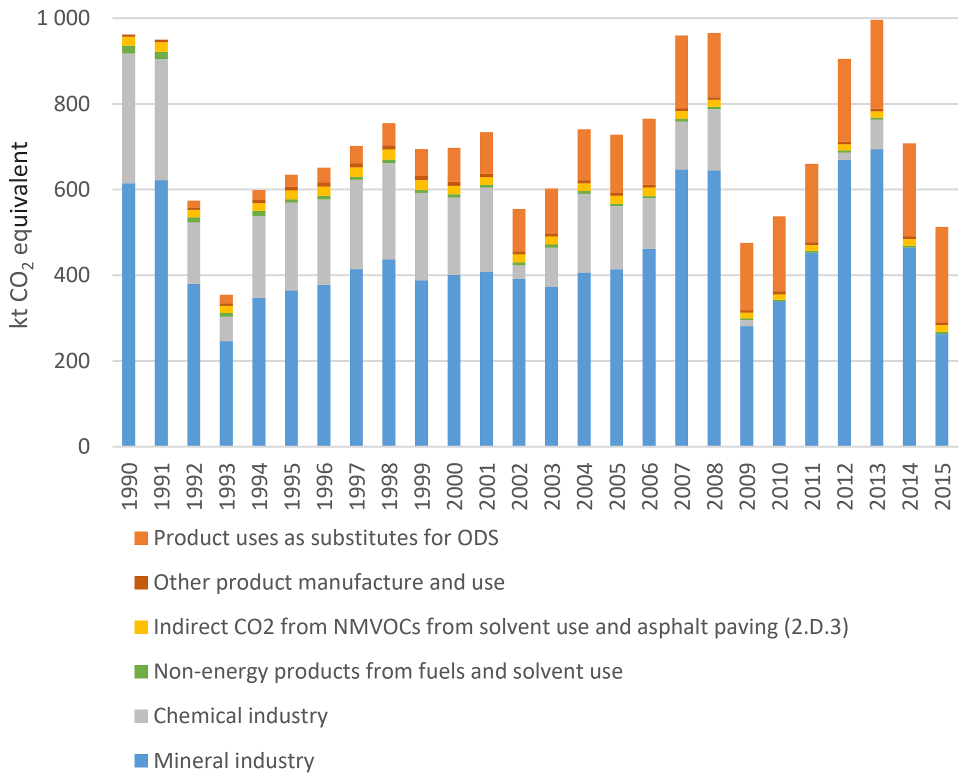

Figure 2.5. Trend in emissions from Industrial processes and product use sector, 1990–2015, kt CO_2 eq.

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, as well as CO_2 emissions from Liming and Urea application to agricultural soils. Direct N_2O emissions include emissions from synthetic fertilisers, emissions from animal waste, compost and sludge applied to agricultural soil, emissions from crop residues and cultivation of organic soils and emissions from urine and dung deposited by grazing animals. Indirect N_2O emissions include emissions due to atmospheric deposition, leaching and run-off.

The total GHG emissions reported in the Agricultural sector of Estonia were 1,337.6 kt CO_2 eq. in 2015. The sector contributed about 7.4%[3] to the total CO_2 eq. emissions in Estonia. In 2015, the emissions from enteric fermentation decreased by 3.5% and from manure management by 6.8% compared to the previous year due to a fall in the numbers of dairy 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 2015 dropped by 5.2% in comparison with 2014. The number of swine has fallen 16% in Estonia as a result of the outbreak of African swine fever in the region in 2015.

Emissions from agricultural soils and enteric fermentation of livestock were the major contributors to the total emissions recorded in the sector – 48% and 40%, respectively.

As a result of the markets of the former Soviet Union collapsing in the early 1990s, 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. Production prices in Estonia fell to a level of up to 50% lower than the prices on world markets and became insufficient for covering production costs. All of this led to a rapid decline of agricultural production in Estonia and explains why the emissions from the Agricultural sector declined by 49.9% by 2015 compared with the base year (1990). In 2002–2008, the most important driving force for Estonian agriculture was the accession to the EU and the implementation of the accompanying common agricultural policy of the EU, a significant effect of which appeared a few years before joining. The positive impact on the agricultural production manifested years preceding the accession to the EU and is reflected in the turnover of a downward GHG emissions trend that began in the 1990s.

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

[3] GHG emissions related to LULUCF sector are not included.

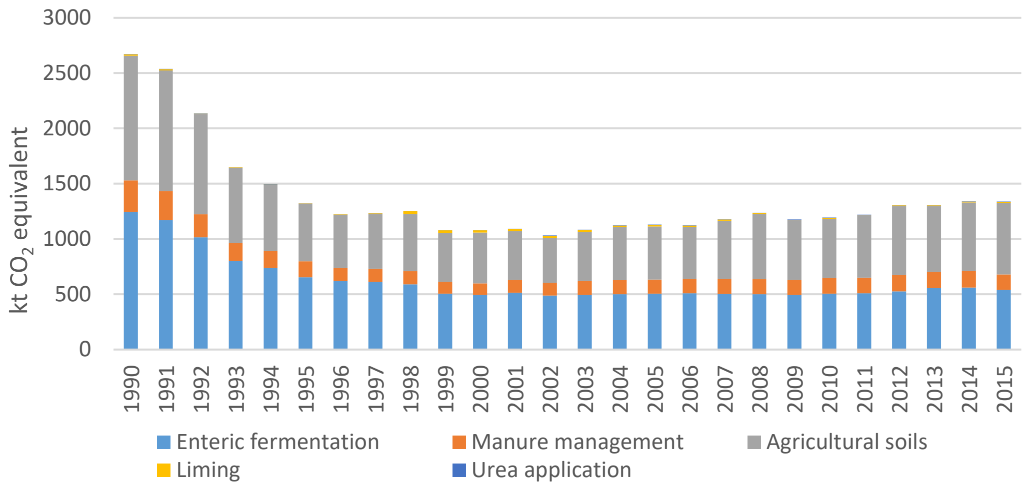

Figure 2.6. GHG emissions from agriculture sector, 1990–2015, kt CO_2 eq.

Land use, land-use change and forestry

The LULUCF sector, acting as the only possible sink of GHG 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 subcategories "land remaining" and "land converted into".

The share of LULUCF sector emissions and removals by each land use category during the period of 1990–2015 is presented in Figure 2.7. In 2015, the LULUCF sector acted as a CO_2 sink, the uptake totalling 2,359.2 kt CO_2 eq.. Compared to the base year (1990), the uptake of CO_2 in LULUCF sector has increased by 36% and compared to the previous year (2014), 34.4%. The main driver behind the LULUCF sector sink is harvest rates, expanding settlements area, Harvested wood products and emissions from organic soils. 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 originates from the biomass increment in forest land remaining forest land and land converted into forest land subcategories. In 2015, forest land and HWP were the only net sink categories.

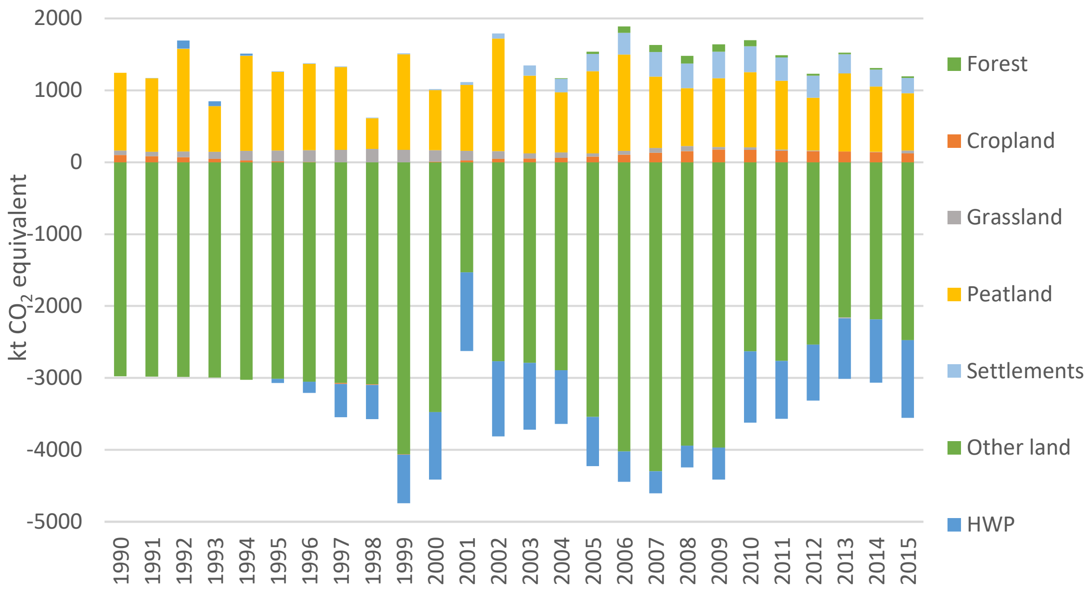

Figure 2.7. GHG emissions and removals from land use, land-use change and forestry sector, 1990–2015, kt CO_2 eq.

Waste

Estonia's GHG emissions from the Waste sector covers solid waste disposal sites which include solid municipal and industrial waste as well as domestic and industrial sludge. The Waste sector also covers GHG emissions which include both CH_4 and N_2O emissions from biogas burnt in flare waste incineration without energy recovery and open burning of waste, biological treatment of solid waste and wastewater treatment and discharge from the domestic and industrial sector. CO_2 emission is reported from non-biogenic incineration without energy recovery. The share of emissions by each category is presented in Figure 2.8.

Compared to the base year of 1990, the amount of CO_2 eq. emission in 2015 is 11.8% lower; compared to 2014, the CO_2 eq. decreased by about 4.2%. The total emission from the Waste sector has been in a decreasing trend in recent years.

In 2015, the Waste sector contributed 1.8% of all GHG emissions, totalling 326.1 kt CO_2 eq. Solid waste disposal is the highest contributor to total emissions in the waste sector in Estonia and is, compared to the base year of 1990, in a decreasing trend with 12.4%. CO_2 eq. Emissions from Incineration and open burning of waste has decreased by about 58.2%. Wastewater treatment and discharge emissions have decreased by 41.1%. On the other hand, emission from Biological treatment of solid waste has increased twice – 113.8%. Burning biogas in a flare has been taking place since 1999 and is connected to the number of active plants. The increase of burning biogas in a flare since 1999 is 1.5%.

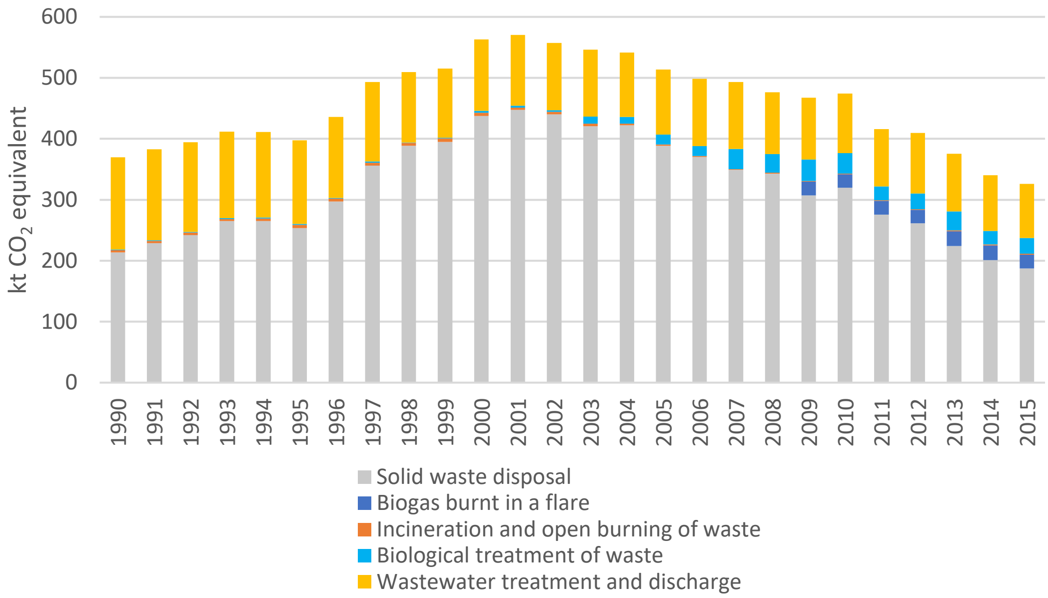

Figure 2.8. GHG emissions from the waste sector, 1990–2015, kt CO_2 eq.

Reporting under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol

Estonia reports activities under paragraph 3 of Article 3 and Forest management under paragraph 4 of Article 3 of the Kyoto Protocol. Estonia has chosen to account for KP-LULUCF activities at the end of the commitment period.

Under paragraph 3 of Article 3 of the Kyoto Protocol (KP), Estonia reports emissions and removals from afforestation (A), reforestation (R) and deforestation (D). Under paragraph 4 of Article 3, Forest management (FM) is reported.

Afforestation and reforestation activities incl. emissions from biomass burning were estimated to be –177.8 kt CO_2 eq., whereas Deforestation resulted in a net emission of 184.6 kt CO_2 eq. Areas subject to AR and D were 59,382 ha and 19,589 ha, respectively, by the end of 2015. Annual rates of afforestation and deforestation have declined continuously from 1.78 kha to 0.04 kha per year for AR and from 1.81 kha to 0.19 kha per year for D during the period of 2008–2015. In 2015, FM contributed to the total GHG balance with an uptake of –2,438.3 kt CO_2 eq. and with HWP –3,518.5 kt CO_2 eq. Total area of FM was 2,361 kha.

2.2 Greenhouse gas inventory system, under Article 5, paragraph 1, of the Kyoto Protocol

2.2.1 Institutional arrangements

The Ministry of the Environment (MoE) is the national entity with overall responsibility for organizing and coordinating the compilation of GHG inventory reports and submitting them to the UNFCCC Secretariat and the European Commission. The inventory is produced in collaboration between the MoE, Estonian Environmental Research Centre (EERC) and Estonian Environment Agency (ESTEA).

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The MoE is responsible for:

- coordinating the inventory preparation process as a whole;
- approving the inventory before official submission to the UNFCCC;
- reporting the GHG inventory to the UNFCCC, incl. the National Inventory Report and CRF tables;
- entering into formal agreements with inventory compilers;
- coordinating cooperation between the inventory compilers and the UNFCCC Secretariat;
- 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
- coordinating the UNFCCC inventory reviews and communication with the expert review team, incl. responses to the review findings.

The EERC is responsible for preparing the estimates for the Energy, Industrial processes and product use, Agriculture and Waste sectors. The Data Management Department of the ESTEA 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.

The EERC, as the inventory coordinator, was responsible for:

- compiling the National Inventory Report according to the parts submitted by the inventory compilers;
- coordinating the implementation of the QA/QC plan;
- coordinating the inventory process; and
- the overall archiving system.

The three core institutions: MoE, EERC and ESTEA work together to fulfil the requirements for the national system. The overview of the allocation of responsibilities is shown in Figure 2.9.

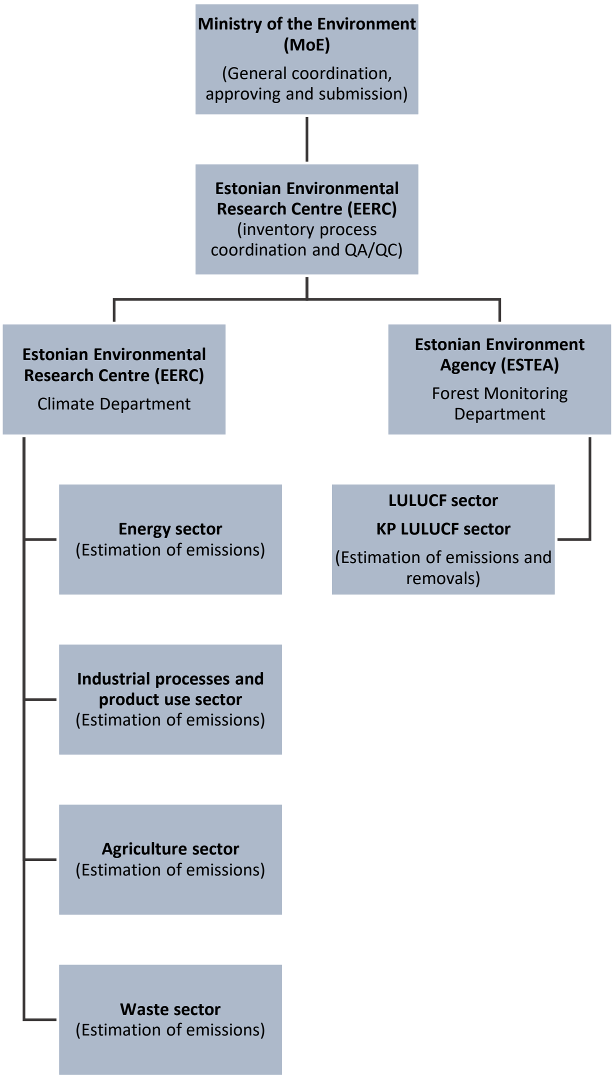

Figure 2.9. Overview of institutional arrangements for compilation of Estonia's 2017 GHG inventory

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 MoE. The basis of the requirements for the restriction of GHG emissions' limit values are provided by the UNFCCC, the Kyoto Protocol and the European Union legislation.

In accordance with §6 of the Statutes of the MoE (RT I 2009, 63, 412), the MoE is responsible for climate change related tasks and according to §23 section 8, the Climate and Radiation Department task is to organize, develop and implement climate change mitigation and adaptation policies. In accordance with the Statutes of the Climate and Radiation 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.

The ESTEA 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 5 of the Statute of the ESTEA, the tasks of the Data Management Department are to collect, process, analyse and publicise sectoral data, comply national and international reporting obligations.

The EERC is a joint stock company, all of the shares in which are held by the Republic of Estonia. The EERC belongs to the government area of the MoE. It compiles the GHG inventory on the basis of contract agreements with the MoE.

A three-year contract agreement (for the 2011, 2012 and 2013 submissions) was entered into with the EERC for inventory compilation in the Industrial processes, Solvent and other product use and Waste sectors. A one-year contract agreement (for the 2013 submission) was entered into with the EERC for inventory preparation in the Energy and Agriculture sectors and for inventory coordination.

A new contract agreement with the EERC for inventory compilation in the Energy, Industrial processes and product use, Agriculture and Waste sectors and for inventory coordination was entered into in 2013 for three years (for the 2014, 2015 and 2016 submissions). Again, a new contract agreement with the EERC for inventory compilation in the Energy, Industrial processes and product use, Agriculture and Waste sectors and for inventory coordination was entered into in 2016 for three years (for the 2017, 2018 and 2019 submissions). The MoE plans to use the three-year contract approach in the coming years to ensure the continuity of inventory preparation.

The Statistics Estonia collects statistical data on the basis of the Official Statistics Act § 3(2), taking into consideration the official statistical surveys approved by the Government of the Republic.

2.2.2 Inventory process

The UNFCCC, the Kyoto Protocol and the European Union (EU) GHG monitoring mechanism require 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.

Under the EU monitoring mechanism 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. The next step is development of the QA/QC plan and implementing the appropriate quality control measures (e.g. routine checks and 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 MoE as the national entity has overall responsibility for the GHG inventory in Estonia, incl. responsibility for assuring that the appropriate QA/QC procedures are implemented annually. The EERC as the inventory coordinator is responsible for coordinating the implementation of the QA/QC plan.

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

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

QC procedures

The QC procedures used in Estonia's GHG inventory comply 2006 IPCC GL. General inventory QC checks include routine checks on 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 QC checklist forms part of Estonia's QA/QC plan.

EERC checks the QC checklists completed by EERC and ESTEA. If it disagrees with a report, the errors are discussed and changes are made, where necessary. In addition to the general inventory QC procedures, Estonia applied category-specific QC procedures on some source/sink categories in the 2017 submission, focusing on key categories and on those categories in which significant methodological changes and/or data revisions occurred.

After the sectoral experts have completed entering data to the CRF Reporter, EERC carries out some general (incl. 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 checks 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 inventory to the UNFCCC.

When the draft NIR is completed it is sent to the MoE. The Climate and Radiation Department looks over the inventory report and makes sure that the submitted data is officially valid. Also the structure of the report is assessed based on the established requirements. When there are no contradictions the report is introduced for coordination to the Forestry, Waste and Water Department and Deputy Secretary General on International Co-operation and afterwards to the Secretary General.

QA 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 2013–2016 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 2017 submission was checked by experts from TUT, EULS 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.

UNFCCC reviews are part of QA. The reviews are performed by a team of experts 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 on 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 improvement.

The draft NIR is uploaded to the MoE website www.envir.ee where all interested parties have the opportunity to comment on it. The inventory is also checked by different Ministries and institutions.

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 BR2

Estonia has not made any changes in the inventory arrangements since the second Biennial report (BR2).

3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

3.1 The European Unions and its Member States target under the Convention

Estonia signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) on 3 December 1998. The Protocol was ratified by the Estonian Parliament in September 2002. Parties adopted an amendment to the Kyoto Protocol by decision 1/CMP.8 in accordance with Articles 20 and 21 of the Kyoto Protocol held in Doha, Qatar, in December 2012. A total of 144 instruments of acceptance are required for the entry into force of the Doha amendment establishing the second commitment period (2013–2020) of the Kyoto Protocol. Doha amendment is not ratified yet. Estonia finished the national ratification process of the Doha Amendment already in 2015 and deposited the instruments of ratification on 21 December 2017 together with the EU.

The second commitment period is consistent with the EU's 2020 *climate and energy package* of legislation and reflects the package's reduction measures at EU and Member State (MS) level to gradually transform Europe into a low-carbon economy and to increase energy security. An agreement was reached on legally binding targets which, by 2020, will:

- cut GHG emissions by 20% from 1990 level;
- establish a 20% share for renewable energy in final consumption; and
- improve energy efficiency by 20%.

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 ETS and non-ETS sectors (EU, 2009[4]).

Under the revised EU ETS Directive[5] 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. here 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). The annual caps imply interim targets for emission reductions in sectors covered by the EU ETS for each year until 2020. Also the phase three covers more sectors and gases.

The Effort Sharing Decision (Decision No 406/2009/EC – ESD) 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 only refers to GHG

[4] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the GHG emission allowance trading scheme of the Community (OJ L 140, 05.06.2009, p. 63) (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:00 63:0087:en:PDF).

[5] 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.

emissions that are not included within the scope of the EU ETS (e.g. transport (except aviation), buildings, agriculture (excluding LULUCF) 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 climate and energy package ensures that the abatement potential from non-ETS 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 non-ETS sectors have to be limited at least by 11% by the end of the period of 2013–2020 compared to 2005.

For the period up to 2030, the European Council set out in its October 2014 conclusions an EU-wide binding target of an at least 40% domestic reduction in GHG emissions by 2030 compared to 1990. The non-ETS sectors will need to reduce emissions by 30% by 2030 compared to 2005, continuing the methodology and elements of the ESD, incl. a linear trajectory of annual targets (AEA) and flexibility instruments to help achieve them. For that purpose, the Commission introduced a proposal for a regulation on the 20 July 2016, which is currently under negotiation. According to the proposal, Estonia would have a target of -13% compared to 2005.

The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation[6]. The use of flexible mechanisms is possible under the EU ETS and the ESD. For the use of CER and ERU under the ETS, please refer to the European BR3.

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 quantified economy-wide emissions reduction target is provided in Table 3.1**Error! Reference source not found.** and CTF table 2.

[6] Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

Table 3.1. Description of quantified economy-wide emission reduction target

Emission reduction target: base year and target		
		Comments
Base year/ base period	1990	Legally binding target trajectories for the period 2013–2020 are enshrined in both the EU-ETS Directive (Directive 2003/87/EC and respective amendments) and the Effort Sharing Decision (Decision No 406/2009/EC). These legally binding trajectories not only result in a 20% GHG reduction in 2020 compared to 1990 but also define the EU's annual target pathway to reduce EU GHG emissions from 2013 to 2020. The Effort Sharing Decision sets annual national emission targets for all MS for the period 2013–2020 for those sectors not covered by the EU emissions trading system (ETS), expressed as percentage changes from 2005 levels. In March 2013, the Commission formally adopted the national annual limits throughout the period for each Member State. By 2020, the national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered compared with 2005 levels. The emission reduction to be achieved from the sectors covered by the EU ETS will be 21% below 2005 emission levels.
Emission reductions target (% of base year/base period)	20%	
Emission reductions target (% of 1990)	20%	
Period for reaching target	**BY-2020**	

Gases and sectors covered. GWP values.	
Gases covered	**Comments**
CO_2; CH_4; N_2O; HFCs PFCs; SF_6	As adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation (IPCC AR4)

Sectors covered	**Covered**	**Comment:**
Energy	Yes	
Transport[c]	Yes	
Industrial processes[d]	Yes	
Agriculture	Yes	
LULUCF	No	
Waste	Yes	
Other sectors		
Aviation in the scope of the EU-ETS		In principle, the EU ETS should cover CO_2 emissions of all flights arriving at, and departing from, airports in all EU Member States, Norway, Iceland and Liechtenstein and closely related territories. However, since 2012, flights to and from aerodromes from other countries have not been included in the EU ETS. This exclusion was taken in order to facilitate negotiation of a global agreement to address aviation emissions in the forum of the International Civil Aviation Organisation (ICAO).

Role of LULUCF sector		
LULUCF in base year level and target	excluded	
Contribution of LULUCF is calculated using		

Emission reduction target: base year and target	
Possible scale of contributions of market-based mechanisms	**Comment:**
Possible scale of contributions of market-based mechanisms under the convention	The 2020 Climate and Energy Package allows Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) to be used for compliance purposes, subject to a number of restrictions in terms of origin and type of project and up to an established limit. In addition, the legislation foresees the possible recognition of units from new market mechanisms. Under the EU ETS the limit does not exceed 50% of the required reduction below 2005 levels. In the sectors not covered by the ETS, annual use shall not exceed to 3% of each Member States' non-ETS GHG emissions in 2005. A limited number of Member States may use an additional 1%, from projects in LDCs or SIDS subject to conditions.
CERs	The use of these units under the ETS Directive and the Effort Sharing Decision is subject to the limits specified above which do not separate between CERs and ERUs, but include additional criteria for the use of CERs.
ERUs	The first Kyoto period ERU's were to be exchanged for EUAs by March 31, 2015 at the latest.
AAUs	Estonia is not currently trading with AAUs, as Kyoto's first commitment period is over and there is no demand for units. Few countries that joined the commitments for the second period of the Kyoto Protocol (2013-2020) have no interest trading AAUs. Estonia has about 20 million AAUs, which we can use to cover the possible deficit in the LULUCF sector.
Carry-over units	The time-period of the Convention target is from 1990–2020, no carry-over units will be used to achieve the 2020 target.
Other mechanism units under the Convention (specify)	There are general provisions in place in the EU legislation that allow for the use of such units provided that the necessary legal arrangements for the creation of such units have been put in place in the EU which is not the case at the point in time of the provision of this report.
Possible scale of contributions of other market-based mechanisms	None
Any other information	In December 2009, the European Council reiterated the conditional offer of the EU to move to a 30% reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.

3.1.1 Other emission reduction targets

Estonia finished the national ratification process of Doha amendment establishing the second commitment period (2013–2020) of the KP in the first half of 2015. The second commitment period is consistent with the 2009 'climate and energy pack-age' of legislation and reflects the package's reduction measures at EU and Member State level to gradually transform Europe into a low-carbon economy and to increase energy security. The EU, its Member States and Iceland are implementing its targets under the Kyoto Protocol jointly, nevertheless Doha amendment has not been ratified yet.

In 2011, the European Commission published *A Roadmap for moving to a competitive low-carbon economy in 2050*. Estonia finalized its report on *Opportunities for a Low-Carbon Economy in Estonia* in 2013. In the report it was concluded, that for Estonia the 75% decrease in GHG emissions by the year 2050 (compared to 1990) would be the most optimal amount. On the basis of the report, in the beginning of 2015 the MoE started to prepare Estonian low-carbon strategy *General Principles of Climate Policy until 2050 (GPCP 2050)*, with the aim to decrease the GHG emissions 80% by 2050 compared to 1990. The roadmap was adopted by the Government on 5 April 2017. *GPCP2050* is a vision document that sets long term GHG emissions reduction target and policy guidelines for adjusting with the impact of climate change or ensuring the preparedness and resilience to react to the impact of climate change. Additional information on GPCP 2050 is provided under Chapter 4.1.4

3.2 Progress to quantified economy-wide emission reduction target

For the quantification of the progress to 2020 targets, the development of GHG emissions is the key indicator. The Convention target of a reduction of emissions by 20% from 1990 to 2020 only refers to the emissions of the EU-28 as a whole. GHG emissions of EU-28 are calculated as the sum of MS emissions. With this, GHG emissions of Estonia are part of EU-28 emissions with a percentage of 0.4% in the year 2015.

The development of GHG emissions is reported in CTF Table 4 for Estonia. Emissions in the sector of LULUCF are not included under the convention target, therefore they are not included in CTF Tables 4 and 4(a).

The use of flexible mechanisms takes place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets. For information on the use in the ETS please see the 3rd BR of the European Union.

Due to changes in reporting methodologies and with a view to ensuring consistency between the methodologies used for the determination of the AEAs and the annual reporting by the EU MS, in 2017 the European Commission revised all Member States' AEAs for the years 2017 to 2020 (Decision (EU) 2017/1471). This resulted in a decrease of AEAs for Estonia for these years. Regardless, Estonia is expected to fulfil its 2020 target with surplus.

The compliance assessment for the 2013 and 2014 ESD emissions took place from 2016 to 2017 with two transfers of AEAs between the Member States. Estonia has not used its surplus ESD units so far. This is why no quantitative information can be given for the use of flexible mechanisms in BR3 in CTF Table 4b.

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

4.1 Mitigation actions and their effects

4.1.1 Joint Implementation and International Emission Trading

Estonia has used two of the three Kyoto flexible mechanisms – Article 6 Joint Implementation (JI) and Article 17 International Emissions Trading (IET). The Clean Development Mechanism set out in Article 12 of the KP is not used, as Estonia is not a developing country.

According to the National GHG Inventories, Estonia's emissions decreased significantly between 1990 and 1993 due to the restructuration of the economy after the collapse of the Soviet Union. Since then, annual emissions have remained approximately 50% below the 1990 level. This is a clear indication that Estonia does not have problems meeting its Kyoto target. As a consequence, Estonia is acting as a seller within both of the used mechanisms and was able to participate in JI projects under the KP.

JI and the Kyoto flexible mechanism, and their relation to the EU Trading Scheme and the national registry are regulated by the *Atmospheric Air Protection Act*.

Joint implementation

During the JI commitment period 2008-2012 there were altogether 12 JI projects (incl. the seven early mover projects) implemented in Estonia which all have been registered in UNFCCC as Track 1 projects. During the commitment period Emission Reduction Units (ERUs, each equal to 1 tonne of CO_2 eq.) were transferred to investor countries for the generated emission reductions.

By 31 December 2012, the 12 JI projects, incl. 2 district heating projects and 7 wind power projects among others, resulted in a total emission reduction of around 1.34 Mt CO_2 eq.

International Emissions Trading

A complete restructuration of the economy after the Soviet Union together with the implementation of energy efficiency measures, increase in the use of renewable energy and modern technologies, a significant emission reduction (about 50%) of GHGs has taken place since 1990. Therefore Estonia had a surplus of Assigned Amount Units (AAU), which could be used for trading under the Article 17 of the KP.

All revenue from sales of surplus AAUs was invested in environmentally friendly projects and programmes via the Green Investment Scheme (GIS). An inter-ministerial working group was formed with the aim to coordinate the preparation of the legal framework and to prepare projects and programs for the use of the revenues.

The GIS provides that the money received must be directed to environmentally friendly projects aimed at reducing CO_2 and other GHG emissions. The main projects and programmes invested via the GIS are the following:

- energy efficiency (incl. thermal refurbishment) of buildings and district heating sector;

- efficient and environmentally benign transport (e.g. electromobility programme);
- development of wind energy farms;
- use of renewable energy (e.g. wind parks);

Since 2010 Estonia has concluded 21 SPAs with Austria, Spain, Luxembourg and Japan. By 2013 Estonia sold AAUs worth of more than 388 MEUR.

4.1.2 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.

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).
- 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. The amount of free allowances is reduced and decreases by 1.74% every year.
- 300 million allowances has 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 and one aircraft operator in the EU ETS.

Articles 10a and 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.

4.1.3 Effort Sharing Decision

The Effort Sharing Decision (Decision No 406/2009/EC – ESD) establishes GHG emission limits for Member States to be achieved by 2020 through binding annual targets between 2013 and 2020 (Annual Emission Allocations – AEA). The ESD only refers to GHG emissions that are not included within the scope of the EU ETS (e.g. transport (except aviation), buildings, agriculture (excluding LULUCF) and waste). According to the ESD, each Member State 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 climate and energy package ensures that the abatement potential from non-ETS 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 non-ETS sectors have to be limited at least by 11% by the end of the period of 2013–2020 compared to 2005.

The European Commission revised all Member States' AEAs for the years 2017 to 2020 (Decision (EU) 2017/1471) due to changes in reporting methodologies and with a view to ensuring consistency between the methodologies used for the determination of the AEAs and the annual reporting by the EU Member States. This resulted in a decrease of AEAs for Estonia for these years. Regardless, Estonia is expected to fulfil its 2020 target with surplus. As seen in Figure 4.1, the projected GHG emissions (described in Chapter 5) in non-ETS sectors until 2020 are expected to stay below the AEA levels in total for the period 2013-2020.

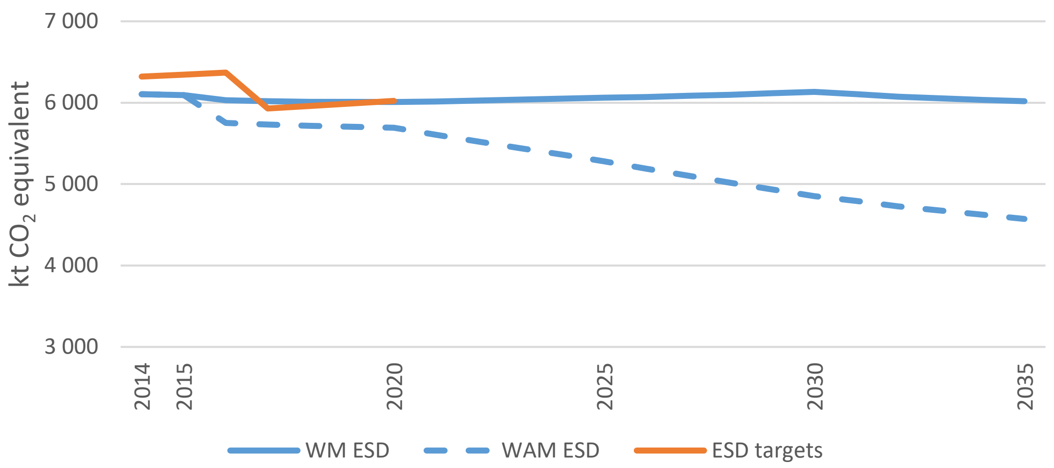

Figure 4.1. Non-ETS projections in WM and WAM scenarios compared to the ESD target, kt CO_2 eq.

For the period up to 2030, the European Council set out in its October 2014 conclusions an EU-wide binding target of an at least 40% domestic reduction in GHG emissions by 2030 compared to 1990. The non-ETS sectors will need to reduce emissions by 30% by 2030 compared to 2005, continuing the methodology and elements of the ESD, incl. a linear trajectory of annual targets (AEA) and flexibility instruments to help achieve them. For that purpose, the Commission introduced a proposal for a regulation on the 20 July 2016, which is currently under negotiation. According to the proposal, Estonia would have a target of -13% compared to 2005.

4.1.4 Cross-cutting measures

Estonia does not have an integrated system how to monitor GHG mitigation PaMs progress. Estonian Ministries are responsible for the monitoring of the sectoral policies and measures that fall under their area of administration. Ministries do annually their own development plans with goals and measures that they monitor.
In accordance with §117 of the Ambient Air Protection Act, activities for the reduction of climate change are organised by the MoE on the basis of the requirements for the restriction of the limit values of emissions of GHGs provided by the UNFCCC and the Kyoto Protocol to the UNFCCC. MoE keeps a record of the reports submitted to the UNFCCC and evaluates the progress towards the emission reduction targets.

National programmes

The *National Reform Programme 'Estonia 2020'* (approved by the Government in 2011, updated in April 2017) established two major priorities of the Government in moving towards an environmentally sustainable economy and energy sector:

- implementing long-term structural changes in the energy sector in accordance with Estonia's energy security and energy efficiency objectives;
- reducing general resource and energy intensity of the economy.

In the Programme, the Government has set an ambitious goal for making final energy consumption more efficient in Estonia – to keep final energy consumption in 2020 at the same level as 2010. The relevant values are presented on Table 4.1.

Table 4.1 Final consumption of energy, PJ

Actual		Target
2010	2015	2020
118	116	118

Regarding GHG emissions, the *National Reform Programme 'Estonia 2020'* provides that according to EU goals, Estonia's emissions from non-ETS sectors should not increase by more than 11% by 2020 compared to the 2005 level.

The level of GHG emissions is related to the plans set in the *Programme for the wider utilization of renewable energy sources* (RES) developing relevant solutions in all sectors (see Table 4.2)

Table 4.2 Share of renewable resources in final energy consumption, %

Actual		Target
2009	2015	2020
19.5	28.6	25

The total target is in accordance with Directive 2009/28/EC – Estonia must ensure that the share of energy from renewable sources amounts to 25% of the gross final consumption of energy by 2020. The same directive also provides that each Member State shall adopt a *National Renewable Energy Action Plan*. In Estonia, the *National Renewable Energy Action Plan up to 2020* (*NREAP)* was approved by the Government in November 2010 (Order No 452, 26.11.2010). The national goals for Estonia in the EU 20-20-20 package require a 25% share of energy from renewable sources in gross final energy consumption by 2020 and allow for an 11% increase in GHG emissions outside the emissions trading directive scope by 2020, compared to the 2005 level. The 10% share of renewable energy sources in road transport fuels by 2020 is an EU-wide goal. The *NREAP* presents estimations and planned policies and measures to achieve the national targets. As the share of renewable resources in final energy consumption was already 28.6% on 2015, it means that Estonia has already reached its 2020 target and the share of renewable energy only has to be held on the same level.

An improvement in energy efficiency can be considered a goal of increasing priority for the Government. A *National Energy Efficiency Programme for 2007-2013* was prepared, through which investments have been made in energy efficiency, relevant information has been made more widely available and consumers have been informed about ways of conserving energy. The Programme is one of the documents prepared for the implementation of the *National Long-term Development Plan for the Fuel and Energy Sector Until 2015*, which was approved by the Government of the Republic in December 2004. It took into account the task of achieving the indicative energy conservation objective set by Directive 2006/32/EC, i.e. a saving of 9% of final energy consumption during the period 2008-2016.

In September 2011, the MoEAC presented a mid-term overview of the implementation of the *Energy Efficiency Plan 2007-2013* and the further implementation plan that was presented to the EC as the *Second Energy Efficiency Action Plan of Estonia* (*NEEAP2*). Since then two new *NEEAP*s have been compiled, of which the latest was presented to the EC in May 2017, which presents a forecast of the final energy consumption in Estonia by 2020 (see Table 4.3)

Table 4.3 Final consumption of energy by sector, PJ

Sector	2020 (forecast)
Industry and agriculture	27.4
Transport	38.4
Households	39.5
Services	13.8
Total	119.1

In Estonia, oil shale is the main domestic fuel, therefore to ensure the long-term balanced use of it, the *National Development Plan for the Use of Oil Shale 2016-2030* was prepared to specify the plans for use of oil shale as a nationally strategic indigenous energy resource. These plans include an assessment of the use of shale fuel oil and oil shale gas taking into account economic, social, security and environmental issues. The Plan was endorsed by the Parliament in March 2016.

The objective of the preparation and implementation of the *Estonian Rural Development Plan* (ERDP) for 2014–2020 is to support Estonian rural development in a manner that is complementary to other measures of the European Union Common Agricultural Policy (for example, direct supports and market organisation measures), cohesion policy and the European Common Fisheries Policy. The main environmental issues covered are improving the sustainable management of natural resources and improving climate action.

GPCP2050 is a vision document that sets a long term GHG emissions reduction target and policy guidelines for adapting to the impact of climate change or ensuring the preparedness and resilience to react to the impact of climate change.

Principles and guidelines in the document have to be taken into account when renewing and implementing the cross-sectoral and sectoral strategies and national development plans. Estonia will be transformed into an attractive environment 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 *GPCP2050* include:

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

The Estonian National Strategy on Sustainable Development – Sustainable Estonia 21 is the key overarching national strategy document aimed at developing the Estonian state and society up to 2030 ensuring that Estonia's policies meet sustainability criteria through integrating economic factors with principles of sustainable development. The strategy was compiled under the coordination of the MoE in close cooperation with experts and stakeholders from various institutions, and its approval was preceded by thorough public discussion. The strategy document was approved by the Parliament in 2005. Among the four main goals of the strategy there is one that requires the ecological balance to be sustained in all planned activities. The sub-goals that aim to achieve ecological balance are the following:

- the use of natural resources in a way and in amounts that ensure that ecological balance is maintained;
- reduction of pollution;
- preservation of biological diversity and natural areas.

The national strategy is based on the *Sustainable Development Act*, adopted by the Parliament in 1995, which establishes, first and foremost, principles for the sustainable use of the natural environment and natural resources. No separate plan has been compiled to implement the *National Strategy on Sustainable Development*. The strategy is being implemented through different sectoral strategies and development plans. More concrete long-term environmental development objectives are formulated in the *National Environmental Strategy until 2030* endorsed by the Parliament in 2007. The aim of the Estonian *Environmental Strategy 2030* is to specify long-term development trends to keep the good standing of the environment while taking into account relation of the field with economic- and social issues and their effect on the natural environment and people. Since the strategy is long-term, it is possible to take into consideration the cause and effect relationships set in the strategy document when renewing development plans of other relevant fields.

The *Action Plan for 2016 – 2019* of the Government, has set the following goals for 2019:

- the re-use amount of the total mass of municipal solid waste (MSW) is 48%;
- felling of timber does not exceed the yearly regrowth of wood;
- the share of renewables in final energy consumption is 27% (17% in final consumption of electricity and 53% in heat generation in district heating systems).

The *Climate Change Adaptation Development Plan until 2030 (CCADP 2030)* (adopted by the Government on 2 March 2017) was prepared in co-operation between the MoE, EERC and other institutions with the support from the European Economic Association Financial Mechanism. The main objective of the Development Plan is to increase the readiness and capacity of the state, the regional and local level to adapt to the effects of climate change.

The implementation plan of CCADP 2030 includes several research and adaptation actions for the period of 2017-2020. One of those research projects aims to describe the cross-sectoral spillover effect of international climate change mitigation and adaptation policy on Estonia, assessing the scope and probability of related climate change risks and opportunities.

The MoE, together with other relevant ministries, has commissioned a study with a view to mapping out the most cost-efficient and socioeconomically favourable measures to meet Estonia’s GHG reduction target in the non-ETS sectors by 2030. The resulting data, incl. estimated socioeconomic effects of proposed measures, can serve as a basis for the review of strategic plans and carving out policies in the non-ETS sectors such as agriculture and transport among others.

European Union Structural Assistance to Estonia

To administer environment-related financial support measures, the Environmental Fund was established in 1993. In 2000 the Fund was reorganized as the Environmental Investments Centre (EIC). The main goals of the EIC are to channel the proceeds from the exploitation of the environment into environmental projects; to act as the implementing agency for the environmental projects funded by the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund (CF); and to lend money for the implementation of environmental projects. Since 2010 the EIC has also acted as the implementing agency for the GIS, i.e. selling the surplus AAUs and supervising the relevant investments.

In the period of 2007–2013 Estonia was allocated more than 3.40 billion Euros from the structural assistance, out of which the EIC mediated 728.6 million euros to the environment sector. In 2011, the EIC distributed foreign aid (ERDF and CF and other smaller EU grant funds), incl. co-financing, to a total value of 149.0 million euros, which was twice as much as in 2010, when foreign aid and co-financing amounted to 74.0 million euros. From 2012 to 2016 EIC has distributed funds in the amount of 505.0 million euros incl. 5,091 different projects, incl., among others, 2,287 environmental education, 718 environmental projection, 504 water, 386 waste and 232 energy sector projects. For the programming period of 2014–2020, the EU support to Estonia via Partnership Agreement conforms 4.4 billion euros, out of which 3.53 billion euros are Cohesion Policy funds, 725 million euros EAFRD (European Agricultural Fund for Rural Development) and about 101 million euros is EMFF (The European Maritime and Fisheries Fund).

Fiscal measures

Fiscal measures with an impact on GHG emissions in Estonia include excise duties and pollution charges.

Excise duties

Excise duties are one of the fiscal measures in Estonia with an impact on GHG emissions. As a Member State, Estonia must comply with EU requirements (Directive 2003/96/EC) for the taxation of fuels and energy. Nevertheless, Estonia has been granted a transitional period for the introduction of relevant taxes.

Regarding oil shale, Directive 2004/74/EC stipulates that until 1 January 2013 Estonia is allowed to apply a reduced level of taxation for oil shale, provided that it does not result in taxation falling below 50% of the relevant Community minimum rate as of 1 January 2011. Regarding shale oil (oil produced from oil shale), Estonia was eligible to apply a transitional period until 1 January 2010 to adjust the national level of taxation on shale oil used for district heating purposes to the EU minimum level of taxation. Nevertheless, Estonia had already introduced the tax on shale oil by that date.

The tax exemption for natural gas (methane) is permitted by Directive 2003/96/EC, which allows an exemption on natural gas in Member States where the share of natural gas in energy end-use was less than 15% in 2000. The exemption applies for a maximum of ten years after the directive's entry into force or until the national share of natural gas in energy end-use reaches 25%, whichever comes first. In fact, Estonia has imposed an excise duty on natural gas since 1 January 2008.

Directive 2004/74/EC allowed Estonia to apply a transitional period until 1 January 2010 to introduce output taxation on electricity. Despite this exemption, Estonia introduced an excise duty on electricity on 1 January 2008. It should be noted that some excise rates exceed the minimum level provided by Directive 2003/96/EC: for example, for light fuel oil (gas oil) the rate is 5.3 times higher, while for electricity it is 4.5 times higher (non-business use) or 8.9 times higher (business use).

The current tax rates stipulated in the *Alcohol, Tobacco, Fuel and Electricity Excise Duty Act* are presented in Table 4.4.

Table 4.4 . Excise tax on fuels and energy (as of 1st of July 2017)

Fuel/energy type	Unit	EUR/unit
Unleaded petrol	1,000 l	512
Aviation spirit	1,000 l	512
Kerosene	1,000 l	330.1
Diesel oil	1,000 l	493
Diesel oil for specific purposes	1,000 l	133
Light heating oil	t	493
Heavy fuel oil	t	559
Heavy fuel oil[7]	t	58
Shale-derived fuel oil	t	548
Shale-derived fuel oil[8]	t	57
LPG (used as heating fuel)	t	55.15
LPG (used as motor fuel)	t	193
Natural gas (used as heating fuel)	1,000 m^3	40.52
Natural gas (used as motor fuel)	1,000 m^3	47.32
Natural gas (liquefied, motor fuel)	t	66
Solid fuels (coal, brown coal, coke, oil shale; heat production	GJ (GCV)	0.93
Electricity	MWh	4.47

Pollution charges

The Government's tax policy is based on objectives aimed at reducing environmental impact by increasing the rates of charges on pollution and resource use. According to

[7] Heavy fuel oil, which density is >900 kg/m^3 at 15 °C, viscosity is >5 mm^2/s at 40 °C, contains >0.5% sulphur.

[8] Shale-derived fuel oil, which density is >900 kg/m^3 at 15 °C, viscosity is >5 mm^2/s at 40 °C, contains >0.5% sulphur.

the *Environmental Charges Act* (enforced in 2006), pollution charges and charges on the use of natural resources will be gradually increased in subsequent years. The sums derived from environmental charges go to the state budget and are mainly directed to environmental protection projects through the Environmental Investment Centre.

In Estonia, a pollution charge for releasing carbon dioxide into the ambient air was introduced in 2000. Currently, the *Environmental Charges Act* obliges the owners of combustion equipment to pay pollution charges for several pollutants emitted into the air. The pollution charge in the case of emissions into ambient air must be paid by all enterprises that are required to have an air pollution permit. According to the regulation of the Minister of the Environment the air pollution permit is obligatory for all enterprises which own and operate combustion equipment (utilizing solid, liquid or gas fuel) with a rated capacity equal to or higher than 1 MW in one location. As an exception, the CO_2 charge must only be paid by enterprises producing heat. Since 2009 the rate of the CO_2 charge has been 2 EUR/t.. Installations that emit nitrous oxide into the ambient air also pay a pollution charge. Methane and fluorinated gases (HFC, PFC and SF_6) are not subject to pollution charges.

As an exception, the *Environmental Charges Act* provides the option of replacing the pollution charge (incl. the CO_2 charge) with environmental investment by enterprises. The financing replaces the pollution charge if the polluter implements, at its own expense, environmental protection measures that reduce pollutants or waste by 15% from their initial value.

Environmental Charges Framework 2016+ includes the description of environmental targets and the analysis of alternatives to achieve the objectives set with the updated *Environmental Charges Act.*

4.1.5 Energy sector

Electricity supply

General development plans

Regarding the energy sector, Estonia's second *National Long-term Development Plan for the Fuel and Energy Sector until 2015* (approved by the Parliament in 2004) was replaced in 2009 with the *National Development Plan of the Energy Sector until 2020*.

The *National Development Plan for Energy Sector until 2020* was passed by the Parliament in June 2009. The plan defines the mission of Estonia's energy sector: to ensure a steady, efficient, environmentally benign energy supply with reasonable prices, whilst ensuring the sustainable use of energy. In the plan, three groups of major goals are set, all accompanied by relevant sets of specified measures:

- a continuous energy supply is ensured for the Estonian population (five measures);
- energy supply and consumption is more sustainable in Estonia (six measures);
- energy supply at a justified price has been ensured for consumers (five measures).

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 European Union. The most beneficial economic competitiveness aspects must be observed for the purposes of the implementation of *EEDP 2030+*. The new plan also drafts the benchmarks for renewable energy and energy efficiency operational programmes and the vision for the renovation of buildings.

Expected outcomes of the *EEDP 2030+* include:

- reduction of GHG emission by 70%, (Energy sector);
- renewable energy sources account 50% of final energy consumption (and 28% of domestic primary energy consumption)
- final energy consumption in 2020 and 2030 at the same level as in 2010 (in accordance with the programme *Estonia 2020*)
- primary energy supply: 57.7 TWh.

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

Regarding pollution, the most important part of the energy sector is the combustion of oil shale, as the majority of emissions are discharged by the oil shale-based power industry. Introduction of new combustion technology has enabled a reduction in emissions from oil shale-firing power plants, which produce more than 80% of electricity in Estonia. At the same time, the wider use of renewable energy sources in electricity production enables GHG emissions from the power sector to be significantly reduced.

Electricity supply

The major national-level document aimed at the electricity sector is the *National Development Plan for Electricity Sector until 2018* approved by the Government in February 2009. The plan foresees a significant decrease in electricity production from oil shale and an increase in proportion of other sources of energy.

The plan emphasizes 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 (up to 900 MW), compared to when the development plant came into effect, together with the required capacity reserves.

The plan stipulated the construction of a second submarine cable (EstLink 2) to Finland. The construction of EstLink 2 was finished in the beginning of 2014 and increased Estonia's transfer capacity with Finland from 350 MW to 1000 MW. Due to increased transfer capacity and affordable electricity generated in Nordic countries, for example in 2015, Estonia was able to import 5277 GWh electricity from Finland.

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, the target is set to keep the domestic final consumption of electricity at 2007 level or lower (7,180 GWh in 2007). The main precondition is that total electricity must be covered by domestic generation.

All scenarios include the following common elements for generation:

- the currently used oil shale-based units with fluidized bed boilers are still in operation;

- at least 200 MW of cogeneration units firing various fuels;
- some old units of oil shale pulverized combustion with desulphurization equipment.

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

The measures of electricity supply sector used in WM emission calculations are based on known investments. The measures are the following (additional information presented in Table 4.9):

1) **Improvement of the efficiency of the use of oil shale** – Two oil shale pulverized combustion units were replaced in Narva Power Plants in 2004 with fluidized bed block combustion units (both with capacity of 215 MW). The cost of investment was 245 MEUR.
2) **Improvement of the efficiency of the use of oil shale** – In 2011, the construction of one more fluidized bed block combustion unit started (with capacity of 300 MW) – Auvere oil shale power plant. The cost of investment was about 640 MEUR. The plant started working in 2015. The new plant has been designed in a way that it enables to use biomass as 50% of the fuel input.
3) **Support for renewable and efficient CHP based electricity production** – The support rates are presented in Table 4.5.
4) **Investments through Green Investment Scheme for construction of wind parks** – The transaction was made in 2010. It included 3 projects with the cost of 23 MEUR.

Table 4.5. Support for renewable and efficient CHP based electricity production

Level of subsidy	Conditions for receiving the subsidy
	Subsidies are paid for electricity that is produced:
0.0537 €/kWh	From renewable energy sources which do not exceed 100 MW
0.0537 €/kWh	From biomass in CHP mode. From 31.12.2010, producers who have started generating electricity from biomass can only get the subsidy for electricity generated in efficient CHP mode
0.032 €/kWh	In efficient CHP mode from waste as defined in the Waste Act, peat or oil shale retort gas
0.032 €/kWh	In efficient CHP mode using generating equipment with a capacity of not more than 10 MW

All policies and measures regarding electricity generation along with their effect on GHG emissions are also presented in Table 4.6.

Table 4.6. Policies and measures on the electricity supply

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2]			
	2020	2025	2030	2035
Support for renewable and efficient CHP based electricity production*	1,309.9	1,554.5	1,570.6	1,730.0
Investments through GIS for construction of wind parks*	66.0	66.0	66.0	66.0
Replacement of oil shale production units (2x215 MW)*	366.3	368.6	0.0	0.0
Replacement of oil shale production unit (300 MW)*	515.1	428.3	155.6	108.5

[1]All policies and measures marked with an asterix (*) are included in the WM scenario. [2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.

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

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

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

1) **Renovation of boilerhouses** – This measure includes fuel switch from oil fuels to renewable and/or local energy sources like biomass, peat, etc. The expected cost is projected to be about 37.5 MEUR annually.
2) **Renovation of heat networks** – The aim of this measure is to reduce the losses in district heating networks. The expected cost is projected to be about 3.8 MEUR annually.
3) **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 expected cost is projected to be about 1 MEUR annually.
4) **Investments through Green Investment Scheme for reconstruction of boilerhouses and heat networks.**
5) **Investments through the European Regional Development Fund for reconstruction of boilerhouses and heat networks** – Total of 21 projects were financed with the total cost of 8.7 MEUR.

All policies and measures regarding heat supply along with their effect on GHG emissions are presented in Table 4.7, which also contains measures that are in a planned state and not yet implemented. These measures show an estimated GHG mitigation impact, should additional funding appear for the renovation of boiler houses and heat networks as well as transitioning consumers to local and place heating.

Table 4.7. Policies and measures on the heat supply

Name of policy or measure[1]	**Total GHG estimate of mitigation impact, kt CO_2 eq.**[2]			
	2020	**2025**	**2030**	**2035**
Renovation of boilerhouses*	65.2	76.4	140.6	224.4
Renovation of heat networks*	48.2	56.6	104.2	205.4
Transition of consumers to local and place heating*	19.7	23.3	42.9	54.7
Investments through Green Investment Scheme for reconstruction of boilerhouses and heat networks*	96.5	96.5	96.5	96.5
Investments through the European Regional Developent Fund for reconstruction of boilerhouses and heat networks*	60.0	60.0	60.0	60.0
Additional renovation of boilerhouses	61.9	73.0	134.1	212.9
Additional renovation of heat networks	168.9	198.1	365.0	440.6
Additional transition of consumers to local and place heating	45.4	53.2	98.1	137.6

[1]All policies and measures marked with an asterix (*) are included in the WM scenario
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.

Manufacturing industries and construction

The *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. In 2017, a study is planned to be conducted to open investment to other sectors of manufacturing industries. According to the Energy Sector Organization Act, large companies are mandated to have regular energy audits.

Other sectors (Commercial/institutional and residential sectors)

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

1) **Reconstruction of public and commercial buildings** – reconstruction of 10% of the existing buildings in the 20 year period to at least energy efficiency class D.
2) **Reconstruction of private houses and apartment buildings** – reconstruction of 10% of existing private houses to at least energy efficiency class E and 15% of

existing apartment buildings in the 20 year period to at least energy efficiency class E. The expected cost of the measure is about 3.5 MEUR annually.

3) **Implementation of the minimum requirements for nearly zero energy buildings** – The requirements will be implemented as required by the Energy Efficiency Directive and in the regulation of the Minister of Economic Affairs and Infrastructure "The minimum requirements of the energy efficiency of buildings".
4) **Promotion of use of energy efficient electrical appliances in Residential sector** – The increased use of energy efficient electrical appliances in households is expected to lead to annual savings of 0.5 PJ of electricity.
5) **Investments through GIS to the improvement of energy efficiency in public buildings** – Between 2010 and 2013, a total of 540 public buildings were reconstructed with a total cost of the measure is 165.6 MEUR.
6) **Investments through GIS to the improvement of energy efficiency in residential buildings** – Grants of 15% to 35% of the total cost of renovation were supported from this measure. The total cost of the measure is 28 MEUR.
7) **Investments through GIS to street lighting reconstruction programme** – According to the program, 7 Estonian cities (with population between 8,000 and 15,000 inhabitants) had their street lighting replaced with energy-efficient lighting. The total cost of the programme was 14.55 MEUR.

Investments through GIS for street lighting reconstruction program – In 2012, the Estonian Environmental Investment Centre (EEIC) launched a program to provide seven Estonian cities (with populations of 8,000–15,000) with energy-efficient street lighting. The goal of the project was to provide high-quality, efficient street lighting. By the end of the project, in autumn of 2015, 12,253 streetlights were successfully replaced. The energy saving was 5.5 GWh per year. The total cost of the program was 14.55 MEUR. In 2017, EEIC launched a next round of the program. 22 Estonian cities and administrative units will get new energy-efficient street lightning in 2020. The total cost of the programm is estimated over 15 MEUR. Investments through GIS for the programm is 9.95 MEUR in 2017.

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

1) **Additional reconstruction of public and commercial buildings** – reconstruction of 20% of the existing buildings in the 20 year period to at least energy efficiency class C.
2) **Reconstruction of private houses and apartment buildings** – reconstruction of 40% of existing private houses (energy efficiency classes C and D) and 50% of existing apartment buildings in the 20 year period to at least energy efficiency class C.
3) **Accelerated implementation of the minimum requirements for nearly zero energy buildings.**

All policies and measures regarding energy consumption in Commercial/institutional and residential sectors along with their effect on GHG emissions are also presented in Table 4.8.

Table 4.8 Energy consumption policies and measures in the Residential, Commercial and Other sectors

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2]			
	2020	2025	2030	2035
Reconstruction of public and commercial buildings*	1.1	1.7	2.3	2.6
Reconstruction of private houses and apartment buildings*	1.7	2.6	3.4	4.2
Implementation of the minimum requirements for nearly zero energy buildings*	5.4	8.1	10.8	13.2
Promotion of the use of energy efficient electrical appliances in the residential sector*	43.2	38.0	33.7	33.8
Energy efficiency improvement in public buildings*	27.8	27.8	27.8	27.8
Energy efficiency improvement in residential buildings*	28.0	28.0	28.0	28.0
Street lighting reconstruction programme*	1.4	1.2	1.1	1.1
Additional reconstruction of public and commercial buildings	3.4	5.2	7.1	8.3
Additional reconstruction of private houses and apartment buildings	37.7	56.6	75.4	92.5
Accelerated implementation of the minimum requirements for nearly zero buildings	8.1	12.1	16.2	19.9

[1]All policies and measures marked with an asterix (*) are included in the WM scenario
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.

Transport sector (excluding international aviation and marine bunkering)

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 favoured means of transport that connects Tallinn and other towns; improving the train connection with Latvia (on Tartu–Riga line, Rail Baltic) and Russia (the trip to St Petersburg should be shorter than 5 hours);
- increasing the share of more economic vehicles that run on renewable energy so that bio methane or compressed gas generated from domestic bio mass and waste would become the main alternative type of fuel in Estonia.

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

In the transport sector, the main 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. This is achieved through stipulating a mixed fuel requirement on liquid fuels and increasing the use of biogas in transport.

2) **Increasing fuel economy in transport** – Includes developing a support system for energy efficient cars, hybrid buses, hybrid trolleys, electrical buses etc. The expected cost is at least 6 MEUR annually.
3) **Promoting economical driving** – Includes promoting eco-driving and also developing light traffic systems. The expected cost of this measure is 14 MEUR annually.
4) **Reducing forced movements with personal vehicles in transport** – Includes developing telecommunication and also developing short-term rental cars systems. This measure aims to mitigate the transport load during rush hours. The expected cost is about 0.5 MEUR annually.
5) **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. The expected cost is about 16.7 MEUR annually.
6) **Development of convenient and modern public transport** – Includes improving the availability of public transport, developing ticket systems and new services. The expected cost is about 17 MEUR annually.

Following measures are still in discussion and henceforth considered in WAM scenario:

1) **Road usage fees for cars and heavy duty vehicles** – Based on mileage, location, environmental aspects, etc. The expected cost is about 62 MEUR annually. This measure is reported as planned, however in June 2017, the Parliament approved road usage fees for vehicles with a maximum mass over 3500 kg (heavy duty vehicles). Because GHG estimations are currently not available for road usage fees that are only applied to these vehicles, this measure is still reported as planned.
2) **Developing and implementing a congestion charge system in Tallinn (the capital of Estonia)** – The expected cost is about 13 MEUR annually.
3) **Developing the railroad infrastructure (includes the building of *Rail Baltic*)** – The expected cost of *Rail Baltic* is 30 MEUR annually (during the period of 40 years). This measure also includes raising the speed limit to 160 km/h in Tallinn–Narva and Tapa–Tartu directions. The expected cost is about 5 MEUR.

In addition to these planned, but not implemented policies and measures, Table 4.9 also contains additional measures, which are in a planned state and not yet implemented. These measures show an estimated GHG mitigation impact, should additional funding be available for increasing fuel economy in transport, promoting economical driving, reduction of forced movements with private vehicles, improvement of the traffic system, and development of convenient and modern public transport.

Table 4.9. Policies and measures in transport sector

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2]			
	2020	2025	2030	2035
Increasing the share of biofuels in transport*	251.8	294.3	329.6	319.6
Increase of fuel economy in transport*	40.7	69.8	98.8	98.8
Promotion of economical driving*	36.3	62.3	88.2	88.2
Reduction of forced movements with personal vehicles in transport*	15.4	26.3	37.4	37.4
Improvement of the traffic system*	39.4	67.5	95.7	95.7
Development of convenient and modern public transport*	22.1	37.9	53.6	53.6

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2]			
	2020	2025	2030	2035
Additional increase of fuel economy in transport*	16.2	45.1	75.2	83.6
Additional promotion of economical driving	23.1	64.5	107.5	119.5
Additional reduction of forced movements with private vehicles in transport	13.7	38.2	63.7	70.8
Additional improvement of the traffic system	68.3	190.6	317.8	353.3
Additional development of convenient and modern public transport	27.6	77.0	128.4	142.8
Road usage fees for cars and heavy duty vehicles	69.9	194.5	324.3	360.7
Congestion charge	17.0	47.7	79.6	88.5
Development of the railroad infrastructure	8.1	22.7	38.0	42.2

[1]All policies and measures marked with an asterix (*) are included in the WM scenario
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.

4.1.6 Industrial processes and product use

Previously in 2015 year's submission Estonia reported as an emission curbing measure the *Industrial Emissions Act* of the Estonian Parliament (entry into force 01.06.2013) that is implemented by means of duty for manufacturing industries to use best available technologies (BATs), integrated environmental permits and domestic reporting of emissions. The *Industrial Emissions Act* is implemented on the base of the *Industrial Emissions Directive* (Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions [integrated pollution prevention and control]).

The effect of the *Industrial Emissions Act* on CO_2 emissions is shown on the aggregated emissions from the industries that are belonging to EU ETS. **According to the integrated environmental permits all Estonian mineral and chemical production plants under IPPU sector already and currently comply with BATs and the future effect of this measure would be zero.**

In January 2017, Ambient Air Protection Act was repealed and amended with the Atmospheric Air Protection Act, which now entails all relevant legislation regarding F-gases, incl. Regulation (EU) No 517/2014 on fluorinated GHGs.

Therefore Estonia is reporting only one measure for IPPU sector – **bans and duties stipulated in the Regulation (EU) No 517/2014 on fluorinated GHGs and Directive 2006/40/EC related to emissions from mobile air conditioners (MACs)**.

The Regulation (EU) No 517/2014 on fluorinated GHGs (entry into force 01.01.2015) strictly imposes a schedule for phase-down of F-gases by 2030, which is implemented by means of the quota system and bans/restrictions.

The most important measures in the Regulation (EU) No 517/2014 that reduce fluorinated GHGs include:

- Bans on bringing certain new equipment to the market;
- The service ban for F-gases with GWP equal or over 2,500;
- Duty of collecting the gases from decommissioned equipment;
- Certification duties for entrepreneurs who are handling the gases.

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 conditioners. Estonia has not imposed significantly stricter requirements than in Regulation 517/2014 and in Directive 2006/40/EC. Therefore Estonia only submits WEM scenario and no additional measures for IPPU sector.

The aforementioned measures and their effect are handled as one measure (named as „bans and duties from the Regulation (EU) No 517/2014“), since it would be difficult to model the effect of each of the aforementioned measure separately. The projected effects of the measures in the IPPU sector are presented in Table 4.10.

Table 4.10. Projected effects of the measures in the IPPU sector

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2]			
	2020	2025	2030	2035
Regulation (EU) No 517/2014*	22.8	67.6	108.8	134.0

[1]All policies and measures marked with an asterix (*) are included in the WM scenario
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.

4.1.7 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 *ERDP*. Under *ERDP* the following priorities and measures, which 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:

1) The objectives of the **support for organic farming** are the following: supporting and improving the competitiveness of organic farming; increasing biological and landscape diversity and maintaining and improving soil fertility and water quality. Organic farm land constituted 15.3% of the total agricultural land in Estonia in 2012. 75% of organic farm land was grassland. Cost of measure will be approximately EUR 92.2 MEUR.

2) **Support for environmentally friendly management**. The objectives are the following: 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 the status of water and soil; to expand environmentally friendly planning in agriculture and to increase the awareness of agricultural producers of the environment. Cost of measure is expected to be around EUR 170 MEUR.

3) **To reduce GHG and ammonia emissions from agriculture it has been** stipulated in the *ERDP* to include 49.6% of the agricultural land currently in use under economizing agreements by 2020. The objectives include promoting use of biomass, producing renewable energy, investing in livestock buildings (incl. manure storage) and increasing the technological capacity of agricultural enterprises. Besides the horizontal measures Transferring of Knowledge and Information and Advisory,

Agricultural Enterprises Management and Substitute Services there are no particular measures or activities programmed to achieve these objectives. The intervention is planned to take place through supporting activities (investments in bioenergy, investments in manure storage facilities) of activity type 'Investments to improve the productivity of agricultural enterprises' under the measure 'Investments in tangibles'.

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 in as an informative item.
EEDP 2030+ describes the objectives of Estonia's energy policy until 2030 and the vision of energy management until 2050, objectives and sub goals of *EEDP 2030+* and measures of the implementation of the development plan. The production of biomethane and bioethanol would enable Estonia to reach the mandatory national target set by the EU for renewable energy shares of final energy consumption in 2020, which also includes 10% of renewables in transport sector.

Measures to reduce nitrogen leakage from agriculture

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 were agreed upon between Ministry of Rural Affairs and the MoE in 2001 and an Action programme for 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 and a Government decree on water protection requirements for fertilizer, manure and silage were introduced and both of these are relevant to Annex II and III in the Nitrates Directive. The Water Act is one of the principal legal acts that the prime measures in *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:

1) **Introduction of effective fertilization technologies.** Expected cost of measure: 7.8 MEUR.
2) **Reducing pollution caused by nutrients from agriculture** (repair manure and silage storage facilities, support the promotion of environmentally friendly fertilizer spreading technologies, support the promotion of good agricultural practice. Expected cost of measure is 0.9 MEUR.
3) **Reconstruction or construction of new livestock facilities** (incl. manure and silage storage facilities) in order to prevent the environmental risks arising from production. Expected cost of measure is 20.9 MEUR.

A summary of all Agriculture sector policies and measures are presented in Table 4.11 GHG estimates under mitigation impact are not available for all policies and measures due to lack of quantifiable activity data under each measure.

Table 4.11. Policies and measures in Agriculture sector

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2,3]			
	2020	2025	2030	2035
Organic farming*	NE	NE	NE	NE
Support for environmentally friendly management*	NE	NE	NE	NE
Reducing GHG and ammonia emissions from agricultural sector*	NE	NE	NE	NE
Introduction of effective fertilization technologies*	NE	NE	NE	NE
Reducing pollution caused by nutrients from agriculture*	NE	NE	NE	NE
Reconstruction or construction of new livestock facilities (incl. manure and silage storage facilities) in order to prevent the environmental risks arising from production*	NE	NE	NE	NE

[1]All policies and measures marked with an asterix (*) are included in the WM scenario
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.
[3]NE – not estimated: GHG estimates of mitigation impact is not available due to lack of quantifiable activity data under reported measures.

4.1.8 Land use, land-use change and forestry sector

The Forest Act 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 regeneration of forest after felling or natural disturbances. According to *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	22 PJ/yr (2009)	30 PJ/yr

Indicator	Baseline level	Target level
production		

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 mil 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 European Union 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 the 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.

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. Cost of the measure is expected to be about 5.5 MEUR in the period 2016–2020.
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. Cost of the measure is expected to be about 7.5 MEUR in the period 2016–2020.
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. Cost of the measure is expected to be about 0.4 MEUR in the period 2016–2020.
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. Cost of the measure is expected to be about 0.3 MEUR in 2016–2020.
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.** Cost of the measure is expected to be about 1 MEUR in 2016–2020.
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. Cost of the measure is expected to be about 13.8 MEUR in 2016–2020.

Measures related to Cropland management

ERDP's following measures pursue to limit and reduce GHG emissions and enhance carbon sequestration:

1) **Support for growing plants of local varieties** – 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. Cost of the measure is expected to be about 0.6 MEUR.
2) **Regional support for soil protection** – The aims of the measure are to: limit GHG emissions, limit soil erosion, reduce nutrient leaching and maintain and raise the content of soil organic matter. Cost of the measure is expected to be about 2.45 MEUR.
3) **Crop diversification (Common Agricultural Policy measure)** – The Crop diversification measure is one of the Greening measures under *CAP*. The objective of the measure is to make farms with monocultures more environmentally friendly and sustainable. Cost of the measure is expected to be about 900 MEUR.
4) **Support for the establishment of protection forest on agricultural land** – With the establishment of protected forests, the share of agricultural lands sensitive to the environment will be reduced and the need to establish protection forests on the account of commercial forests will be decreased. With the establishment of small groves forest, the biodiversity will be increased in particular areas as well. The measure supports the permanent conversion of vulnerable agricultural lands to protected forest lands.

Measures related to Grassland, Wetland and Grazing land management

Measures related to Grassland, Wetland and Grazing land management that have a GHG mititgation impact are:

1) **Support for the maintenance of semi-natural habitats** – The overall objectives of this measure are: to improve the quality of maintenance of semi-natural habitats whereas increasing the share of semi-natural habitats maintained by farm animals, to preserve and increase biological and landscape diversity; to increase the area of land under maintenance; to improve the condition of species related to semi-natural habitats. Cost of the measure is expected to be about 40 MEUR.
2) **Ensuring the favourable conservation status of habitats** – the 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 ha 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. Cost of the measure is expected to be about 2.7 MEUR in 2017.

3) **Preservation of permanent grassland** – The Preservation of permanent grassland is one of the Greening measures under *CAP*. The objective of the measure is to avoid massive conversion of grassland to arable land. The Member State is obliged to maintain the total area of permanent grassland. Estonia has to maintain the area of permanent grassland at least on the level of the year 2005.

A summary of LULUCF sector policies and measures are presented in Table 4.13. GHG estimates under mitigation impact are not available for all policies and measures due to lack of quantifiable activity data under each measure.

Table 4.13. Policies and measures in LULUCF sector

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq[2,3]			
	2020	2025	2030	2035
Increasing forest increment and ability to sequestrate carbon through timely regeneration of forests for climate change mitigation*	NE[1]	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
Improvement of forest economic and ecological vitality*	NE	NE	NE	NE
Support for growing plants of local varieties*	NE	NE	NE	NE
Regional support for soil protection*	NE	NE	NE	NE
Crop diversification measure*	NE	NE	NE	NE
Support for the maintenance of semi-natural habitats*	NE	NE	NE	NE
Ensuring the favourable conservation status of habitats*	NE	NE	NE	NE

[1]All policies and measures marked with an asterix (*) are included in the WM scenario
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.
[3]NE – not estimated: GHG estimates of mitigation impact is not available due to lack of quantifiable activity data under reported measures.

4.1.9 Waste sector

General waste related requirements and rules are stipulated under *Waste Act*, which provides waste management requirements to prevent waste generation and health and environmental hazards arising therefrom. The act also includes measures to improve the usage efficiency of natural resources and reducing the adverse impacts of such use. According to the *Waste Act*, 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 includes following measures to limit and reduce GHG emissions:

1) **Prohibition concerning percentage of biodegradable waste deposited** – 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 (NWMP) 2014–2020*. 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.
2) **Increasing reusing and recycling of waste materials** – To meet the requirements of the directive 2009/98/EC, the *Waste Act* stipulates that by 1st of January 2020, re-use 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 2014–2020*. The level of reusing and recycling of waste materials was 27% in 2011, which increased to 35% by 2014.

Establishment of waste management rules incl. adoption and updating the waste management plan is stipulated under *The Local Government Organization Act* and is the responsibility of the local government. Most of local government waste management plans also stipulate prohibition of open burning of municipal solid waste.

The National Environmental Strategy until 2030 includes following policy:

1) **Reducing 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 2014–2020*.

The objective of the *NWMP 2014–2020* is to introduce sustainable waste management that follows 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 2014-2020 has set following target levels for 2020 (Table 4.14).

Table 4.14. Target levels in *NWMP 2014–2020, %*

NWMP 2014–2020	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 2014–2020 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. Expected cost of implementing the measure is 3.73 MEUR.

2) **Recycling or reusing waste at the maximum level** – This strategic objective is set to increase recycling of municipal waste and biodegradable waste in the total amount of municipal solid waste and developing a nationwide waste collection network with intensified waste reporting system. Consistent waste reuse and recycling guidance and simple expanding system for waste handling will thereby increasing the amount of waste separately collected and decrease the amount of waste landfilled. Establishing the state-wide biodegradable waste collection and treatment network is especially important when reducing the GHG emission from solid waste disposal. Expected cost of implementing the measure is 32.46 MEUR.

3) **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. Measure is supporting the previously mentioned measures. Expected cost of implementing the measure is about 27.77 MEUR.

The summary of the policies and measures with expected mitigated GHG emissions, where available, are presented in Table 4.15. GHG mitigation estimates of mitigation impact are not available for all policies and measures due to lack of quantifiable activity data under each measure.

Table 4.15. Policies and measures in Waste sector

Name of policy or measure[1]	Total GHG estimate of mitigation impact, kt CO_2 eq.[2,3]			
	2020	2025	2030	2035
Reducing landfilling waste*	NE	NE	NE	NE
Promoting the prevention and reduction of waste generated, incl. reducing the hazard of waste*	NE	NE	NE	NE
Reducing environmental risks arising from waste, improvement of monitoring and supervision*	NE	NE	NE	NE
Increasing reusing and recycling of waste materials*	NE	NE	NE	NE
Prohibition concerning percentage of biodegradable waste deposited and Increasing reusing and recycling of waste materials*	11.9	34.6	50.6	62.2

[1]All policies and measures marked with an asterix (*) are included in the WM scenario.
[2]Effects of PaMs for the years 2020, 2025, 2030 and 2035 are not estimated by gas, only the total estimate of mitigation impact kt CO_2 equivalent is available. Mitigation impact of PaMs for the years 1990, 1995, 2000, 2005, 2010 and 2015 are not estimated and therefore not presented in table.
[3] NE – not estimated: GHG estimates of mitigation impact is not available due to lack of quantifiable activity data under reported 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 250 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 250 kt.

4.2 Information on changes in domestic institutional arrangements

Estonia has not made major changes in the domestic institutional, legal, administrative and procedural arrangements for domestic compliance, monitoring, reporting and archiving of information and evaluation of the progress towards Estonia's emission reduction obligations and targets since the previous BR2 report.

4.3 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 2015, which emission data is based on the 15 April 2017 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 2015

Sector	kt CO_2 eq		Change from base year to latest reported year (per cent)
	1990	2015	
Energy	36,397.4	15,863.9	–56.4
IPPU	965.7	512.9	–46.9
Agriculture	2,669.7	1,337.6	–49.9
Waste	369.9	326.1	–11.9
Total (excluding LULUCF, with indirect CO_2)	40,402.7	18,040.5	–55.4
LULUCF	–1,734.7	–2,359.2	36.0
Total (incl. LULUCF, with indirect CO_2)	38,668.0	15,681.3	–59.5

5. PROJECTIONS

The main objective of this chapter is to give an indication of future trends of GHG emissions in Estonia, given the policies and measures implemented and adopted within the current national climate policies. Projections are given for all GHGs considered in UNFCCC and in Kyoto Protocol, presented in the following sectors (CRF categories): Energy (incl. Transport); Industrial processes and product use (IPPU); Agriculture; Waste and Land use, land use change and forestry (LULUCF). Projections of GHG emissions have been calculated for the period from 2015–2035. 2014 has been used as a reference year and activity data for the year 2015 is in accordance with the 2017 National GHG Inventory (submitted to the European Commission on 15 March 2017).

Two projection scenarios are presented. The 'With Measures' (WM) 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 'With Additional Measures' (WAM) scenario.

The projections in current biennial report are updated, compared to the previous BR2, because pursuant to Regulation No. 525/2013 of the European Parliament and Council, EU Member States must update their GHG projections every two years. Key assumptions and differences between BR3 and BR2 GHG projections are presented in Chapter 5.1.7.

5.1 Methodology

5.1.1 Key assumptions used in the projections

The key underlying assumptions used in the projections are presented in Table 5.1. Data on the population for the period 2014–2035 was received from Statistics Estonia. Annual real GDP growth rate is in accordance with the *EEDP 2030+* estimations.

Table 5.1. Main assumptions used in the projections

Parameter used	2014	2015	2020	2025	2030	2035
Population, thousands	1,315.8	1,313.3	1,297.4	1,276.0	1,250.7	1,222.9
GDP growth, real growth rate, %		3.3	3.0	2.5	2.5	2.1
EU ETS carbon price, EUR/EUA			15.0	20.0	26.5	36.5
International (wholesale) fuel import prices: Electricity Coal, EUR/GJ			2.58	2.61	2.64	2.67
International (wholesale) fuel import prices: Natural gas, EUR/GJ			6.69	8.01	9.36	9.83
Final energy consumption: Industry, TJ	24,125	22,965	28,214	29,491	30,769	31,294
Final energy consumption: Transport WM, TJ	31,094	31,821	35,483	37,791	40,098	38,659
Final energy consumption: Transport WAM, TJ	31,094	31,821	31,267	29,897	28,528	25,216
Final energy consumption: Residential WM, TJ	37,373	36,184	43,164	43,290	43,416	43,416
Final energy consumption: Residential WAM, TJ	37,373	36,184	38,376	36,288	34,200	31,572
Final energy consumption: Agriculture/Forestry, TJ	5,459	5,596	5,362	5,655	5,949	6,074
Final energy consumption: Services WM, TJ	17,565	18,470	17,136	17,190	17,244	17,046
Final energy consumption: Services	17,565	18,470	1,656	1,633	1,609	1,580

Parameter used	2014	2015	2020	2025	2030	2035
WAM, TJ						
Final energy consumption: Other, TJ	446	367	367	367	367	367
Final energy demand for road transport WM, TJ	29,541	30,292	33,997	36,017	37,811	36,363
Final energy demand for road transport WAM, TJ	29,541	30,292	30,020	28,534	26,873	23,741
Livestock: Total cattle, thousands	265	256	270	281	292	304
Nitrogen in crop residues returned to soils, kt	24,949	29,843	29,843	29,843	29,843	29,843
Application of synthetic fertilisers, kt	56	56	57	60	61	62
Area of cultivated organic soils, 1,000 ha	24	24	24	24	24	24
Municipal solid waste (MSW) generation, kt MSW	299.4	310.9	342.8	360.6	376.2	389.3

5.1.2 Energy sector

The scenarios projecting GHG emission in the Energy sector are mostly based on the *EEDP 2030+* scenarios in which numerous studies were made. In addition, some of the scenarios were updated when compiling Estonian low-carbon strategy *General Principles of Climate Policy until 2050* (*GPCP* 2050). For electricity generation and shale oil production, the updated *EEDP 2030+* scenarios were used.

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. The projected future usage of fuel based on the model was applied while using the emission calculations of the *2006 IPCC Guidelines*. The projections of fuel consumption for electricity generation are in accordance with the Estonia's *GPCP 2050*.

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 done in the process of compiling *EEDP 2030+*. The scenarios developed in the *EEDP 2030+* were used in combination with the methodology of the *2006 IPCC Guidelines*.

The projections of the GHG emissions of shale oil production in the Manufacturing of solid fuels and other energy industries were calculated based on the scenario set out in Estonia's *GPCP 2050*. 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 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+*. Relevant data was modelled with *LEAP* (*Long Range Energy Alternatives Planning System*) to calculate the GHG emissions. The demand of energy for transport was entered into the model with a bottom-up approach. Fuel consumption data from the *EEDP 2030+* along with expert judgements as well as emission factor data from *2006 IPCC Guidelines* along with country-specific emission factors were used to estimate GHG emissions.

LEAP is an integrated, scenario-based modelling tool that can be used to track energy consumption, production and resource extraction in all sectors of the economy. It can be used to account for both energy sector and non-energy sector GHG emission sources and sinks. In addition to tracking GHGs, *LEAP* can also be used to analyse emissions of local and regional air pollutants and short-lived climate pollutants, making it well-suited to studies of the climate action co-benefits of local air pollution reduction. *LEAP* is developed by the Stockholm Environment Institute.

5.1.3 Industrial processes and product use sector

The Estonian Industry sector is relatively small and 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 and models are used only in subcategories "Product uses as substitutes for ODS" and "Urea based catalysts for motor vehicles". Otherwise, bottom-up, companies' own 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.

The Mineral industry's projected emissions are based on the projections of industries' operators, taking into account maximal planned production capacities and best available technologies according to the environmental permits of companies.

The operators of the Chemical industry have indicated that they have no plans to restore the production in the near future.

Taking into account the long-term national economic growth forecast of less than 3% and virtually no growth in population, the consumption of lubricants and paraffin waxes is projected to stay roughly at the level of the year 2014.

Indirect CO_2 emissions from solvent use are also projected to slowly decrease in view of low economic growth and no growth in population.

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

- the broadening of NO_x emission standards to light vehicles (Euro 6 standards);
- the forecast of the number of vehicles pursuant to *EEDP 2030+*;
- the average diesel fuel consumption of vehicles pursuant to the COPERT model;
- the current trend in vehicle sales (data from the Estonian Road Administration).

Emissions of fluorinated gases are projected pursuant to the 2006 IPCC Guidelines. Forthcoming bans and restrictions stipulated in the Regulation (EU) No. 517/2014 and Directive 2006/40/EC were taken into account. Companies who own or service large commercial refrigeration systems were interviewed about their intentions towards the restrictions of Regulation (EU) No. 517/2014. In addition, some importers of pre-charged air conditioning equipment and stand-alone refrigeration equipment were interviewed. Their intentions were included in calculations.

Emissions were calculated from large and small commercial refrigeration equipment, industrial refrigeration and cooling, stationary air conditioning/cooling, mobile refrigeration, mobile air conditioning by taking the following bans into account:

- Marketing bans, incl.:
  - stationary refrigeration equipment with GWP of 2,500 or more;
  - commercial refrigeration equipment (hermetic equipment with HFCs, multipack systems (40 kW or more) with HFCs, except for multilevel cascade systems partly with HFC-134a;
  - single split stationary air conditioners and heat pumps with GWP of 750 or more;
  - fire protection equipment with HFC-23 (additionally, the use of HFC-227ea containing fire protection systems is sharply decreasing);
  - the 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 (pursuant to the Directive 2006/40/EC);
- Ban of refilling equipment with HFCs with GWP of 2,500 or more;
- Diminishing amounts of HFCs placed onto the market due to a quota system.

In categories where the use of banned high-GWP HFCs was subtracted with no information about alternatives, substitutions with lower GWP HFCs were taken into account.

SF_6 emissions are not regulated by the Regulation (EU) No. 517/2014. Therefore, the emissions were calculated pursuant to the *2006 IPCC Guidelines*, taking into account plans on equipment replacement by the electrical network operators.

N_2O projections are based on the consumption data provided by wholesalers who forecasted that sales will either stay at the current level or decline slowly.

5.1.4 Agriculture sector

Projections in the Agriculture sector are calculated based on the 2006 IPCC Guidelines by using a bottom-up approach model. The agricultural GHG emissions projections reported 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 fertilisation. Projected values of agricultural output and fertiliser use are based on the expert judgements received from the Estonian Ministry of Rural Affairs.

As a result of the new *EU 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. 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 average milk yield may increase up to 19% by the year 2020.

Gross energy (GE) intake of dairy cows was calculated on the basis of projected milk yields. Expert judgement was used to project the number of livestock (Table 5.1).

Average milk yield per cow should increase until 2020. Projected values for the period 2020–2035 are not available, so it is assumed that milk yield during this period will remain at the level of 2020. Milk fat (%) for the projected period of 2015–2035 was assumed to be the same as in 2015 (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.

Projection of N_2O emissions from manure management systems were done by using livestock population (Table 5.1) and AWMS system distribution. Country-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 synthetic N-containing fertilisers applied to soil and quantities of harvested crops.

As a result of the increasing global food demand, it is foreseen that Estonia's cultivated agricultural land area is going to expand, which will most likely boost the use of synthetic fertilisers. The projected activity data on crop production and the data on the use of synthetic N fertilisers are presented in Table 5.1.

CO_2 emissions from liming are foreseen to increase, as the current level of liming used for neutralising the naturally acidic agricultural soils is presently insufficient in Estonia.

5.1.5 Land use, land-use change and forestry sector

Half of Estonia's territory is covered with forest, 10% of which 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.

Projections in the LULUCF sector are calculated by using land use data from 1990 to 2015 and emissions/removals reported in the National Inventory Report 2017 and CRF tables. Estimates of CO_2, N_2O and CH_4 projections were calculated as an average of:

- linear forecast over whole time series 1990–2015;
- average of time series 1990–2015;
- average of time series 2000–2015;
- estimation of reference year.

The emissions of the LULUCF sector have been quite volatile during the past decades. The year 2005 is the starting point of the current trend of all relevant factors. The period of intensive felling as well as the afforestation of agricultural areas stopped around this time. The main reason for the use of multiple averages in projection calculations is to reduce the sudden or abnormal trends and tendencies.

5.1.6 Waste sector

CH4 emission projections in the Solid waste disposal subcategory are done by using the bottom-up 2006 IPCC Waste Model, which has been developed by IPCC for estimating CH4 emissions from solid waste disposal sites. This model takes into account both municipal solid waste (MSW) and industrial waste generation and depositing, incl. also the CH4 recovery from the sites. Projections of the MSW generation are based on the population projection and the projection of the annual real

GDP growth rate. The 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 of the Biological treatment of solid waste are based on the annual real GDP growth rate and an expert judgement from GPCP 2050 on the increasing amount of biologically treated sludge.

Only a small amount of waste is incinerated without energy recovery and the Open burning of MSW is prohibited; nevertheless, an expert judgment is used to evaluate the amount of waste that might be open burned based on the amount of MSW generated. Projections were done by using the assumptions from GPCP 2050 stating that no burning without energy recovery nor open burning will be taking place after 2030.

Projections of GHG emissions in the Wastewater treatment and discharge subcategory account human population projections and an expert judgement by the MoE on the usage of different wastewater treatment types and the coverage of the centralised wastewater system. GHG emissions from Industrial wastewater were calculated using assumption of stable production throughout the time series with a fraction of the annual real GDP growth rate.

Biogas generated at Estonia's SWDS are both combusted with energy recovery and burnt in a flare. Projections in the subcategory of Burning Biogas in a flare and recovered methane under the Solid waste disposal subcategory are based on the decrease percentage of biodegradable waste in the total amount by weight of MSW allowed to be deposited in landfills by 2020.

5.1.7 Comparison of projections between previous BR2 and current BR3

BR3 as well as BR2 have been compiled by the EERC. There have been several methodological developments since the previous BR that include using 2014 as the base year and using *LEAP* model for compiling Transport projections. Table 5.2 includes some of the main assumptions and results of the previous and current projections.

Table 5.2. Comparison of projections between previous and current BR

	2015	2020	2025	2030	2035
BR3 Population, thousand people	1,313.3	1,297.4	1,276.0	1,250.7	1,222.9
BR2 Population, thousand people	1,311.5	1,284.5	1,247.2	1,208.3	NE
BR3 Annual GDP growth rates, %	3.3	3.0	2.5	2.5	2.1
BR2 Annual GDP growth rates, %	2.3	2.1	2.3	1.9	NE
BR3 WM total emissions (without LULUCF), kt CO_2 eq.	15,681.3	17,192.2	17,061.5	15,329.8	14,945.0
BR2 WM total emissions (without LULUCF), kt CO_2 eq.	21,225.0	21,903.0	19,019.0	17,715.0	NE
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
BR2 WAM total emissions (without LULUCF), kt CO_2 eq.	21,024.0	21,210.0	17,949.0	16,048.0	NE

NE– not estimated: BR2 2035 GHG emissions were not estimated.

5.2 Projections

Projections of GHG emissions have been calculated for the period from 2015–2035 and 2014 has been used as a reference year. Two scenarios are presented. The 'With Existing Measures' (WM) 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 'With Additional Measures' (WAM) scenario.

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 WM scenario are presented in Table 5.3 and Figure 5.1. In the WM scenario, the emissions are projected to decrease by 27.1% from 2014 to 2035. The largest decrease occurs in the Energy industries sector.

The main electricity producer in Estonia is Narva Elektrijaamad AS (Narva Power Plants) incl. the Eesti Power Plant and the Balti Power Plant. Both of these plants mainly use oil shale for electricity production. Narva Power Plants are also the largest producers of GHG emissions in Estonia. Due to the phasing out of direct oil shale combustion in these plants, the building of a more effective Auvere oil shale combustion plant, and the introduction of new shale oil production plants, GHG emissions are projected to decrease by 36.7% by 2035 compared to 2014 in the Energy industries sector.

GHG emissions in the Manufacturing and construction sector (divided into iron and steel; non-ferrous metals; chemicals; pulp, paper and print; food processing, beverages and tobacco; non-metallic minerals; and other industries) are projected to increase by 12.3% by 2035 compared to 2014. In this sector, only one WM scenario is projected, as there are no additional planned policies or measures.

The emissions from the Transport sector are projected to increase by 11.7%, mainly due to the increased use of CNG. At the same time, the share of biofuels and electricity is expected to increase from 0.5% in 2014 to 10.0% in 2035 in the WM scenario.

The emissions in Other sectors (Commercial/institutional, Residential and Agriculture/Forestry/Fishing/Fish farms) are expected to increase by 7.7% in 2035 compared to 2014. GHG emissions from other sources are projected to decrease by 17.1% by 2035 compared to 2014. Only the WM scenario is projected, as there are no additional policies or measures defined. Due to increased natural gas use, the Fugitive emissions are expected to increase by 29.6% by 2035 compared to 2014.

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

WM		2014	2015	2020	2025	2030	2035
Energy industries	CO_2	14,889.9	12,188.3	12,634.8	12,026.0	9,880.4	9,350.0
	CH_4	0.6	0.6	1.3	1.5	1.6	1.6
	N_2O	0.1	0.1	0.2	0.2	0.2	0.2
	Total CO_2 eq.	14,936.0	12,237.2	12,727.9	12,131.1	9,991.4	9,455.6
Manufacturing and construction	CO_2	698.3	489.8	707.4	739.2	771.0	784.9
	CH_4	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O	0.02	0.02	0.02	0.02	0.02	0.02
	Total CO_2 eq.	706.0	497.6	715.1	747.1	779.1	793.1
Transport	CO_2	2,234.7	2,293.1	2,323.8	2,448.8	2,581.0	2,486.4
	CH_4	0.2	0.2	0.2	0.3	0.4	0.4
	N_2O	0.1	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	2,264.4	2,323.8	2,359.3	2,489.0	2,626.0	2,530.4
Other sectors	CO_2	558.0	591.0	564.3	580.3	596.3	601.2
	CH_4	4.9	4.8	5.4	5.4	5.3	5.3
	N_2O	0.2	0.2	0.2	0.2	0.2	0.2
	Total CO_2 eq.	734.1	762.4	751.6	769.1	786.5	790.9
Other sources	CO_2	32.6	26.8	26.8	26.8	26.8	26.8
	CH_4	0.002	0.001	0.001	0.001	0.001	0.001
	N_2O	0.002	0.001	0.001	0.001	0.001	0.001
	Total CO_2 eq.	33.2	27.3	27.3	27.3	27.3	27.3
Fugitive emissions	CO_2	0.03	0.03	0.05	0.04	0.04	0.04
	CH_4	0.7	0.6	1.1	0.9	0.9	0.9
	Total CO_2 eq.	17.5	15.5	26.6	23.3	22.8	22.7
Energy total	**CO_2**	**18,413.6**	**15,589.1**	**16,257.0**	**15,821.0**	**13,855.4**	**13,249.3**
	CH_4	**6.5**	**6.3**	**8.1**	**8.2**	**8.4**	**8.3**
	N_2O	**0.4**	**0.4**	**0.5**	**0.5**	**0.6**	**0.6**
	Total CO_2 eq.	**18,691.2**	**15,863.9**	**16,607.7**	**16,186.8**	**14,233.0**	**13,619.9**

The projected emissions of the Energy sector in the WAM scenario are presented in Table 5.4 and Figure 5.1. In the WAM scenario, the emissions are projected to decrease by 38.8% in the period of 2014–2035. 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 42.0% in the period of 2014–2035.

The emissions of the Transport sector are projected to decrease by 44.0% by 2035 compared to 2014 in the WAM scenario. The larger decrease compared to the WAM scenario is caused by additional measures, which result in a higher use of electricity and biofuels in transport (the part of electricity and biofuels is expected to be 33% in 2035). 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.

Due to the decreased use of natural gas, Fugitive emissions are expected to decrease by 17.1% by 2035 compared to 2014.

Table 5.4. Total projected WAM scenario GHG emissions from the Energy sector, kt

WAM		2014	2015	2020	2025	2030	2035
Energy industries	CO_2	14,889.9	12,188.3	12,361.2	11,706.3	9,290.9	8,569.3
	CH_4	0.6	0.6	1.3	1.4	1.5	1.4
	N_2O	0.1	0.1	0.2	0.2	0.2	0.2
	Total CO_2 eq.	14,936.0	12,237.2	12,451.7	11,806.8	9,394.1	8,664.4
Manufacturing and construction	CO_2	698.3	489.8	707.4	739.2	771.0	784.9
	CH_4	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O	0.02	0.02	0.02	0.02	0.02	0.02
	Total CO_2 eq.	706.0	497.6	715.1	747.1	779.1	793.1
Transport	CO_2	2,234.7	2,293.1	2,080.0	1,775.3	1,460.9	1,242.7
	CH_4	0.2	0.2	0.4	0.4	0.4	0.4
	N_2O	0.09	0.09	0.09	0.08	0.07	0.06
	Total CO_2 eq.	2,264.4	2,323.8	2,115.3	1,808.7	1,491.7	1,269.1
Other sectors	CO_2	558.0	591.0	535.3	536.7	538.1	530.1
	CH_4	4.9	4.8	4.7	4.3	4.0	3.6
	N_2O	0.2	0.2	0.2	0.2	0.2	0.2
	Total CO_2 eq.	734.1	762.4	702.4	695.1	687.9	670.3
Other	CO_2	32.6	26.8	26.8	26.8	26.8	26.8
	CH_4	0.002	0.001	0.001	0.001	0.001	0.001
	N_2O	0.002	0.001	0.001	0.001	0.001	0.001
	Total CO_2 eq.	33.2	27.3	27.3	27.3	27.3	27.3
Fugitive emissions	CO_2	0.03	0.03	0.04	0.04	0.03	0.03
	CH_4	0.7	0.6	1.0	0.8	0.7	0.6
	Total CO_2 eq.	17.5	15.5	24.2	20.5	17.3	14.5
Energy total	**CO_2**	**18,413.6**	**15,589.1**	**15,710.7**	**14,784.3**	**12,087.6**	**11,153.8**
	CH_4	**6.5**	**6.3**	**7.4**	**7.1**	**6.7**	**6.1**
	N_2O	**0.4**	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**
	Total CO_2 eq.	**18,691.2**	**15,863.9**	**16,035.9**	**15,105.5**	**12,397.3**	**11,438.6**

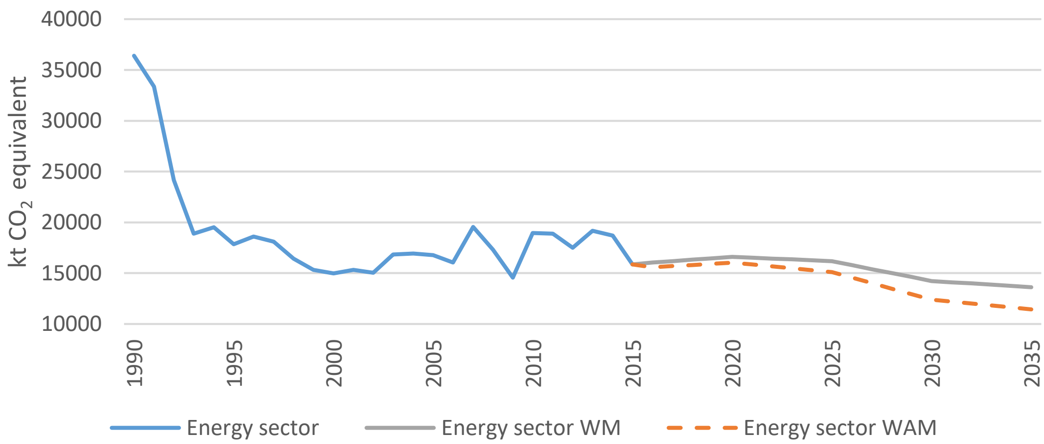

Figure 5.1. Total projected WM and WAM scenario GHG emissions from the Energy sector, 1990–2035 kt CO_2 eq.

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 WM scenario are expected to rise about 11.7% in 2035 compared to 2014. The emissions in the Road transportation and Railways sector are projected to increase in the future. Domestic aviation emissions are expected to stay at the same level during the period of 2014–2035. The biggest relative growth is taking place in rail transport due to a modal shift from Road transport. Domestic navigation emissions are projected to decrease due to decreased fuel consumption. The total projected GHG emissions in the WM scenario are presented in Table 5.5 and Figure 5.2.

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

WM		2014	2015	2020	2025	2030	2035
Domestic aviation	CO_2	1.2	1.2	1.2	1.2	1.2	1.2
	CH_4	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007
	N_2O	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
	Total CO_2 eq.	1.3	1.3	1.3	1.3	1.3	1.3
Road transportation	CO_2	2,140.6	2,192.9	2,215.4	2,324.0	2,427.2	2,333.5
	CH_4	0.2	0.2	0.2	0.3	0.4	0.4
	N_2O	0.06	0.07	0.07	0.07	0.07	0.07
	Total CO_2 eq.	2,162.7	2,216.1	2,240.7	2,352.8	2,458.9	2,364.2
Railways	CO_2	61.2	59.4	86.5	101.6	129.2	128.6
	CH_4	0.003	0.003	0.005	0.02	0.06	0.06
	N_2O	0.02	0.02	0.03	0.04	0.04	0.04
	Total CO_2 eq.	68.4	66.4	96.7	113.0	142.6	141.8
Domestic navigation	CO_2	31.7	39.6	20.6	21.9	23.3	23.1
	CH_4	0.003	0.004	0.001	0.001	0.002	0.002
	N_2O	0.0009	0.0011	0.0002	0.0002	0.0002	0.0002
	Total CO_2 eq.	32.1	40.1	20.7	22.0	23.4	23.2
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**	**2,234.7**	**2,293.1**	**2,323.8**	**2,448.8**	**2,581.0**	**2,486.4**
	CH_4	**0.2**	**0.2**	**0.2**	**0.3**	**0.4**	**0.4**
	N_2O	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
	Total CO_2 eq.	**2,264.4**	**2,323.8**	**2,359.3**	**2,489.0**	**2,626.0**	**2,530.4**

NO- not occurring: GHG emissions do not occur.

The emissions in the Transport sector in the WAM scenario are expected to decrease significantly (44.0%) in 2035 compared to 2014. Domestic aviation emissions are expected to stay approximately at the same level (as in the WM scenario) during the period of 2014–2035. 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 48.0% in 2035 compared to 2014 – a total of 1,039.74 kt CO_2 eq., which is the result of higher use of biofuels, increased use of public transport, and a lower demand for private transport. The emissions of the Railways sector are expected to increase less compared to the WM scenario. The total projected GHG emissions in the WAM scenario are presented in Table 5.6 and Figure 5.2

Table 5.6. Total projected WAM scenario GHG emissions from the Transport sector, kt

WAM	GHG	2014	2015	2020	2025	2030	2035
Domestic aviation	CO_2	1.2	1.2	1.2	1.2	1.2	1.2
	CH_4	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007
	N_2O	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
	Total CO_2 eq.	1.3	1.3	1.3	1.3	1.3	1.3
Road transportation	CO_2	2,140.6	2,192.9	1,920.2	1,620.9	1,311.9	1,106.7
	CH_4	0.2	0.2	0.2	0.3	0.3	0.2
	N_2O	0.1	0.1	0.1	0.1	0.0	0.0
	Total CO_2 eq.	2,162.7	2,216.1	1,943.1	1,642.5	1,331.6	1,123.7
Railways	CO_2	61.2	59.4	141.3	137.7	134.1	123.3
	CH_4	0.003	0.003	0.1	0.1	0.1	0.1
	N_2O	0.02	0.02	0.03	0.03	0.03	0.02
	Total CO_2 eq.	68.4	66.4	153.7	149.4	145.1	132.6
Domestic navigation	CO_2	31.7	39.6	17.2	15.5	13.7	11.5
	CH_4	0.003	0.004	0.001	0.001	0.001	0.001
	N_2O	0.0009	0.0011	0.0001	0.0001	0.0001	0.0001
	Total CO_2 eq.	32.1	40.1	17.3	15.5	13.8	11.5
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**	**2,234.7**	**2,293.1**	**2,080.0**	**1,775.3**	**1,460.9**	**1,242.7**
	CH_4	**0.2**	**0.2**	**0.4**	**0.4**	**0.4**	**0.4**
	N_2O	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
	Total CO_2 eq.	**2,264.4**	**2,323.8**	**2,115.3**	**1,808.7**	**1,491.7**	**1,269.1**

NO- not occurring: GHG emissions do not occur.

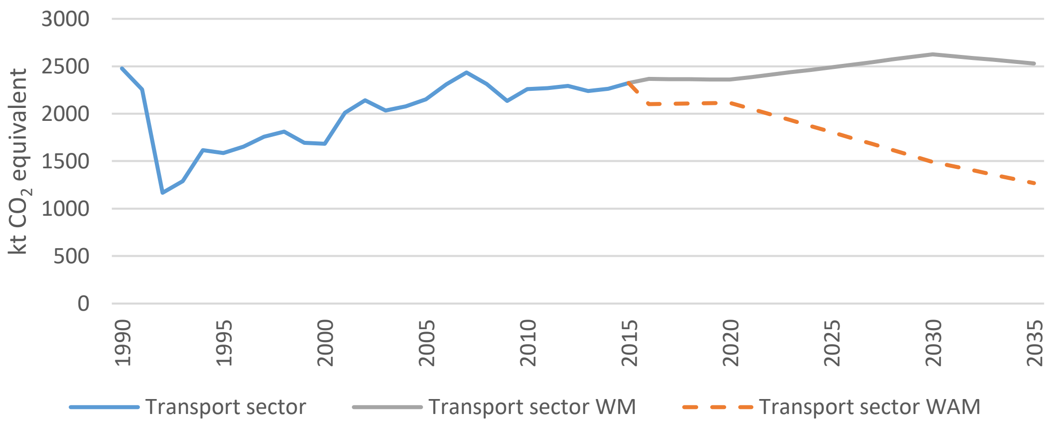

Figure 5.2. Total projected WM and WAM scenario GHG emissions from Transport sector, kt CO_2 eq.

5.2.2 Industrial processes and product use sector

Emissions from the IPPU sector are projected only based on the WM scenario. Existing measures are bans and duties stipulated in the Regulation (EU) No. 517/2014 on fluorinated GHGs and Directive 2006/40/EC related to emissions from mobile air conditioners (MACs).

Projections of GHG emissions from the IPPU sector by subcategory and GHG type are presented in Table 5.7 and Figure 5.3.

Table 5.7. WM scenario GHG emissions from Industrial processes and product use sector, kt

WM		2014	2015	2020	2025	2030	2035
Mineral industry	CO_2	464.5	262.7	784.1	837.3	837.3	837.3
Chemical industry	CO_2	NO	NO	NO	NO	NO	NO
Non-energy products from fuels and solvent use	CO_2	20.5	21.4	20.3	20.4	20.3	20.0
	Incl. indirect CO_2	15.7	15.9	14.9	14.6	14.3	14
Product uses as substitutes for ODS	HFCs	0.1	0.1	0.1	0.1	0.08	0.07
	Total CO_2 eq.	217.5	222.8	194.7	150.0	108.7	83.5
Other product manufacture and use	SF_6 kt·10^{-3}	0.09	0.1	0.1	0.1	0.1	0.1
	N_2O	0.01	0.01	0.01	0.01	0.01	0.01
	Total CO_2 eq.	5.3	6.0	6.0	6.0	6.1	6.1
Industrial processes total	**CO_2 (incl. indirect CO_2)**	**484.9**	**284.1**	**804.3**	**857.7**	**857.7**	**857.3**
	Indirect CO_2	**15.7**	**15.9**	**14.9**	**14.6**	**14.3**	**14.0**
	HFC	**0.1**	**0.1**	**0.1**	**0.1**	**0.08**	**0.07**
	N_2O	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
	Total CO_2 eq.	**707.7**	**512.9**	**1 005.0**	**1 013.8**	**972.5**	**946.8**

NO- not occurring: GHG emissions do not occur.

Emissions of fluorinated GHG (substitutes for ODS) are projected to decrease much after 2025, by 51% in 2030 and over 62% by 2035. This will be the effect of Regulation (EU) No 517/2014 and Directive 2006/40/EC.

Mineral industry's production plants hope to recover from economic slowdown and reach their maximal production capacities in 2025 and stay at this level. Therefore until 2025 emissions are projected to rise 1.8 times of the 2014 year's low level. All the plants are already using best available Technologies (BATs) according current reference documents for BATs (BREFs).

Emissions from non-energy products from fuels and solvent use are projected to stay almost constant. Consumption of these products depends on economic situation of many small industries and solvent use also depends much on population size. Because very little economic growth can be foreseen and population is not growing, these emissions are projected to stay almost constant.

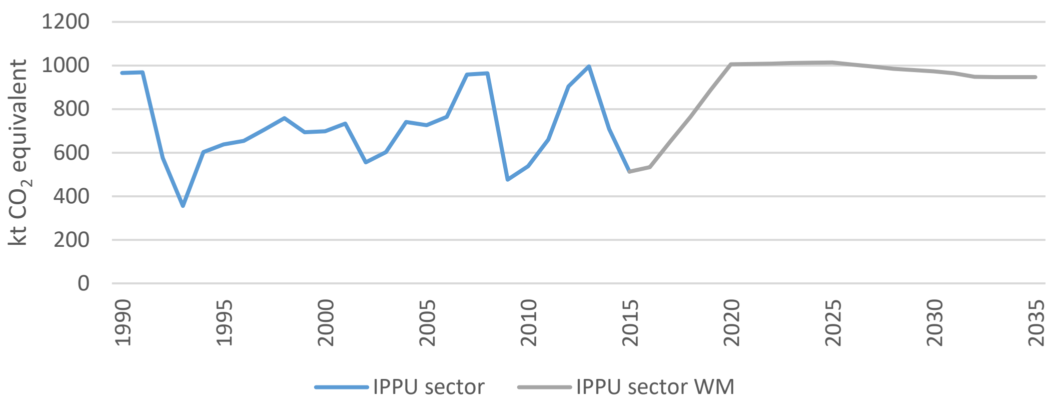

Figure 5.3. Total WM scenario GHG emissions from IPPU sector, kt CO_2 eq.

5.2.3 Agriculture sector

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

In the WM scenario, total emissions from the Agriculture sector are projected to grow steadily, reaching 1,679 kt CO_2 eq. in 2035, which is an increase of 25% compared to 2014. The upward trend (Table 5.8 and Figure 5.4) in GHG emissions in the Agriculture sector is the result of Enteric fermentation, Manure management, Agricultural soils and Liming subsectors due to the growth in livestock numbers and an increased milk yield in the case of dairy cows. The rise in emissions from agricultural soils is the result of the expected increase in the use of synthetic and lime fertilisers.

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

WM		2014	2015	2020	2025	2030	2035
Enteric fermentation	CH_4	22.4	21.6	23.7	25.8	27.0	28.2
	Total CO_2 eq.	560.3	540.5	592.0	643.9	674.4	705.3
Manure management	CH_4	3.4	3.1	3.4	3.7	3.8	3.9
	N_2O	0.2	0.2	0.3	0.3	0.3	0.3
	Total CO_2 eq.	150.0	139.8	162.3	174.8	183.0	188.9
Agricultural soils	N_2O	2.1	2.2	2.3	2.4	2.5	2.5
	Total CO_2 eq.	620.9	646.1	698.2	727.4	741.7	755.6
Liming	CO_2	8.3	8.3	12.7	17.1	21.5	25.9
	Total CO_2 eq.	8.3	8.3	12.7	17.1	21.5	25.9
Urea application	CO_2	2.5	3.0	3.0	3.0	3.0	3.0
	Total CO_2 eq.	2.5	3.0	3.0	3.0	3.0	3.0
Agriculture total	**CO_2**	**10.8**	**11.2**	**15.6**	**20.0**	**24.4**	**28.8**
	CH_4	**25.8**	**24.7**	**27.1**	**29.4**	**30.8**	**32.2**
	N_2O	**2.3**	**2.4**	**2.6**	**2.7**	**2.8**	**2.8**
	Total CO_2 eq.	**1,341.9**	**1,337.6**	**1,468.1**	**1,566.1**	**1,623.6**	**1,678.6**

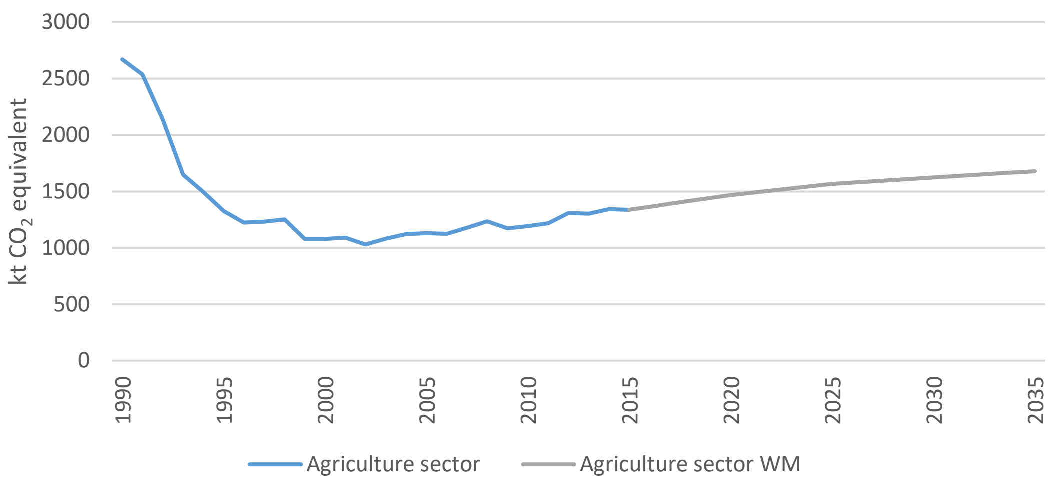

Figure 5.4. Total GHG emissions from the Agriculture sector, kt CO_2 eq.

5.2.4 Land use, land-use change and forestry sector

The LULUCF sector includes emissions and removals of GHGs 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 which is the land reform, but also accession to the European Union, economic rises and falls. Since there are no additional measures intended in the LULUCF sector then the WAM scenario emissions are equal to the WEM scenario emissions.

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

Land use class	2014	2015	2020	2025	2030	2035
Forest land	2,420.4	2,420.7	2,439.9	2,456.2	2,472.5	2,488.8
Cropland	1,038.5	1,038.3	1,027.1	1,017.6	1,008.2	998.7
Grassland	290.3	289.7	278.8	269.2	259.6	250.1
Wetlands	420.0	420.1	419.0	418.1	417.1	416.2
Settlements	321.4	321.7	327.7	332.9	338.1	343.3
Other Land	42.9	42.9	41.1	39.5	37.9	36.4
LULUCF total	4,533.5	4,533.5	4,533.5	4,533.5	4,533.5	4,533.5

Predicted area of land use by classes is presented in Table 5.9. Forest area grew steadily until 2035. As there are several EU support schemes at present for agriculture activities, only slight change of forest land area is foreseen in future (mainly conversion of grassland to forest land). At the same time, decrease of arable land took place since 1990s. This process has been stopped since 2004 after Estonia became a member of the EU and agricultural subsidies were implemented. However, area of cropland is not expected to increase further. Grasslands should continue to decline in the near future, mainly due to natural afforestation. The area of Infrastructure and settlements is continuously growing 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 method causes a temporary decrease in GHGs sink from forest land. As there are no additional measures intended in the LULUCF sector, then the WAM scenario emissions are equal to the WM scenario emissions (Table 5.10).

Table 5.10. Total GHG emissions and removals from LULUCF sector in WM scenario, kt

WM	GHG	2014	2015	2020	2025	2030	2035
Forest Land	CO_2	-2,183.5	-2,475.4	-2,067.9	-1,660.3	-1,252.8	-845.3
	CH_4	0.002	0.0001	0.013	0.008	0.002	-0.003
	N_2O	0.00001	0.000001	0.00013	0.00008	0.00002	-0.00003
	Total CO_2 eq.	-2183.4	-2475.4	-2067.5	-1660.1	-1252.8	-845.4
Cropland	CO_2	133.4	119.8	147.0	174.3	201.5	228.7
	N_2O	0.02	0.02	0.03	0.04	0.05	0.05
	Total CO_2 eq.	138.8	125.2	155.8	185.5	215.1	244.8
Grassland	CO_2	6.7	37.6	33.1	28.6	24.1	19.6
	CH_4	0.00003	0.000003	0.001	0.001	0.001	0.001
	N_2O	0.000003	0.0000003	0.00008	0.00008	0.00009	0.00009
	Total CO_2 eq.	6.7	37.6	33.1	28.6	24.1	19.6
Wetlands	CO_2	905.7	794.7	755.2	715.8	676.3	636.8
	CH_4	0.002	0.002	0.002	0.002	0.002	0.002
	N_2O	0.004	0.004	0.004	0.004	0.004	0.003
	Total CO_2 eq.	907.0	796.1	756.4	716.9	677.4	637.8
Settlements	CO_2	235.1	214.1	254.2	294.4	334.5	374.6
Other Land	CO_2	23.4	23.4	6.5	-10.3	-27.2	-44.1
HWP	CO_2	-882.6	-1 080.2	-1,278.4	-1,476.6	-1,674.8	-1,873.0
Other*	N_2O	0.00006	0.00006	NE	NE	NE	NE
LULUCF total	**CO_2**	**-1,761.7**	**-2,366.0**	**-2,150.2**	**-1,934.4**	**-1,718.6**	**-1,502.7**
	CH_4	**0.004**	**0.002**	**0.016**	**0.011**	**0.005**	**-0.00003**
	N_2O	**0.02**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**
	Total CO_2 eq.	**-1,754.9**	**-2,359.2**	**-2,139.8**	**-1,921.7**	**-1,703.7**	**-1,485.6**

*NE- not estimated: 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.

The LULUCF sector is expected to stay GHG sink category according to the projections (Figure 5.5).

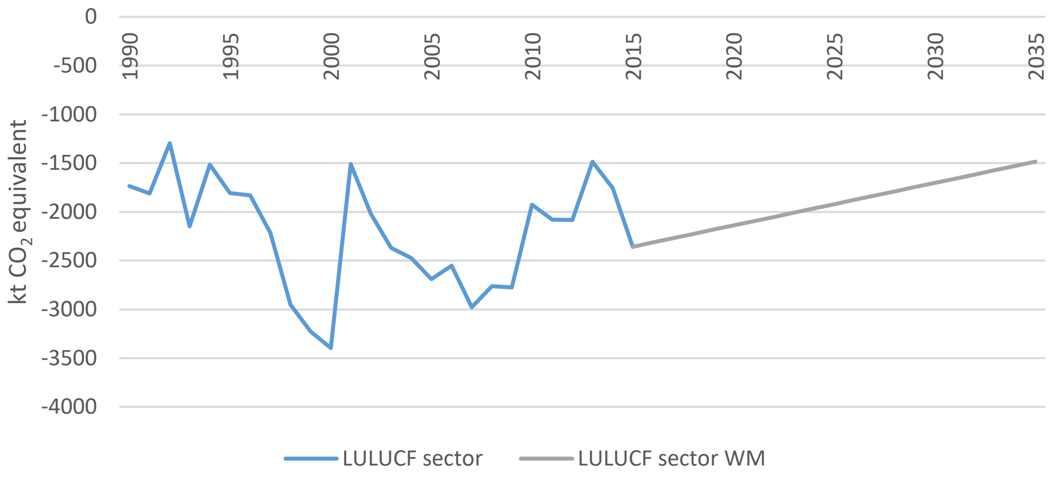

Figure 5.5. Total GHG emissions from the LULUCF sector, kt CO_2 eq.

5.2.5 Waste sector

Compared to 2014, the 2035 WM scenario CO_2 eq. projections from the Waste sector will decrease by 46% (Table 5.11 and Figure 5.6). The decrease in emissions is mainly related to the increase in reusing and recycling waste materials, decrease in the amount of biodegradable waste deposited in landfills as well as to waste incineration in Iru CHP plant, as the main emission share originates from the solid waste disposal on land. The increase in GHG emissions from biological treatment of solid waste is related 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 related to the expanding sewerage network. Since there are no additional measures intended in the Waste sector then the WM scenario emissions are equal to the WEM scenario emissions.

Table 5.11. Total GHG emissions from waste sector in WM scenario, kt

WM		2014	2015	2020	2025	2030	2035
Solid waste disposal on land	CH_4	8.0	7.5	4.4	2.9	2.3	1.4
	Total CO_2 eq.	201.1	187.3	110.3	73.0	57.9	35.0
Biological treatment of solid waste	CH_4	0.5	0.6	1.0	1.1	1.3	1.4
	N_2O	0.03	0.04	0.06	0.07	0.08	0.08
	Total CO_2 eq.	22.0	25.7	44.0	48.9	54.1	59.4
Waste incineration and open burning	CO_2	1.0	1.0	1.0	0.5	NO	NO
	CH_4	0.02	0.02	0.01	0.01	NO	NO
	N_2O	0.0003	0.0003	0.0002	0.0001	NO	NO
	Total CO_2 eq.	1.5	1.5	1.4	0.7	NO	NO
Wastewater treatment and discharge	CH_4	2.5	2.4	2.2	2.2	2.1	2.1
	N_2O	0.1	0.1	0.1	0.1	0.1	0.09
	Total CO_2 eq.	91.7	89.1	84.5	83.1	81.4	79.8
Other (Burning biogas in a flare)	CH_4	0.9	0.9	0.4	0.4	0.4	0.4
	N_2O	0.004	0.003	0.002	0.002	0.002	0.002
	Total CO_2 eq.	24.0	22.5	11.0	11.0	11.0	11.0
Waste total	**CO_2**	**1.0**	**1.0**	**1.0**	**0.5**	**NO**	**NO**

WM		2014	2015	2020	2025	2030	2035
	CH_4	**12.0**	**11.3**	**8.1**	**6.6**	**6.1**	**5.3**
	N_2O	**0.1**	**0.1**	**0.2**	**0.2**	**0.2**	**0.2**
	Total CO_2 eq.	**340.3**	**326.1**	**251.2**	**216.7**	**204.4**	**185.2**

NO- not occurring: GHG emissions do not occur.

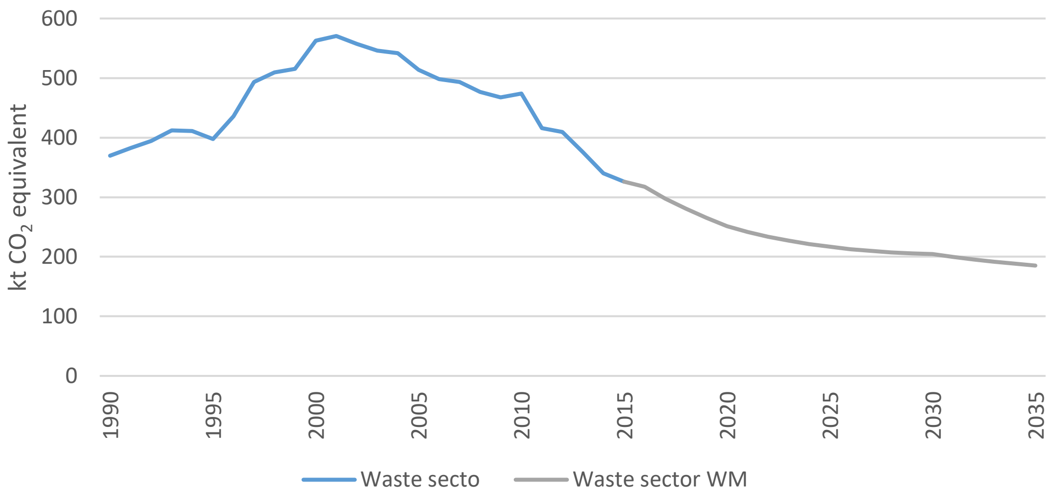

Figure 5.6. Total GHG emissions from waste in WM scenario, kt CO_2 eq.

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

The projected GHG emissions of Estonia are presented in Table 5.12 and Figure 5.7. Estonia's GHG emissions are expected to decrease by about 22.1% in the WM scenario (without LULUCF) and by about 32.4% in the WAM scenario (without LULUCF) by 2035 compared to the base year of 2014. GHG emissions in the WM scenario (with LULUCF) are expected to decrease by about 22.7% and in the WAM scenario (with LULUCF) by about 34.0% by 2035 compared to the base year of 2014.

The main difference in the results of the WM and WAM scenarios is related to measures foreseen to be implemented with regard to energy efficiency and the use of biofuels. This will lead to smaller final consumption of energy in the WAM scenario compared to the WM scenario.

Total GHG emissions in the WM and WAM scenarios are presented in Table 5.12 and Figure 5.7.

Table 5.12. Total GHG emissions in Estonia, kt CO_2 eq.

	GHG emission projection, kt CO_2 eq.			
	2020	**2025**	**2030**	**2035**
Sector				
Energy WM	16,607.7	16,186.8	14,233.0	13,619.9
Energy WAM	16,035.9	15,105.5	12,397.3	11,438.6
IPPU WM	1,005.0	1,013.8	972.5	946.8
Agriculture WM	1,468.1	1,566.1	1,623.6	1,678.6
LULUCF WM	-2,139.8	-1,921.7	-1,703.7	-1,485.6
Waste WM	251.2	216.7	204.4	185.2
Total WM (excl. LULUCF, incl. indirect CO_2)	19,332.0	18,983.3	17,033.5	16,430.6
Total WAM (excl. LULUCF, incl. indirect CO_2)	18,760.1	17,902.0	15,197.8	14,249.2

	GHG emission projection, kt CO_2 eq.			
	2020	2025	2030	2035
Total WM (incl. LULUCF, incl. indirect CO_2)	17,192.2	17,061.5	15,329.8	14,945.0
Total WAM (incl. LULUCF, incl. indirect CO_2)	16,620.3	15,980.2	13,494.1	12,763.6
CO_2 WM emissions incl. net CO_2 from LULUCF	14,927.9	14,765.0	13,018.9	12,632.6
CO_2 WAM emissions incl. net CO_2 from LULUCF	14,381.5	13,728.2	11,251.1	10,537.2
Gas				
CO_2 WM emissions excl. net CO_2 from LULUCF	17,078.1	16,699.3	14,737.5	14,135.4
CO_2 WAM emissions excl. net CO_2 from LULUCF	16,531.7	15,662.6	12,969.7	12,039.9
CH_4 WM emissions incl. CH_4 from LULUCF	1,081.2	1,107.1	1,134.0	1,143.5
CH_4 WAM emissions incl. CH_4 from LULUCF	1,062.6	1,077.8	1,090.2	1,087.7
CH_4 WM emissions excl. CH_4 from LULUCF	1,080.8	1,106.9	1,133.9	1,143.5
CH_4 WAM emissions excl. CH_4 from LULUCF	1,062.2	1,077.5	1,090.0	1,087.7
N_2O WM emissions incl. N_2O from LULUCF	985.9	1,036.8	1,065.5	1,082.8
N_2O WAM emissions incl. N_2O from LULUCF	978.1	1,021.4	1,041.4	1,052.6
N_2O WM emissions excl. N_2O from LULUCF	975.9	1,024.5	1,050.8	1,065.6
N_2O WAM emissions excl. N_2O from LULUCF	968.1	1,009.1	1,026.7	1,035.5
HFCs WM =WAM	194.7	150.0	108.7	83.5
PFCs WM =WAM	NO	NO	NO	NO
SF_6 WM=WAM	2.5	2.6	2.6	2.6

The GHG emissions are expected to decrease about 22.1% in the WM scenario (without LULUCF) and about 32.4% in the WAM scenario (without LULUCF) by 2035 compared to 2014 and about 22.7 per cent in the WM scenario (with LULUCF) and about 34.0% in the WAM scenario (with LULUCF) by 2035 compared to 2014.

The main difference in the results of the WM and WAM scenarios is related to measures foreseen to be implemented regarding energy efficiency and use of biofuels. This will lead to smaller final consumption of energy in the WAM scenario compared to the WM scenario.

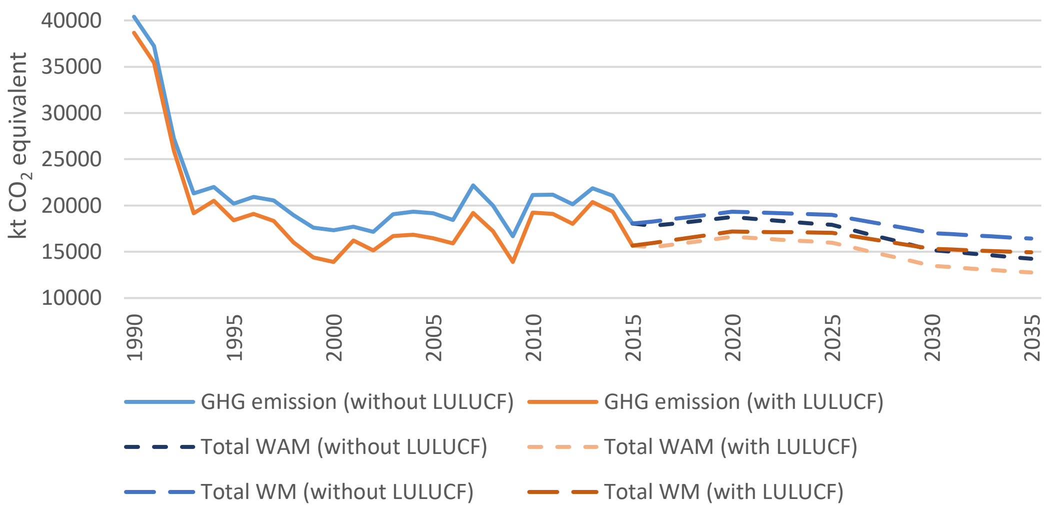

Figure 5.7. Total GHG emissions of Estonia (with and without LULUCF), kt CO_2 eq.

5.2.7 Sensitivity analysis

The sensitivity (SEN) analysis was carried out separately in Energy, IPPU and Waste sectors. SEN analysis is excluding agriculture and LULUCF sectors.

SEN in the Energy sector

Shale oil production industry is a growing branch in Estonia. According to the projections, the companies are planning to expand their production over 4 times in the next twenty years. However, this scenario is the most optimistic one and so wide expanding might not happen. Therefore there was an alternative scenario modelled (SEN scenario).

In the SEN scenario it is expected, that instead of 7 additional SHC technology shale oil production plants, only 3 will be built in the period 2015–2035. This could happen if the economic situation is not so suitable for shale oil production etc. This means, that instead of 20 million tons of oil shale (geological[9]), only 15 million tons of oil shale will be used for shale oil production. This means, in turn, that the amount of oil shale gas used for electricity production is reduced compared to the WM scenario. In the SEN scenario it is expected, that the amount of electricity produced from oil shale gas is imported. The results of the SEN scenario are presented in Figure 5.8.

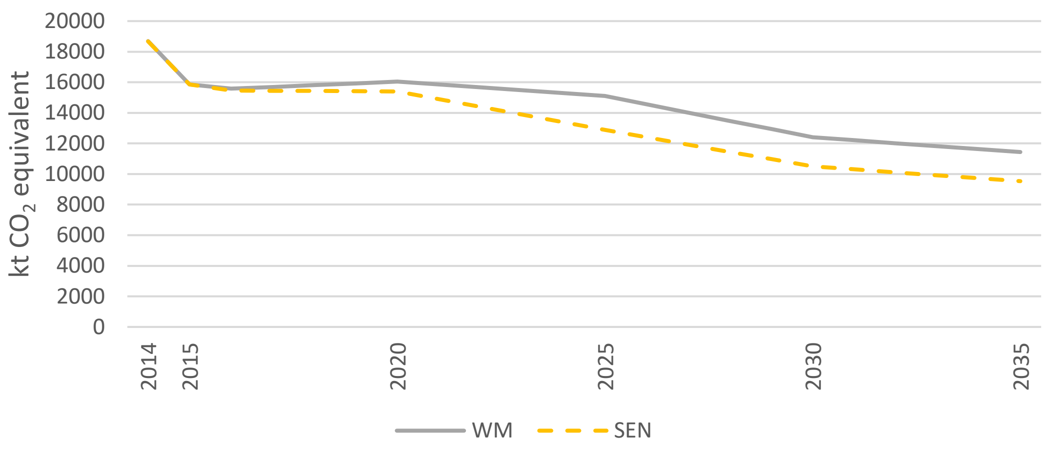

Figure 5.8. Comparison of GHG emissions of WM and SEN scenarios, kt CO_2 eq.

SEN in the Industrial processes and product use sector

Sensitivity analysis for IPPU sector emissions is based on an alternative F–gas phase-down scenario which is possible but not most probable. This is an alternative WM scenario and no additional measures are involved. This scenario directly affects only emissions from category 2.F Product uses as substitutes for ODS (and thus total emissions from IPPU). The assumptions for this scenario are following:

- The use of refrigerant R-404A totally ends in 2020, even in small equipment that is not covered by the servicing ban. The possible reason why the use of R-404A in small equipment could end, is that quota restrictions could cause a deficit of R-404A which has a high GWP of 3922. An important part of this assumption is that refrigerants from disposed equipment are collected properly and destroyed. In the main scenario, it is assumed otherwise – that lots of equipment which has reached

[9] 20 million tons of geological oil shale equals approximately to 25 million tons of commercial oil shale.

its end of service is operated further until it breaks down and up to this moment much of the refrigerant has leaked out;

- Very few new equipment with the refrigerant R-404A will be marketed in the years 2016–2019. This will be the case should enterprises make more long-term investments in equipment with alternative refrigerants;
- From 2027 onward there will be no equipment with the refrigerant R-404A.

Emissions are calculated the same way as in the first F-gas scenario (main and most probable WM projection).

This scenario would result in 7% less HFC emissions in 2025 and 22% less in 2030 in comparison with the main scenario. It may not sound much but the main effect would be the cumulative reduction of HFCs, assuming that a significant part of HFCs from disposed equipment is collected and destroyed. HFC emissions projected according this alternative scenario and cumulative reduction and emissions from IPPU sector according sensitivity analysis scenario (alternative WM) in comparison with main WM scenario are presented in Figure 5.9, together with emissions from the category 2.F and total emissions from IPPU.

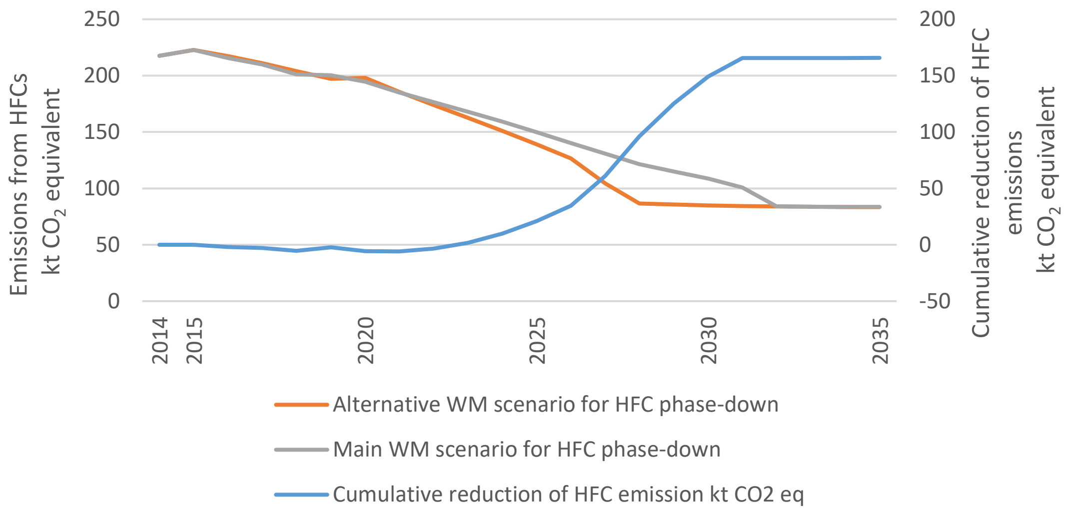

Figure 5.9. Projection of HFC emissions according to main and alternative scenarios and cumulative reduction of HFC emissions according to alternative scenario, kt CO_2 eq.

SEN in the Waste sector

Sensitivity analysis for Waste sector emissions are based on the scenarios, where population and annual real GDP growth rate (Table 5.13) are based on the harmonized values given by the European Commission (*Recommended parameters for reporting on GHG projections in 2017* 14.06.2016).

Table 5.13. Harmonised values given by the European Commission

Indicator	2020	2025	2030	2035
Annual real GDP growth rate (in market prices), %	2.2	1.7	1.6	1.4
Population in Estonia, million	1.281	1.243	1.205	1.177

Under SEN scenario, population and GDP growth rate from Table 5.13 were both implemented in calculations. 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 (Figure 5.10).

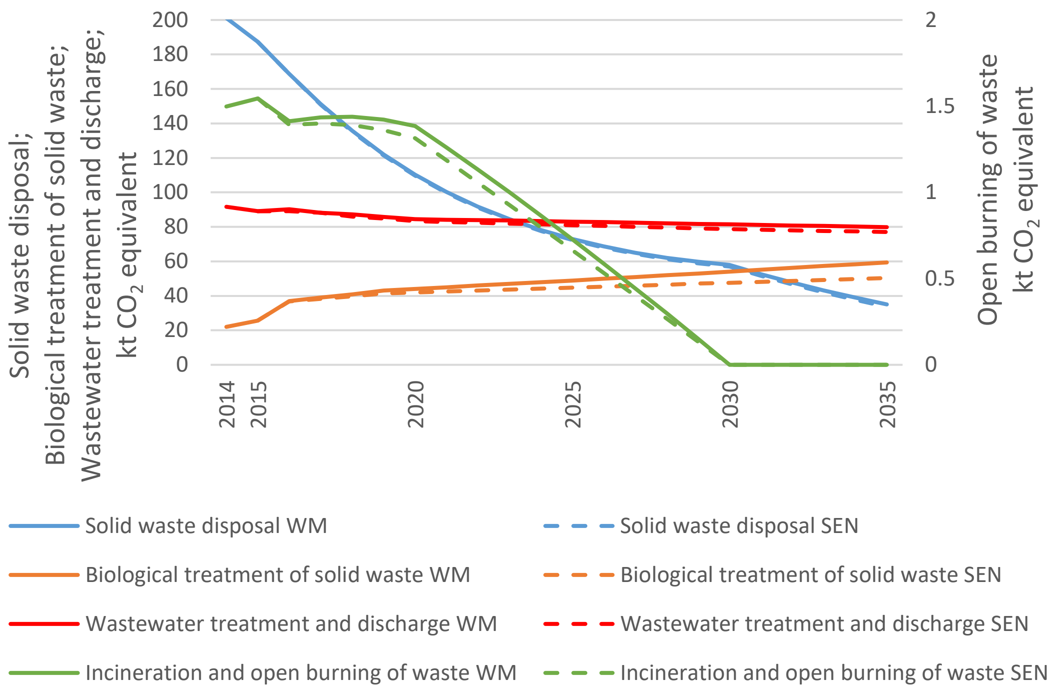

Figure 5.10. WM and SEN scenarios in the Waste sector, kt CO_2 eq.

5.2.8 International bunker fuels

Historically, the emissions from Aviation bunkering form about 10% of all bunkering emissions. The projected GHG emissions of International bunkering are presented in Table 5.14. The emissions of Aviation bunkering are projected to decrease by 19.8% in 2035 compared to 2014. The total GHG emissions of Marine bunkering are expected to decrease by 7.9% in 2035 compared to 2014. Overall, the GHG emissions from International bunkering are expected to increase by 9.1% in 2035 compared to 2014.

Table 5.14. Total GHG emissions of International bunkering, kt

	GHG	2014	2015	2020	2025	2030	2035
Aviation bunkering	CO_2	122.3	73.7	98.0	98.0	98.0	98.0
	CH_4	0.002	0.002	0.002	0.002	0.002	0.002
	N_2O	0.003	0.002	0.003	0.003	0.003	0.003
	Total CO_2 eq.	123.3	74.4	98.8	98.8	98.8	98.8
Marine bunkering	CO_2	979.7	885.3	932.5	932.5	932.5	932.5
	CH_4	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O	0.3	0.0	0.1	0.1	0.1	0.1
	Total CO_2 eq.	1,061.9	894.7	978.3	978.3	978.3	978.3
International bunkering total	CO_2	1,102.0	959.0	1,030.5	1,030.5	1,030.5	1,030.5
	CH_4	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O	0.3	0.0	0.1	0.1	0.1	0.1
	Total CO_2 eq.	1,185.2	969.0	1,077.1	1,077.1	1,077.1	1,077.1

5.3 Assessment of aggregate effect of policies and measures

The total effect of planned PAMs is calculated as the difference between WM and WAM scenarios and presented in Table 5.15.

Table 5.15. Total effect of implemented and adopted PaMs, kt CO_2 eq.

GHG	2015	2020	2025	2030	2035
CO_2	NE*	546.4	1,036.8	1,767.8	2,095.4
CH_4		18.6	29.4	43.9	55.8
N_2O		7.8	15.4	24.1	30.1
Total CO_2 eq.		572.8	1,081.6	1,835.7	2,181.3

*Emission calculations for the year 2015 are in in accordance with the 2017 National GHG Inventory submitted to the UNFCCC on 15 April 2017 and therefore the difference between WM and WAM scenarios is NE.

5.4 Supplementarity relating to mechanisms under Article 6, 12 and 17 of the Kyoto Protocol

Estonia has used two of the three Kyoto flexible mechanisms – Article 6 Joint Implementation (JI) and Article 17 International Emissions Trading (IET) (Table 5.16**Error! Reference source not found.**). The Clean Development Mechanism set out in Article 12 of the KP is not used, as Estonia is not a developing country.

Table 5.16. Quantitative contribution of Kyoto mechanisms for first commitment period

Kyoto mechanism	Total projected quantities for first commitment period (kt CO_2 eq.)
Total for all Kyoto mechanisms (*)	73,619
International emissions trading	72,592 (as of March 2013)
All project-based activities	1,027
Joint implementation	1,027
Clean development mechanism	–

(*) These are quantities that Estonia has transferred or intends to transfer as a JI host country and has sold in IET.

During the first Kyoto period, Estonia had entered into six agreements with different European governments and 15 agreements with different Japanese companies by February 2013. The proceeds received from these agreements were solely disbursed through the Green Investment Scheme (GIS) projects or programmes (The legal framework for the GIS is stipulated in the Atmospheric Air Protection Act (RT I, 05.07.2016, 1)). A special working group led by the State Chancellery was created to develop environmentally friendly projects and programmes to offer these to potential buyers. Each agreement was approved by the Government with a mandate given to the Minister of the Environment to sign the agreements. The primary fields of investments in frames of GIS included:

- renovation (incl. thermal refurbishment) of buildings;
- efficient and environmentally benign transport;
- development of wind energy farms; and
- efficiency improvements and wider use of renewables in the district heating sector.

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

Estonia is not included in Annex II to the Convention, therefore the provisions of Decision 2/CP 17, Annex I ‘UNFCCC biennial reporting guidelines for developed country Parties’, section VI (A, B, C) are not applicable. Summary information on provision of public financial support can be found in CTF tables 7, 7a and 7b.

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