ESTONIA'S SECOND BIENNIAL REPORT

under the United Nations Framework Convention on Climate Change

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TABLE OF CONTENTS

1. INTRODUCTION 5
2. INFORMATION ON GHG EMISSIONS AND TRENDS, GHG INVONTORY INCLUDING INFORMATION ON NATIONAL INVENTORY SYSTEM 5
2.1. Introduction and summary information from the national GHG inventory 5
2.1.1. Overall greenhouse gas emission trends 6
2.1.2. Greenhouse gas emissions by sector 9
2.1.2.1. Energy 9
2.1.2.2. Industrial processes and product use 12
2.1.2.3. Agriculture 15
2.1.2.4. Land use, land-use change and forestry 16
2.1.2.5. Waste 17
2.1.2.6. Reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol 19
2.2. National inventory arrangements 20
2.2.1. Institutional arrangements 20
2.2.2. Inventory process 22
2.2.3. Quality management 23
2.2.4. Changes in national inventory arrangements since NC6 and BR1 25
3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET 26
3.1. The European Unions and its member states target under the Convention 26
3.1.1. Other emission reduction targets 29
3.2. Progress to quantified economy-wide emission reduction target 30
4. PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION 31
4.1. Mitigation actions and their effects 31
4.1.1. Joint Implementation and International Emission Trading 31
4.1.1.1. Joint Implementation 31
4.1.1.2. International Emissions Trading 32
4.1.2. The EU Emissions Trading System and Effort Sharing Decision 32
4.1.2.1. EU Emissions Trading System 32
4.1.2.2. Effort Sharing Decision 34
4.1.3. Cross-cutting measures 34
4.1.3.1. General documents and EU assistance 34
4.1.3.2. Fiscal measures 35
4.1.4. Energy sector 37
4.1.4.1. Energy industries 40
4.1.4.2. Manufacturing industries and construction 42
4.1.4.3. Transport sector 42
4.1.4.4. Other sectors (commercial/institutional and residential sectors) 44
4.1.5. IPPU sector 45
4.1.6. Agriculture sector 47
4.1.7. LULUCF sector 50
4.1.8. Waste sector 53
4.2. Information on changes in domestic institutional arrangements 56
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 56
5. PROJECTIONS 57

5.1. Methodology 57
5.1.1. Energy sector 57
5.1.2. IPPU sector 58
5.1.3. Agriculture sector 59
5.1.4. LULUCF sector 60
5.1.5. Waste sector 60
5.1.6. Key assumptions used in the projections 61
5.1.7. Comparison of projections between NC6 and BR2 62
5.2. Projections 63
5.2.1. Energy sector 63
5.2.1.1. Energy industries 63
5.2.1.2. Manufacturing industries and construction 67
5.2.1.3. Transport (excluding international aviation and marine bunkering) 68
5.2.1.4. Other sectors 70
5.2.1.5. Fugitive emissions from natural gas distribution 73
5.2.1.6. Energy sector total 74
5.2.2. IPPU sector 75
5.2.3. Agriculture sector 78
5.2.4. LULUCF sector 79
5.2.5. Waste sector 81
5.2.6. Total projected GHG emissions of Estonia and the national GHG target 83
5.2.7. Sensitivity analysis 85
5.2.7.1. SEN in the energy sector 85
5.2.7.2. SEN in the IPPU sector 86
5.2.7.3. SEN in the waste sector 87
5.2.8. International bunker fuels 88
5.3. Assessment of aggregate effect of policies and measures 88
6. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT TO DEVELOPING COUNTRIES 89
REFERENCES 90

1. INTRODUCTION

Estonia is pleased to submit its Second Biennial Report (BR2) 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 including 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 BR2 submission (BR2 CTF). For the CTF submission to the UNFCCC, the electronic reporting facility provided by the UNFCCC Secretariat has been used as required by UNFCCC decision 19/CP.18.

2. INFORMATION ON GHG EMISSIONS AND TRENDS, 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 1990–2013. It also provides information on Estonia's national inventory arrangements. The greenhouse gas data presented in the chapter is consistent with Estonia's 2015 submission to the UNFCCC Secretariat. Summary tables of GHG emissions are presented in CTF Table 1.

The chapter presents data on direct greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

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

2.1.1. Overall greenhouse gas emission trends

Estonia's total greenhouse gas emissions in 2013 were 21,754.86 Gg CO_2 equivalent (with indirect CO_2), excluding net emissions from LULUCF (land use, land-use change and forestry). Emissions decreased by 45.7 per cent from 1990–2013 (see Table 2.1) but increased by around 12 per cent between 2012 and 2013. Emission trends by sector are given in Figure 2.1.

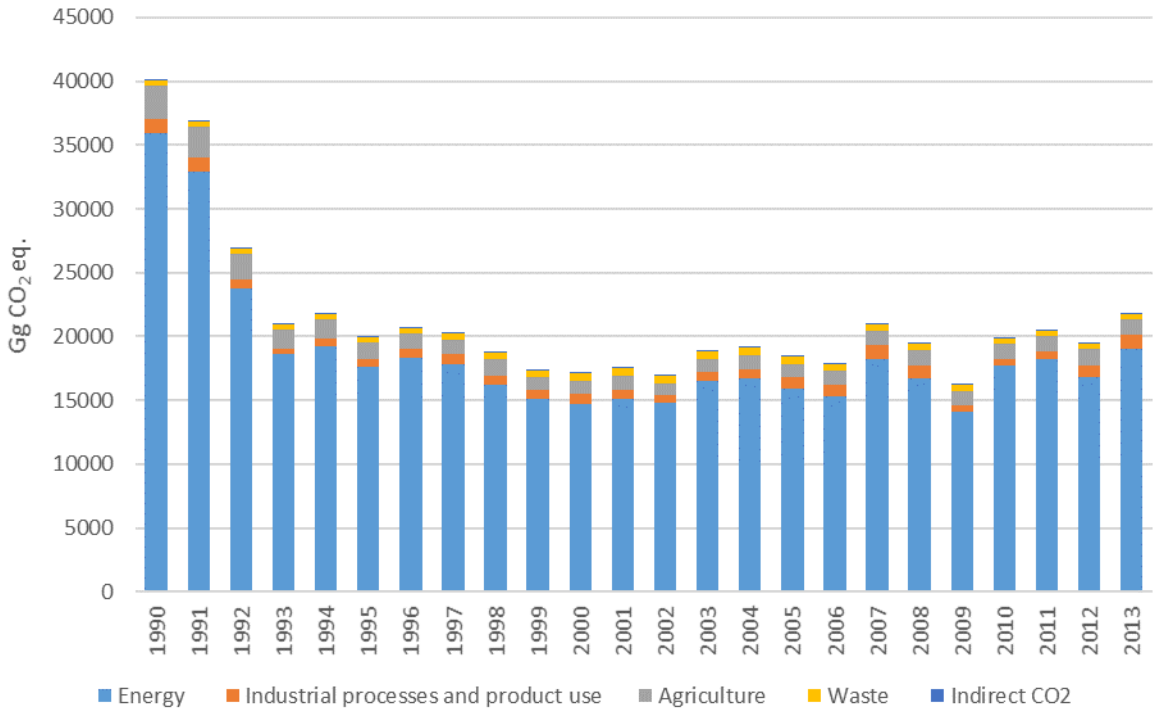

Figure 2.1. Estonia's greenhouse gas emissions by sector (with indirect CO_2), 1990–2013, excluding LULUCF, Gg CO_2 equivalent

The energy sector is by far the largest producer of GHG emissions in Estonia. In 2013 the sector accounted for 87.6 per cent of Estonia's total greenhouse gas emissions (Figure 2.2). The second largest sector is agriculture, which accounted for 5.8 per cent of total emissions in 2013. Emissions from the industrial processes and product use and waste sectors accounted for 4.9 per cent and 1.7 per cent of total emissions respectively.

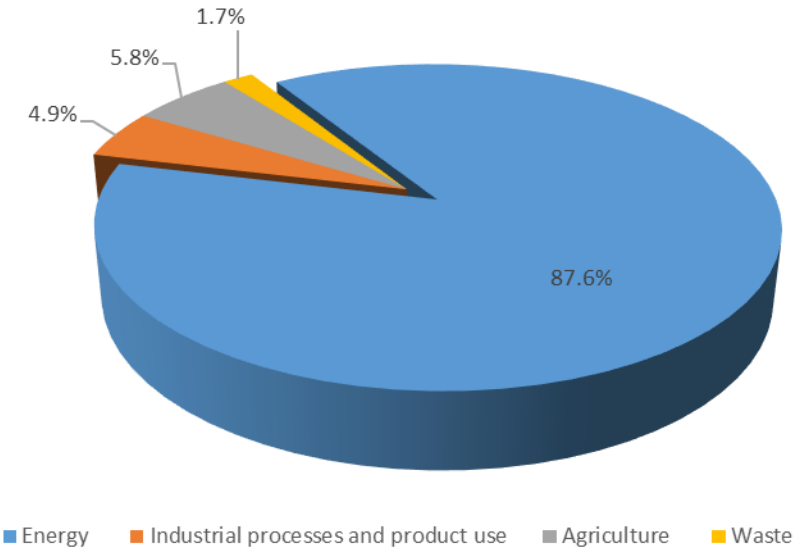

Figure 2.2. Greenhouse gas emissions by sector in 2013, per cent

The LULUCF sector, acting as the only possible sink of greenhouse gas emissions in Estonia, plays an important role in the national carbon cycle. In 2013 the LULUCF sector acted as a CO_2 sink, with total uptake of 329.97 Gg CO_2 equivalent (see Table 2.1). Uptake of CO_2 decreased by 95.7 per cent compared to the base year (1990) and by 77.5 per cent compared to the previous year (2012).

Table 2.1. Greenhouse gas emissions and removals by sector in 1990, 1995, 2000 and 2005–2013, Gg CO_2 equivalent

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change, per cent[2]
Energy	35,947.08	17,594.40	14,741.90	15,967.99	15,329.55	18,217.02	16,700.37	14,102.96	17,745.61	18,232.23	16,856.11	19,054.27	-47.0
Industrial processes and product use	1,056.14	688.33	728.46	831.61	897.34	1,086.64	1,076.38	477.35	524.11	645.57	897.25	1,061.84	0.5
Agriculture	2,657.26	1,281.13	1,046.92	1,074.56	1,079.56	1,117.46	1,186.03	1,118.08	1,154.51	1,159.11	1,245.72	1,254.05	-52.8
Waste	369.10	396.59	561.95	518.12	504.07	515.39	510.67	475.41	466.15	427.62	409.05	370.93	0.5
Indirect CO_2	20.85	20.57	19.21	19.11	20.01	18.64	16.52	13.46	12.84	13.98	14.55	13.77	-34.0
Total (excl. LULUCF)	40,029.57	19,960.44	17,079.23	18,392.29	17,810.52	20,936.50	19,473.45	16,173.80	19,890.38	20,464.53	19,408.14	21,741.09	-45.7
Total (excl. LULUCF, with indirect)	40,050.42	19,981.01	17,098.44	18,411.39	17,830.53	20,955.15	19,489.97	16,187.26	19,903.22	20,478.52	19,422.69	21,754.86	-45.7
Land use, land-use change and forestry	-7,636.91	-9,212.72	930.97	-4,893.52	-6,321.86	-7,415.78	-7,448.55	-6,158.87	-4,919.70	-3,142.17	-1,463.40	-329.97	-95.7
Total (incl. LULUCF)	32,392.66	10,747.72	18,010.20	13,498.77	11,488.66	13,520.72	12,024.91	10,014.93	14,970.68	17,322.36	17,944.74	21,411.12	-33.9
Total (incl. LULUCF, with indirect)	32,413.51	10,768.29	18,029.42	13,517.87	11,508.68	13,539.37	12,041.42	10,028.39	14,983.53	17,336.35	17,959.29	21,424.89	-33.9

[2] Change from base year (1990) to latest reported year (2013).

In 2013, the main greenhouse gas in Estonia was carbon dioxide (CO_2), accounting for 90.3 per cent of all GHG emissions (with indirect CO_2 and excluding LULUCF), followed by methane (CH_4) on 5.1 per cent and nitrous oxide (N_2O) on 3.6 per cent. F-gases (HFCs, PFCs, SF_6 and NF_3[3]) collectively accounted for about 1 per cent of overall GHG emissions (see Figure 2.3).

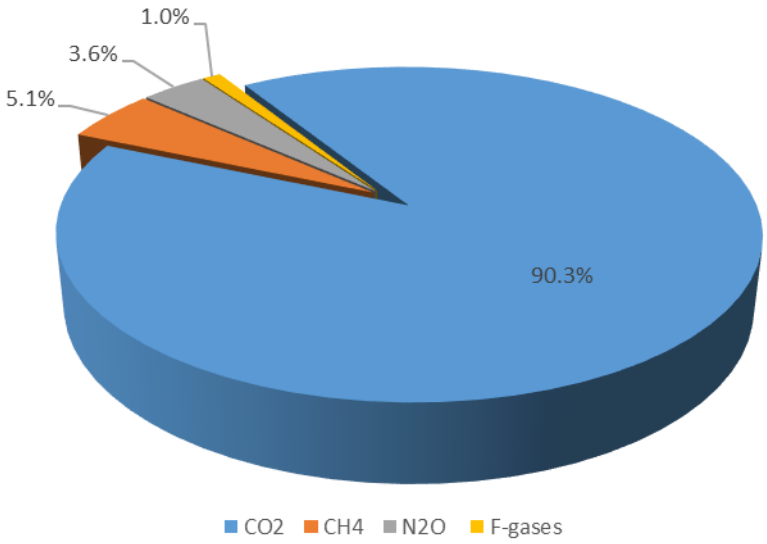

Figure 2.3. Greenhouse gas emissions by gas in 2013, per cent

Emissions of CO_2 (with indirect CO_2) decreased by 46.6 per cent from 1990–2013 (see Table 2.2), caused largely by CO_2 emissions from the energy sub-sector of public electricity and heat production, which is the major source of CO_2 in Estonia. N_2O emissions decreased by 44.4 per cent, especially N_2O emissions from the agriculture sub-sector of agricultural soils, which is the major source of N_2O in Estonia. Emissions of CH_4 decreased by 40.4 per cent, largely from the agriculture sub-sector of enteric fermentation, which is the major source of CH_4 in Estonia.

Emissions of F-gases increased from 0 Gg CO_2 equivalent in 1990 to 205.61 Gg CO_2 equivalent in 2013, especially HFC emissions from refrigeration and air-conditioning, which is the major source of halocarbons in Estonia. GHG emission trends from 1990–2013 by gas are shown in Figure 2.4.

Table 2.2. Greenhouse gas emissions by gas in 1990, 1995, 2000 and 2005–2013, excluding LULUCF, Gg CO_2 equivalent

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change, per cent[4]
CO_2 emissions (excl. net CO_2 from LULUCF)	36,758.65	18,001.97	15,170.15	16,433.84	15,850.52	18,882.17	17,373.90	14,153.59	17,819.61	18,434.55	17,296.27	19,640.84	-46.6
CO_2 emissions with indirect CO_2 (excl. net CO_2 from LULUCF)	36,779.50	18,022.54	15,189.36	16,452.94	15,870.53	18,900.81	17,390.42	14,167.05	17,832.46	18,448.53	17,310.83	19,654.61	-46.6

[3] PFC and NF_3 emissions did not occur in Estonia in 2013.
[4] Change from base year (1990) to latest reported year (2013).

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change, per cent[4]
CH_4 emissions (excl. CH_4 from LULUCF)	1,870.78	1,227.29	1,223.16	1,194.41	1,177.65	1,206.22	1,197.67	1,152.78	1,167.10	1,118.54	1,127.15	1,115.71	-40.4
N_2O emissions (excl. N_2O from LULUCF)	1,400.14	699.65	604.17	628.06	626.59	676.74	750.14	708.53	726.50	726.67	789.80	778.94	-44.4
HFCs	NO	28.45	79.15	134.96	154.57	170.37	150.39	157.53	175.43	183.00	193.03	203.60	100.00
PFCs	NO	NO	NO	NA,NO	0.09	0.08	0.05	NO	NO	NO	NO	NO	
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
SF_6	NO	3.07	2.60	1.03	1.10	0.92	1.29	1.38	1.73	1.77	1.88	2.00	100.00
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Total (excl. LULUCF)	40,029.57	19,960.44	17,079.23	18,392.29	17,810.52	20,936.50	19,473.45	16,173.80	19,890.38	20,464.53	19,408.14	21,741.09	-45.7
Total (excl. LULUCF, with indirect)	40,050.42	19,981.01	17,098.44	18,411.39	17,830.53	20,955.15	19,489.97	16,187.26	19,903.22	20,478.52	19,422.69	21,754.86	-45.7

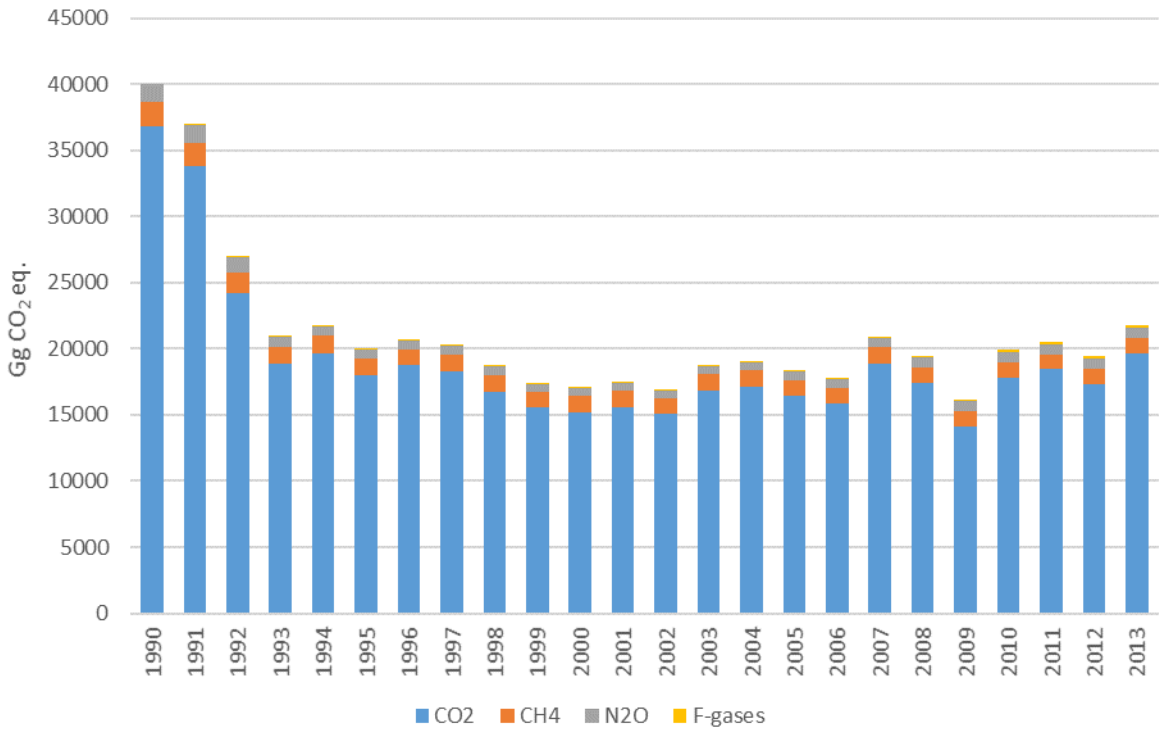

Figure 2.4. Estonia's greenhouse gas emissions by gas, 1990–2013, excluding LULUCF, Gg CO_2 equivalent

2.1.2. Greenhouse gas emissions by sector

2.1.2.1. Energy

Estonia's emissions from the energy sector are divided into the following categories: fuel combustion, including energy industries; manufacturing industries and construction;

transport; other sectors (incl. commercial/institutional, residential and agriculture/forestry/fisheries); other; and fugitive emissions from fuels.

The energy sector is the main source of greenhouse gas emissions in Estonia. In 2013 the sector contributed 87.6 per cent of all emissions, totalling 19,054.27 Gg CO_2 equivalent. 99.9 per cent of emissions in the sector originated from fuel combustion – just 0.1 per cent were from fugitive emissions. The share of emissions by category in 2013 is presented in Figure 2.5.

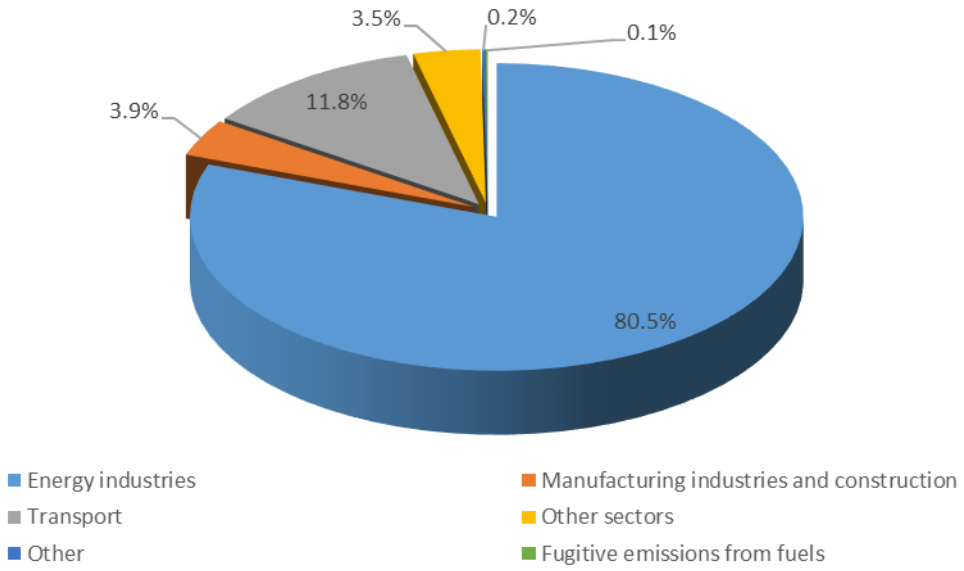

Figure 2.5. Share of emissions from energy sector by category, 2013

A substantial amount of energy-related emissions in Estonia are caused by extensive consumption of fossil fuels in power and heat production. 71.2 per cent of energy sector emissions resulted from consumption of solid fuels in public electricity and heat production.

Emissions from the energy sector decreased by 47.0 per cent compared to 1990 (incl. energy industries – 46.8 per cent; manufacturing industries and construction – 70.2 per cent; transport – 9.6 per cent; other sectors – 67.0 per cent; other – 25.8 per cent; and fugitive emissions from fuels – 55.5 per cent). 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 (closure 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 is presented in Figure 2.6.

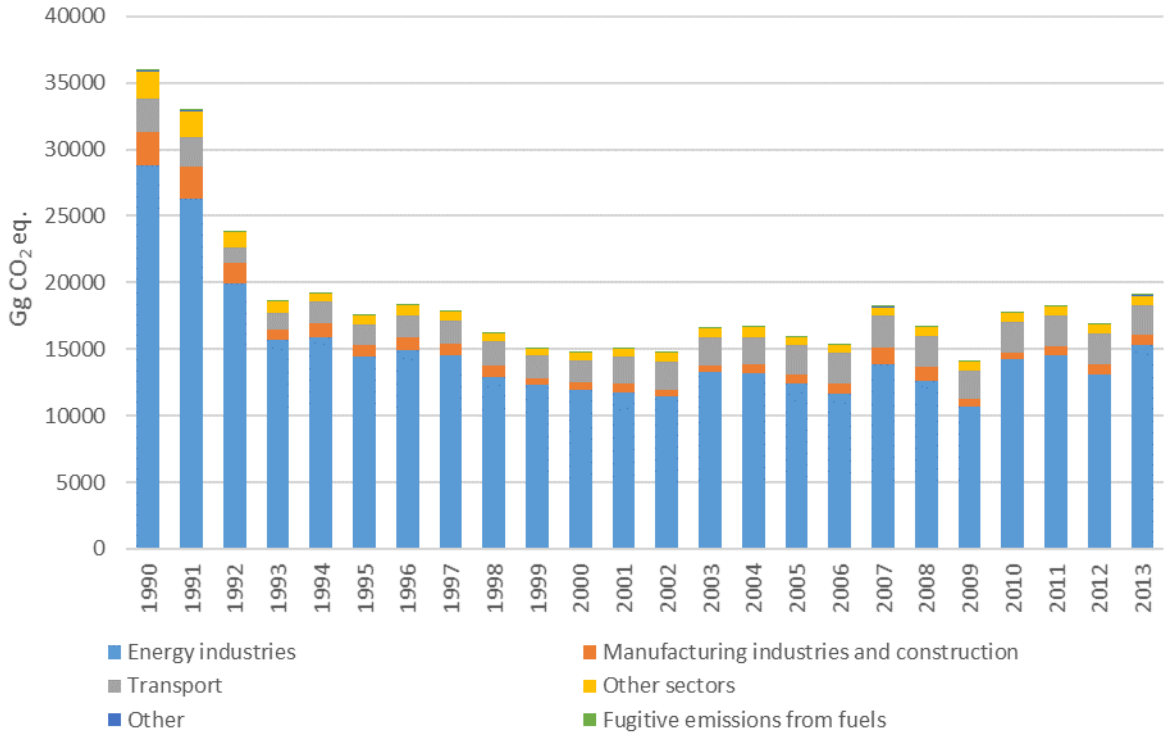

Figure 2.6. Greenhouse gas emissions from energy sector, 1990–2013, Gg CO_2 equivalent

Domestic fuels form a large share of Estonia's total energy resources and of the balance of primary energy, which is mainly based on oil shale. This gives Estonia strategic independence for the supply of electricity. The share of imported fuels amounts to approximately one-third, while the average share within European Union (EU) Member States is around two-thirds. The volume of exported electricity essentially influences the share of oil shale in the balance of primary energy i.e. the higher the exports of electricity, the higher the share of oil shale in the balance of primary energy.

In 2013, the supply of primary energy was 252.0 PJ, of which oil shale formed 68 per cent, and peat, renewables (wood, briquette, pellets, biogas and other biomass) and waste together 16 per cent (see Figure 2.7). The total primary energy supply increased about 10 per cent in 2013 compared with the previous year.

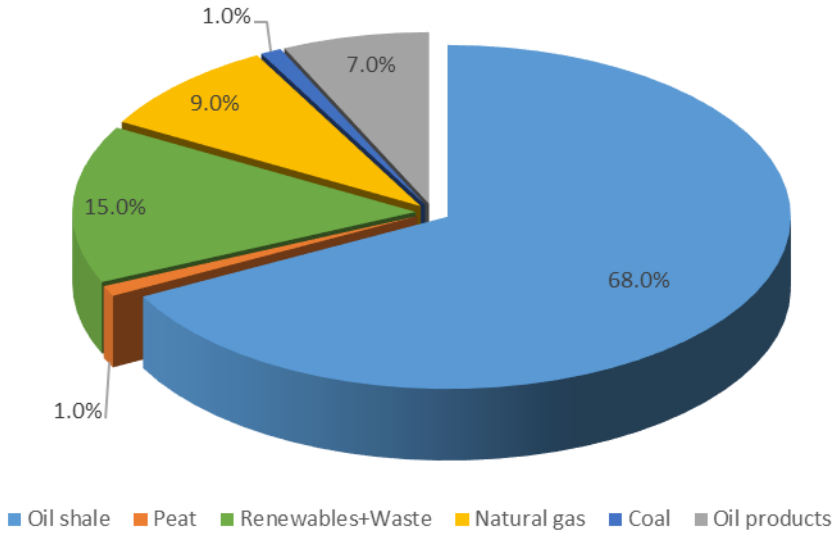

Figure 2.7. Structure of primary energy supply in Estonia, 2013

2.1.2.2. Industrial processes and product use

Estonia's GHG emissions from the industrial processes and product use sector are divided into the following emission categories: mineral industry; chemical industry; non-energy products from fuels and solvent use; product uses as substitutes for ODS and other product manufacture and use. Under mineral industry, emissions from cement, lime, glass production and other process uses of carbonates are reported. Emissions from ammonia production are reported under chemical industry. Under non-energy products from fuels and solvent use, CO_2 emissions from lubricant and paraffin wax use are reported. Product uses as substitutes for ODS covers HFC emissions from refrigeration and air conditioning, foam blowing, fire protection and aerosols. SF_6 emissions from electrical equipment, SF_6 and PFC emissions from other product use and N_2O emissions from product uses are reported under other product manufacture and use. Estonia also reports indirect CO_2 emissions calculated from NMVOC emissions from the solvent use and road paving with asphalt. The share of emissions by category in 2013 is presented in Figure 2.8.

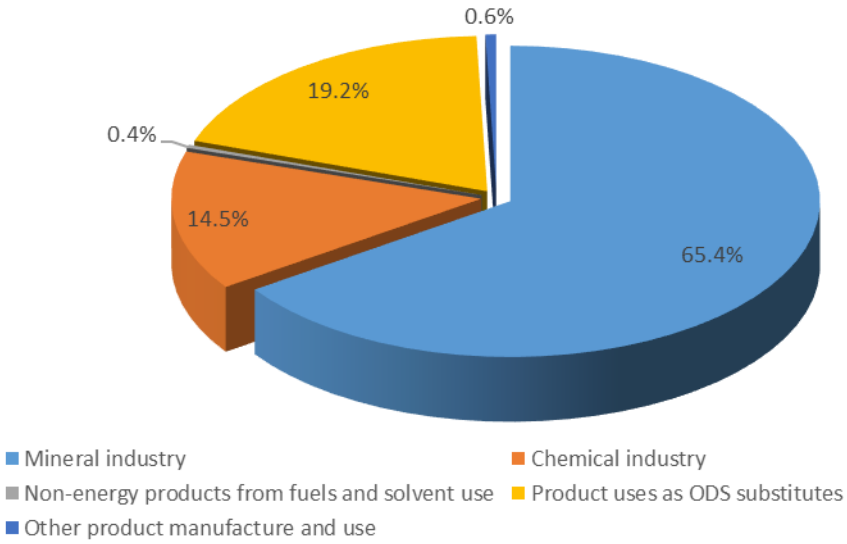

Figure 2.8. Share of emissions from industrial processes and product use sector by category, 2013

In 2013 the industrial processes and product use sector contributed 4.9 per cent of all GHG emissions in Estonia, totalling 1,075.61 Gg CO_2 equivalent with indirect CO_2 (and 1,061.84 Gg CO_2 equivalent without indirect CO_2). The most significant emission sources were CO_2 from cement and limestone use for flue gas desulphurisation at 37.1 per cent and 21.7 per cent respectively, and HFC emissions from refrigeration and air conditioning at 18.2 per cent of total GHG emissions from the sector. F-gas emissions as a whole comprised about 1 per cent of total GHG emissions.

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 lower industrial production and to an overall decrease in emissions from industrial processes between 1991 and 1993. 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 renovated its third kiln. In 2009 the industrial processes sector was affected by the recession. Decline in production was mainly due to insufficient demand on both the domestic and external markets. The overall progression of GHG emissions in the industrial processes sector is presented in Figure 2.9.

F-gas emissions have increased significantly from 0 Gg CO_2 equivalent in 1990 to 205.61 Gg CO_2 equivalent in 2013. A key driver behind the growing emissions trend in refrigeration and air conditioning, which is the major source of halocarbons in Estonia (see Figure 2.10), has been the substitution of ozone-depleting substances with HFCs. The second largest source is foam blowing, which shows a relatively steady increase of emissions over the years, except for two major decreases – in 2001 one of two big Estonian producers of one component foam replaced HFC-134a with HFC-152a, followed by the other producer, starting from 2007. Due to the much lower GWP of HFC-152a the emissions decreased suddenly in the corresponding years. All remaining sources are comparatively small emitters of F-gases in Estonia.

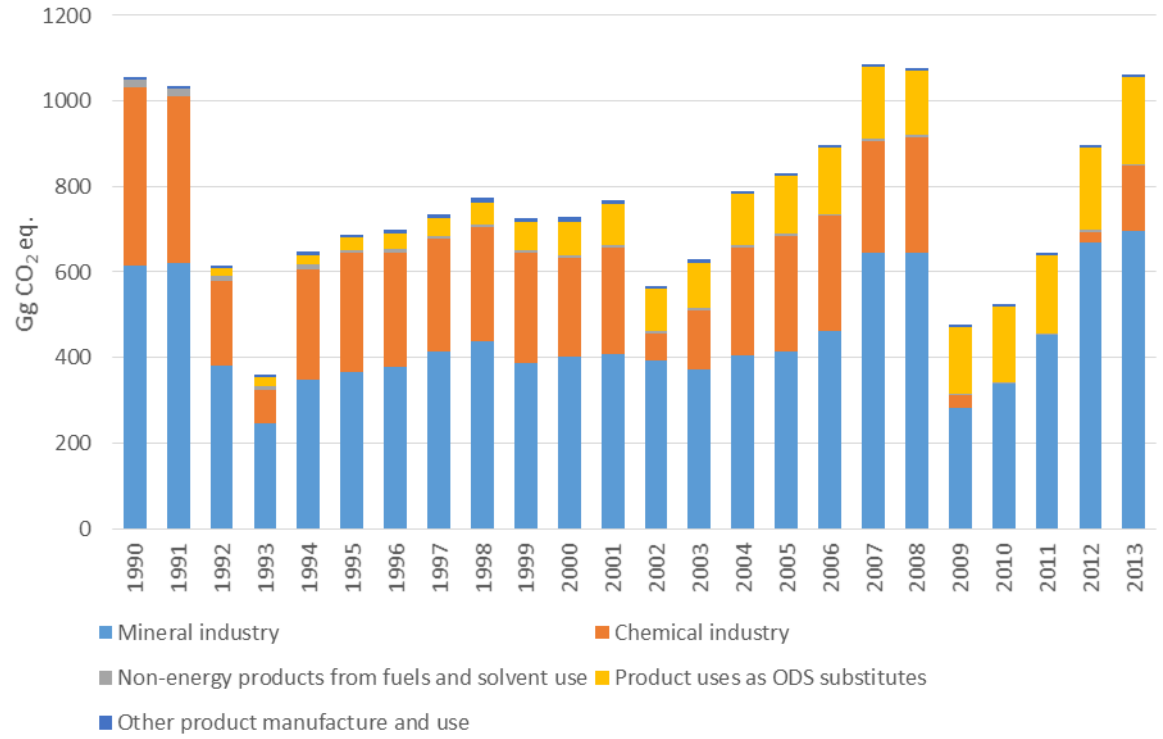

Figure 2.9. Greenhouse gas emissions from industrial processes and product use sector, 1990–2013, Gg CO_2 equivalent

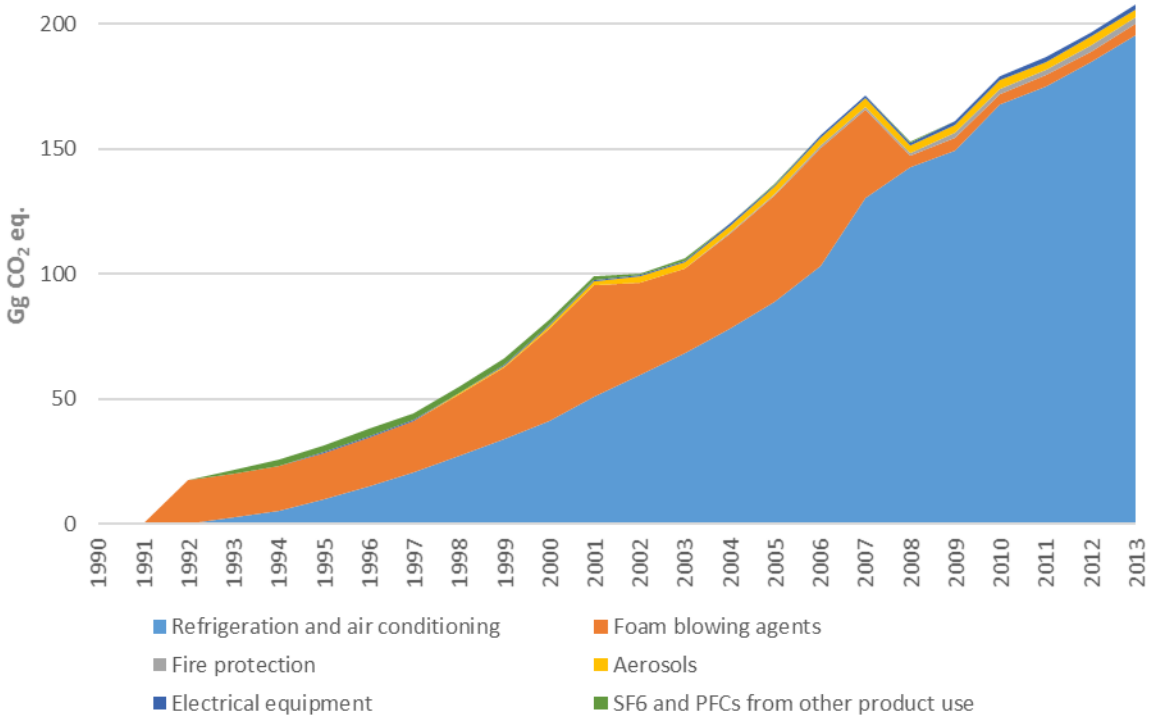

Figure 2.10. Actual emissions of F-gases by category, 1990–2013, Gg CO_2 equivalent

2.1.2.3. Agriculture

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

The total greenhouse gas emissions reported in the agriculture sector of Estonia were 1,254.05 Gg CO_2 equivalent in 2013. The sector contributed around 5.8 per cent to total CO_2 equivalent emissions. Emissions from enteric fermentation of livestock and direct emissions from agricultural soils were the major contributors to the total emissions recorded in the sector – 44.3 per cent and 35.0 per cent respectively. The share of emissions by category is presented in Figure 2.11.

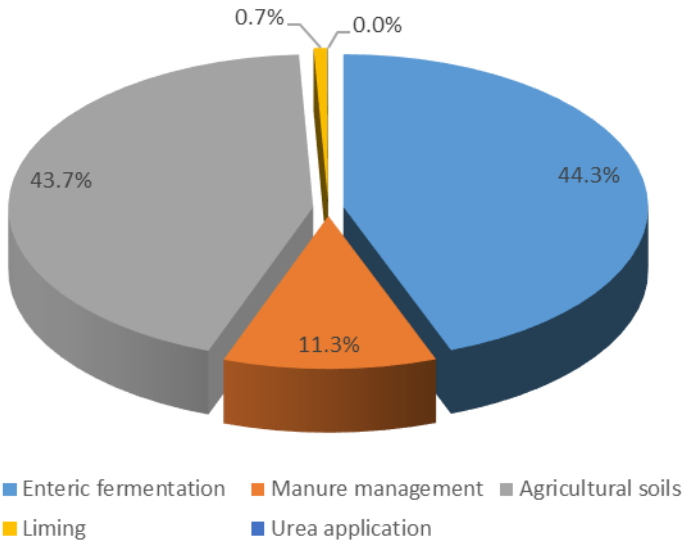

Figure 2.11. Share of emissions from agriculture sector by category, 2013

Emissions from the agricultural sector declined by 52.8 per cent by 2013 compared with the base year (1990), mostly due to the decrease in the livestock population and quantities of synthetic fertilizers and manure applied to agricultural fields. The overall progression of GHG emissions in the agriculture sector is presented in Figure 2.12.

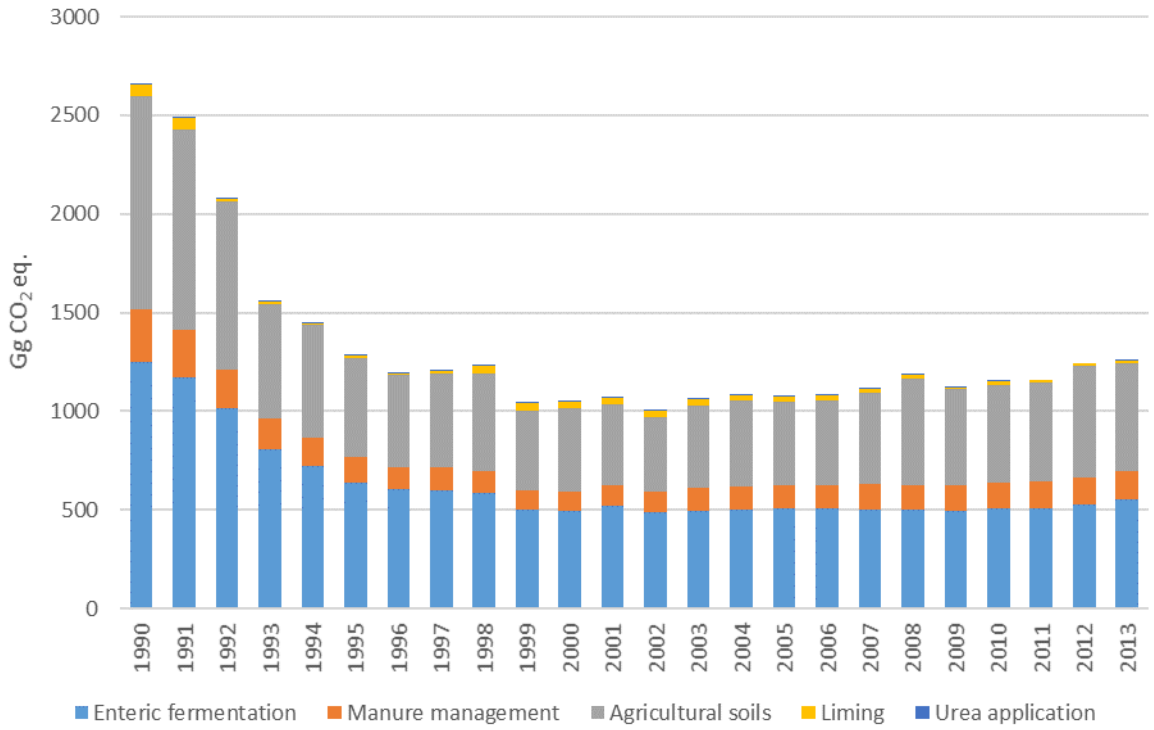

Figure 2.12. Greenhouse gas emissions from agriculture sector, 1990–2013, Gg CO_2 equivalent

2.1.2.4. Land use, land-use change and forestry

The LULUCF sector, acting as the only possible sink of greenhouse gas emissions in Estonia, plays an important role in the national carbon cycle. Emissions and removals from the LULUCF sector are divided into the following categories: forest land; cropland; grassland; wetlands (peatland); settlements; other land and harvested wood products (HWP). Each category, except HWP, is further divided between 'land remaining' and 'land converted to' sub-categories.

In 2013 the LULUCF sector acted as a CO_2 sink, totalling uptake of 329.97 Gg CO_2 equivalent. Compared to 1990, uptake of CO_2 has decreased by 95.7 per cent; compared to 2012, it has decreased by 77.5 per cent. In the last decade, CO_2 emissions have varied widely due to highly unstable rates of felling and deforestation. As can be seen in Figure 2.13, the LULUCF sector also acted as a net source from 2000–2003, when harvesting exceeded biomass increment in forests. A key driver behind these trends has been the socio-economic situation in Estonia.

The majority of CO_2 removals in the LULUCF sector come from the biomass increment in 'forest land remaining forest land' and 'land converted to forest land' sub-categories. In 2013, forest land and HWP were the only net sink category. From 2003–2007, grasslands constituted a significant CO_2 sink in addition to forest land. Grasslands are reallocated to the forest land category when the tree growth cover exceeds 30 per cent due to natural succession and a reduction in management activities.

Most of the emissions in the LULUCF sector are the result of biomass loss due to land conversion to settlements and drainage of organic soils. Minor sources of CO_2 are biomass burning (wildfires) and peat extraction.

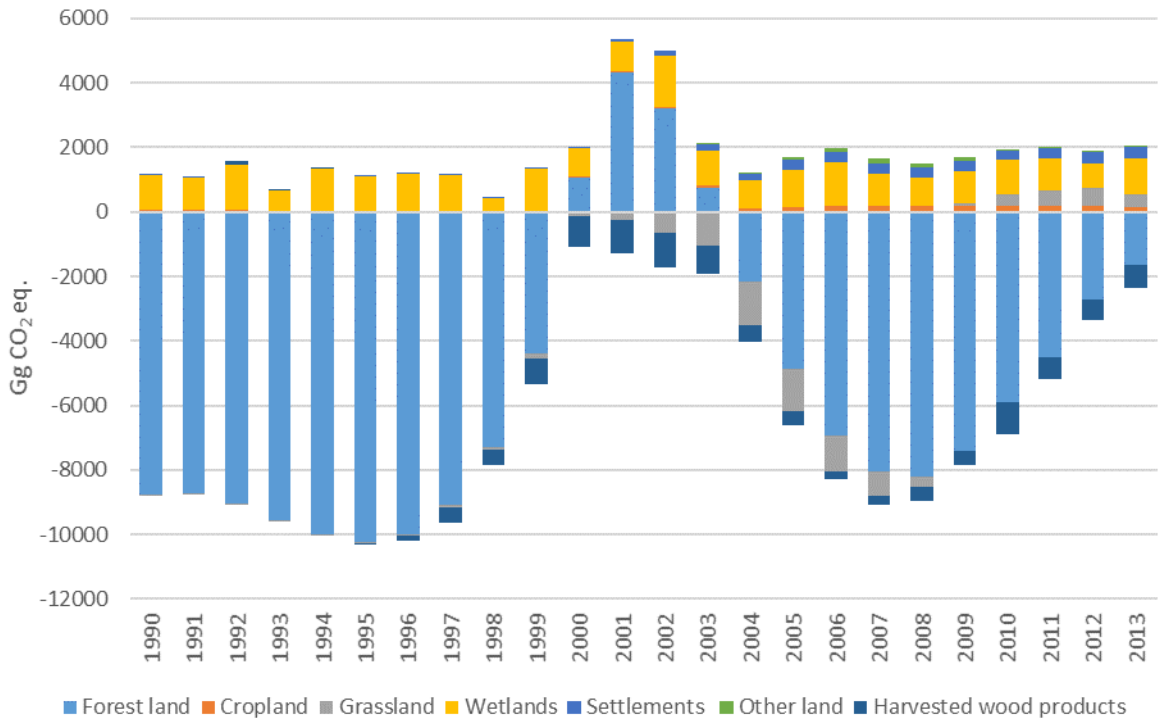

Figure 2.13. Greenhouse gas emissions and removals from land use, land-use change and forestry sector, 1990–2013, Gg CO_2 equivalent

2.1.2.5. Waste

In the waste sector, Estonia's GHG inventory covers CH_4 emissions from solid waste disposal sites including solid municipal and industrial waste and domestic and industrial sludge. The waste sector also covers GHG emissions from waste incineration without energy recovery and open burning of waste, biological treatment of solid waste and wastewater treatment and discharge from domestic and industrial sector.

In 2013, the waste sector contributed 1.7 per cent of all greenhouse gas emissions, totalling 370.93 Gg CO_2 eq. Solid waste disposal contributed the most to total emissions in the waste sector in Estonia. The share of emissions by category in 2013 is presented in Figure 2.14.

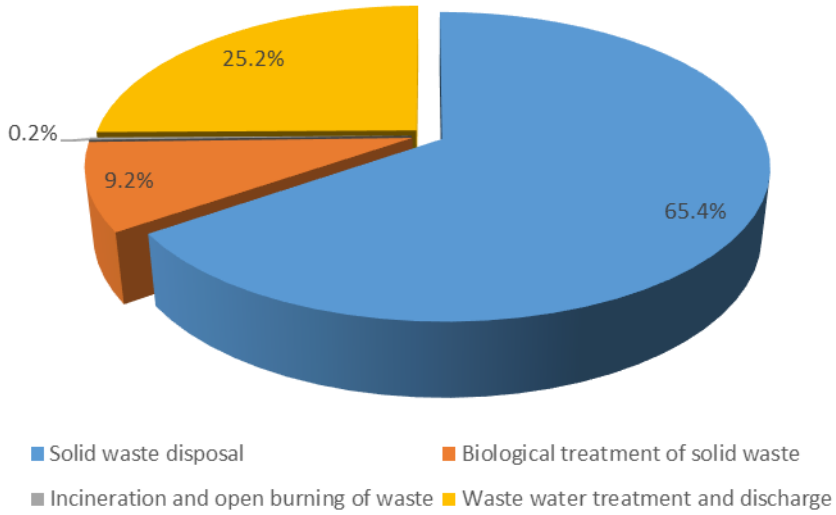

Figure 2.14. Share of emissions from waste sector by category, 2013

The total CO_2 equivalent emissions from the waste sector in 2013 increased by 0.5 per cent compared to the base year. The emissions from solid waste disposal increased by 13.4 per cent, nevertheless, the emissions from solid waste disposal are in decreasing trend. Emissions from biological treatment of solid waste increased 2,554.8 per cent. On the other hand, the CO_2 emitted from incineration and open burning of waste has decreased 64.6 per cent and wastewater treatment and discharge decreased 38.3 per cent.

In 1995 the GHG emissions from the waste sector decreased, which was due to CH_4 emissions from paper and sludge waste disposal on land decreasing. Total CO_2 equivalent emissions were highest in 2001, mostly due to significant increase in emissions mainly from solid waste disposal. Increasing trend of emission until 2001 is linked to the high amount deposited organics and food which were deposited due to low rate of waste sorting. The decrease of CO_2 from waste sector after 2004 is connected with the increasing amount of methane recovery from the landfills. CO_2 emission decrease starting from 2008 is connected with the financial crisis during 2007–2008. Financial crisis did not affect the waste sector immediately, because companies had prepared a raw material reserve. The total CO_2 equivalent in 2011 decreased significantly compared to previous years, mainly because of the change in the national currency, which raised prices in the country and therefore reduced consumption habits and waste generation. Also, the opening of Iru waste incineration plant in 2013 had a decreasing effect on the amount of deposited waste trend since 2010 (see Figure 2.15).

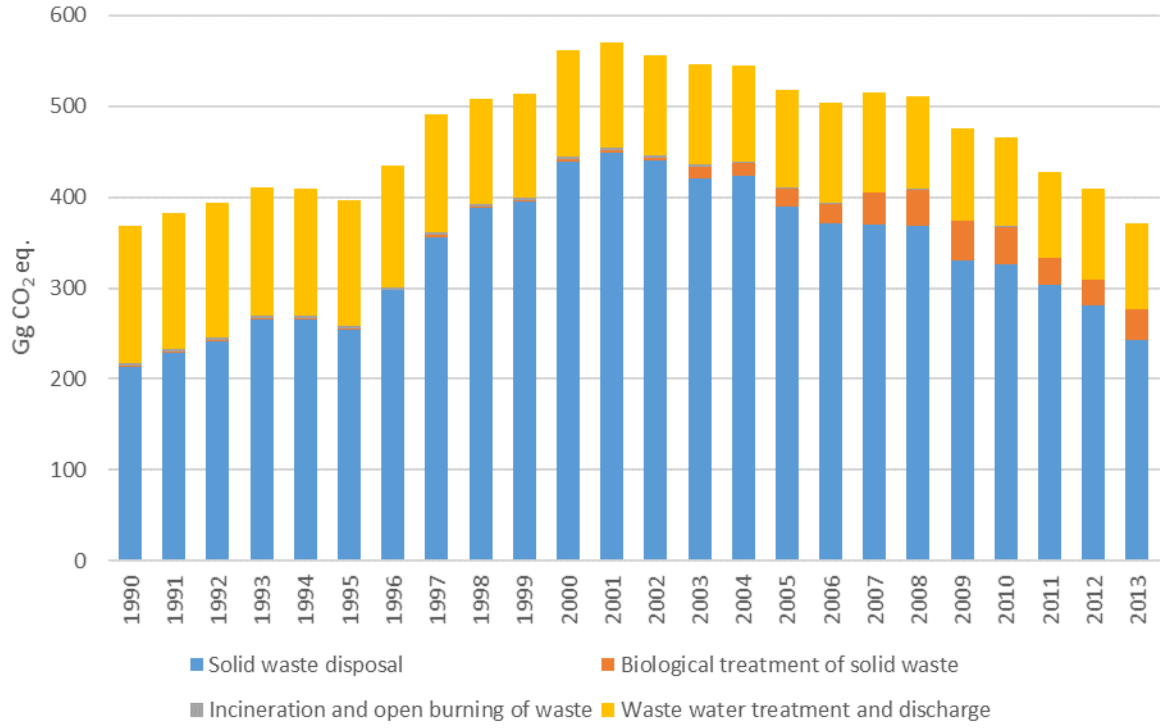

Figure 2.15. Greenhouse gas emissions from waste sector, 1990–2013, Gg CO_2 equivalent

2.1.2.6. Reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

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

Under Article 3, paragraph 3, of the Kyoto Protocol (KP), Estonia reports emissions and removals from afforestation (A), reforestation (R) and deforestation (D), and under Article 3, paragraph 4, emissions and removals from forest management (FM). In 2013, net emissions from Article 3.3 activities were 225.8 Gg CO_2 equivalent. Uptake from afforestation and reforestation activities, including emissions from biomass burning, was estimated at -183.2 Gg CO_2 equivalent, whereas deforestation resulted in a net emission of 409.1 Gg CO_2 equivalent and harvested wood products contributed to that with -28.99 Gg CO_2 equivalent. Areas subject to AR and D were 31,827 and 21,457 ha respectively by the end of 2013. Annual rates of afforestation and deforestation declined continuously from 0.80 kha to 0.22 kha per year for AR and from 2.13 kha to 1.0 kha per year for D during the period 2008–2013. In 2013, forest management contributed to the total GHG balance with an uptake of -0.13 Gg CO_2 equivalent and with HWP it was -859.91 Gg CO_2 equivalent. Total area of FM was 2,256.2 kha.

2.2. National inventory arrangements

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 contact in the MoE is:

Ms Katre Kets
Senior Officer, Climate and Radiation Department
Tel. +372 626 0754
Fax +372 626 2801
katre.kets@envir.ee

The MoE is responsible for:

- coordinating the inventory preparation process as a whole;
- approving the inventory before official submission to the UNFCCC;
- reporting the greenhouse gas inventory to the UNFCCC, including 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, including responses to the review findings.

Estonia's 2015 GHG inventory submission was compiled in collaboration between the MoE, the Estonian Environmental Research Centre (EERC) and the Estonian Environment Agency (EtEA).

The MoE contracted EERC to prepare the estimates for the energy, industrial processes and product use, agriculture and waste sectors and to coordinate inventory.

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 Forest Monitoring Department at the EtEA was responsible for the LULUCF and KP LULUCF sectors.

An overview of the division of responsibilities in 2015 inventory submission is shown in Figure 2.16.

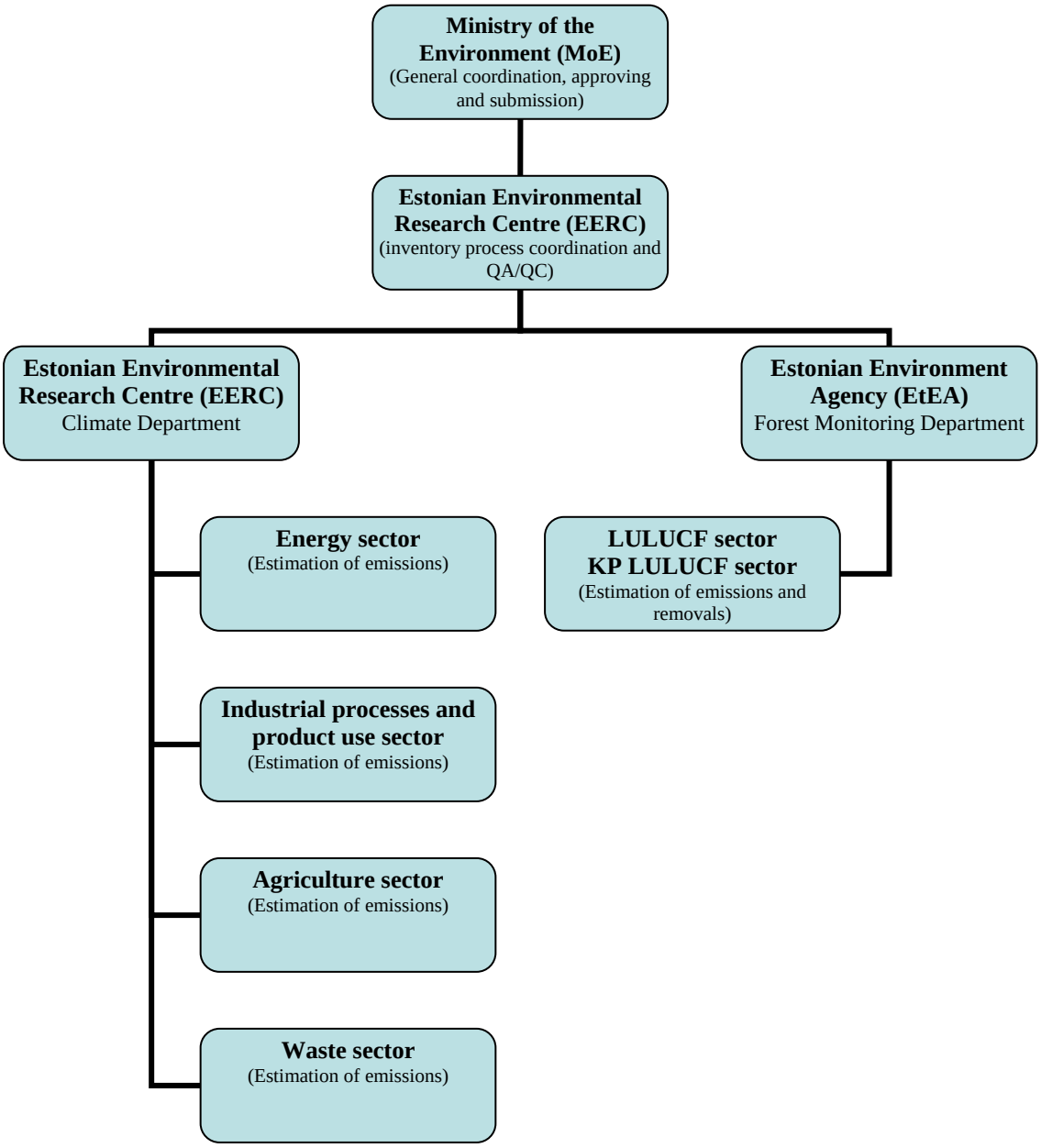

Figure 2.16. Overview of institutional arrangements for compilation of Estonia's 2015 GHG inventory

Legal arrangements

In accordance with §117 of the Ambient Air Protection Act (RT I 2004, 43,298), activities for the reduction of climate change are organised by the Ministry of the Environment on the basis of the requirements for the restriction of the limit values of emissions of greenhouse gases provided by the UNFCCC and the Kyoto Protocol to the UNFCCC. 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 European Union legislation.

The EtEA 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 12 of the Statute of the EtEA, the tasks of the Forest Monitoring Department are to plan, organize and perform forest monitoring and applied research, statistical forest inventory, land-use and land use change and carbon cycle monitoring, and to control, process and analyse monitoring 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). The MoE plans to use the three-year contract approach in the coming years to ensure the continuity of inventory preparation.

2.2.2. Inventory process

The UNFCCC, the Kyoto Protocol and the European Union (EU) greenhouse gas 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 greenhouse gas 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 Greenhouse Gas Inventories (IPCC 2006).

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 guidelines 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 is conducted according to the Tier 1 method presented by IPCC 2006. This method combines the uncertainty in activity rates and emission factors, for each source category and greenhouse gas, and then aggregates these uncertainties, for all source categories and greenhouse gases, to obtain the total uncertainty for the inventory. The uncertainty values for each source category are provided by sectoral experts, which in many cases are assigned based on default uncertainty estimates according to IPCC guidelines or expert judgements, as there is a lack of information.

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 both Tier 1 and Tier 2 method to identify key categories. 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 guidelines 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 in 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.

The MoE as the national entity has overall responsibility for the greenhouse gas inventory in Estonia, including 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.

Annual inventory meetings with experts from all institutes participating in inventory preparation are held three times a year. Bilateral quality meetings between the quality coordinator (the EERC) and the inventory experts are held whenever necessary.

QC procedures

The QC procedures used in Estonia's greenhouse gas inventory comply with IPCC 2006 Guidelines. General inventory QC checks (IPCC 2006, Volume 1, Table 6.1) 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 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.

The EERC checks the QC reports of sectoral experts. If it disagrees with a report, the errors are discussed and changes are made, where necessary. The EERC also carries out general QC of the NIR and CRF tables.

In addition to the general inventory QC procedures, Estonia applied category-specific QC procedures on some source/sink categories in the 2015 submission, focusing on key categories and on those categories in which significant methodological changes and/or data revisions occurred.

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.

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. In the 2015 submission the inventory was reviewed in parts by the Tallinn University of Technology, University of Tartu, Estonian University of Life Sciences and other national experts. A public review is also carried out. The draft NIR is uploaded to the MoE website, where all interested parties have the opportunity to comment on it. The comments received during these processes are reviewed and, as appropriate, incorporated into the inventory. In addition, the inventory is checked by different ministries and institutions (e.g. the Waste and Water Department of the MoE and Statistics Estonia).

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.

2.2.4. Changes in national inventory arrangements since NC6 and BR1

Since the 6th National Communication (NC6) and First Biennial Report (BR1) the following changes have occurred in Estonia's national inventory arrangements:

- As a result of the merger of the Estonian Meteorological and Hydrological Institute (EMHI) and the Estonian Environment Information Centre (EEIC), the Estonian Environment Agency (EtEA) was formed in 2013. The agency is the legal successor to its predecessors. The Forest Monitoring Department of the Estonian Environment Agency is responsible for LULUCF ja KP LULUCF estimates.

3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

3.1. The European Unions and its member states target under the Convention

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 per cent compared to 1990 levels (UNFCCC, 2014a). As this target under the convention has only been submitted by EU-28 and not by each of its Member States (MS), there are no specified convention targets for single MS. Due to this, Estonia as part of the EU-28, takes on a quantified economy-wide emission reduction target jointly with all Member States.

With the 2020 climate and energy package the EU has set internal rules which underpin the implementation of the target under the Convention. The 2020 climate and energy package introduced a clear approach to achieving the 20 per cent reduction of total GHG emissions from 1990 levels, which is equivalent to a 14 per cent reduction compared to 2005 levels. This 14 per cent reduction objective is divided between two sub-targets, equivalent to a split of the reduction effort between ETS and non-ETS sectors of two thirds vs one third (EU, 2009[5]).

Under the revised EU ETS Directive[6], one single EU ETS cap covers the EU Member States and the three participating non-EU Member States (Norway, Iceland and Liechtenstein), i.e. there are no further differentiated caps by country. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020; these decrease by 1.74 per cent annually, starting from the average level of allowances issued by Member States 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. For further information on the EU ETS and for information on the use of flexible mechanisms in the EU ETS see EU-BR chapter 4.2.2.

Non-ETS emissions are addressed under the Effort Sharing Decision (ESD)[7]. The ESD covers emissions from all sources outside the EU ETS, except for emissions from international maritime, domestic and international aviation (which were included in the EU ETS from 1 January 2012) and emissions and removals from land use, land-use change and forestry (LULUCF). It thus includes a diverse range of small-scale emitters in a wide range of sectors: transport (cars, trucks), buildings (in particular heating), services, small industrial installations, fugitive emissions from the energy

[5] 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 greenhouse gas 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).

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

[7] Decision No 406/2009/EC.

sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste. Such sources currently account for about 60 per cent of total GHG emissions in the EU.

While the EU ETS target is to be achieved by the EU as a whole, the ESD target was divided into national targets to be achieved individually by each Member State. In the Effort Sharing Decision national emission targets for 2020 are set, expressed as percentage changes from 2005 levels. These changes have been transferred into binding quantified annual reduction targets for the period from 2013 to 2020 (EC 2013)[8+9], expressed in Annual Emission Allocations (AEAs). The quantified annual reduction targets 2013–2020 of Estonia are tightened from 6.30 Million AEAs in 2013, increasing to 6.47 Million AEAs in 2020. In the year 2013 verified emission of stationary installations covered under the EU-ETS in Estonia summed up to 15.92 Mt CO_2 equivalent. With total GHG emissions of 21.75 Mt CO_2 equivalent (without LULUCF, with indirect) the share of ETS emissions is 73.2 per cent.

The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation[10]. 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 BR2.

The ESD allows Member States to make use of flexibility provisions for meeting their annual targets, with certain limitations. There is an annual limit of 3 per cent 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 Member States or be banked for own use until 2020.

Description of quantified economy-wide emissions reduction target is provided in Table 3.1 and CTF table 2.

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 Member States for the period 2013–2020 for those sectors not covered by the EU emissions trading system (ETS), expressed as percentage changes from 2005 levels.
Emission reductions target (% of base year/base period)	20%	
Emission reductions target	20%	

[8] Commission decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/162/EU).

[9] Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/634/EU).

[10] 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.

Emission reduction target: base year and target		
		Comments
(% of 1990)		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.
Period for reaching target	**BY-2020**	

Gases and sectors covered. GWP values.				
Gases covered	**Covered**	**Base Year**	**GWP[b] reference source**	**Comments**
CO_2	Yes	1990	IPCC AR4	as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation
CH_4	Yes	1990	IPCC AR4	as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation
N_2O	Yes	1990	IPCC AR4	as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation
HFCs	Yes	1990	IPCC AR4	as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation
PFCs	Yes	1990	IPCC AR4	as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation
SF_6	Yes	1990	IPCC AR4	as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation
NF_3	NO		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). The EU has decided on a reduced scope in the 2013–2016 period (Regulation (EU) No 421/2014 of the European Parliament and of the Council of 16 April 2014).

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

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 greenhouse gas 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 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.
AAUs		AAUs for the period 2013–2020 have not yet been determined. The EU expects to achieve its 20% target for the period 2013–2020 with the implementation of the ETS Directive and the ESD Decision in the non-ETS sectors which do not allow the use of AAUs from non-EU Parties.
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

Kyoto Protocol

Estonia is implementing the second commitment period of the Kyoto Protocol to the UNFCCC (2013–2020). The EU, its Member States and Iceland are implementing its targets under the Kyoto Protocol jointly.

The Estonian Low Carbon Development Strategy

In addition to the European target setting under the convention and under the EU climate and energy package, Estonia has (MoE) started to prepare *the Low Carbon*

Development Strategy, with the aim to decrease the GHG emissions 80 per cent by 2050 compared to 1990. The document expected to be endorsed by the Government in the end of 2016.

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 per cent 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 0.5 per cent in the year 2013.

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 2nd BR of the European Union.

The use of flexible mechanisms under the ESD cannot be quantified in the moment: As the compliance assessment for the first year 2013 under the ESD will only take place in 2016, any potential use of units for the first year will only take place in 2016. Thus, for the 2nd BR the EU and its MS can only report that no units have been used under the ESD so far. This is why no quantitative information can be given for the use of flexible mechanisms in BR2 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 is using two of the three Kyoto flexible mechanisms – Joint Implementation (JI) and International Emissions Trading.

4.1.1.1. Joint Implementation

In 1993 Estonia started working with Sweden on projects preceding Joint Implementation – Activities Implemented Jointly – where no actual emissions reductions were transferred. A total of 12 projects were implemented. Information on these projects is available on the UNFCCC website[11].

Since 2002, Estonia has been active in carrying out JI projects under the Kyoto flexible mechanisms. There were seven early mover projects that started generating emission reductions before 2008 and for those years Assigned Amount Units (AAUs each equal to 1 ton of CO_2 equivalent) were transferred to investor countries.

In 2004 Estonia signed a Memorandum of Understanding for JI projects with Austria, Denmark, Finland, the Netherlands and Sweden. Also, Estonia has signed the Agreement on a Testing Ground for Application of the Kyoto Mechanisms on Energy Projects in the Baltic Sea Region. Parties to the agreement (Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia and Sweden) agreed to establish a Testing Ground for the Baltic Sea Region to gain experience from and facilitate the use of JI under Article 6 and International Emissions Trading under Article 17 of the Kyoto Protocol and to implement projects generating emission reductions prior to and during the commitment period commencing in 2008, in order to reduce anthropogenic emissions of GHG in a cost-effective way.

Since May 2006 the Minister of the Environment has been designated by the Government to sign international agreements for JI projects. The Designated National Focal Point for Joint Implementation is the Ministry of the Environment. Guidelines for the procedure and implementation of JI projects in Estonia are available on the UNFCCC website.

During the commitment period 2008–2012 there were all together twelve JI projects (including 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 equivalent) were transferred to investor countries for the generated emission reductions.

[11] http://ji.unfccc.int/JI_Parties/DB/ZY0IK6ZF2CQKOTBPPY1MKN130ITMM7/viewDFP.

JI and CDM, as Kyoto flexible mechanisms, and their relation to the EU Emission Trading Scheme (EU ETS) and the national registry are regulated by the Ambient Air Protection Act.

By 31 December 2012, the twelve JI projects that have been implemented in Estonia resulted in a total emission reduction around 1.34 Mt CO_2-eq.

4.1.1.2. International Emissions Trading

In 2010 the Ambient Air Act was amended with provisions on AAU trading and procedures for the use of revenue from surplus AAUs in the framework of the Green Investment Scheme (GIS). All revenue from sales of surplus AAUs will be invested in environmentally friendly projects and programmes via the GIS. Also 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 MoE with the help of external experts is responsible for trade with AAUs (negotiations and signing the AAU sale and purchase agreements (SPAs)). For sales of AAUs, a government regulation is issued to approve each AAU SPA. The use of AAU revenue exclusively via GIS is required by the State Budget Act and the government regulation for the approval of AAU SPAs.

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

- energy efficiency (including thermal refurbishment) of buildings and district heating sector;
- efficient and environmentally benign transport;
- development of wind energy farms; and
- use of renewable energy.

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

4.1.2. The EU Emissions Trading System and Effort Sharing Decision

The two main overarching policies are the EU Emission Trading System (ETS) and the Effort Sharing Decision (ESD), both establishing EU internal rules under the '2020 climate and energy package' which underpin the implementation of the target under the Convention.

4.1.2.1. 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. It was established by Directive 2003/87/EC (the Emissions Trading Directive) and entered into force on 1 January 2005. The EU ETS was established in the context of international mitigation commitments under the Kyoto Protocol and aimed at helping Member States reach their individual Kyoto targets in a cost-effective manner.

Estonia's first National Allocation Plan (NAP) for the EU ETS for 2005–2007 included 43 installations. The first NAP for greenhouse gas emission allowances provided the right to emit 56.7 Mt of carbon dioxide in 2005–2007.

On 30 June 2006, Estonia submitted its second NAP for the EU ETS for 2008–2012 to the European Commission (EC) for approval. On 4 May 2007, the European Commission published the decision on the second NAP, reducing the total quantity of Estonia's allowances by 47.8 per cent, to 12.7 million tonnes of carbon dioxide per year. Based on this decision the Government of the Republic adopted, on 20 December 2007, Regulation No 257 on 'Total Allowance of Greenhouse Gases Emitted by Stationary Sources of Pollution and Allocation Plan Thereof for 2008–2012', which was used to implement the EU ETS in Estonia during 2008 and 2009. On 16 July 2007, Estonia contested the decision in the Court of First Instance of the European Communities. The Court agreed with Estonia's positions and annulled the Commission Decision of 4 May 2007 in its judgement of 23 September 2009. On 11 December 2009, the Commission took a new decision by revoking Estonia's NAP of 30 June 2006. As requested in the Decision of 11 December 2009, Estonia, following numerous consultations with the EC, submitted the revised second NAP to the European Commission for approval in February 2011. In the revised NAP2 Estonia applied for 71.65 Mt of allowances (14.44 Mt/a). In April 2011 the Commission, with its decision, also rejected the revised NAP2. Another revised plan was compiled and presented to the EC in September 2011. In December 2011 the EC adopted the NAP2 of Estonia. Finally, the NAP2 for the period 2008–2012 was legally enforced in December 2011 with a Regulation of the Government (No 183; 22.12.2011). This plan 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.

Estonia's third emission trading period for 2013–2020 includes 46 installation from eight fields including 3 aircraft operators. The total CO_2 eq. for 2013 was 15.92 Mt.

Article 10c of the EU Emissions Trading Directive (Directive 2003/87/EC as amended by Directive 2009/29/EC) allows several Member States (incl. Estonia) to allocate carbon emission allowances free of charge, provided that the funds are used to modernize the energy system. Estonia has applied for free allocation of a certain amount of allowances for the electricity sector. In June 2012 the EC concluded that provisions of Estonia's development plan for the electricity sector allocating carbon emissions trading allowances free of charge are in line with EU state aid rules. During the transition period (2013–2019) Estonia is permitted to allocate 20 Mt of emission allowances free of charge to electricity producers included in the EU ETS.

The Estonian national investment plan includes 13 investments. As of January 2014 4 of them were successfully finished and 3 investments were not needed anymore as the required values of the investments were fulfilled. 2 investments are postponed, 1 investment will start in 2018, 1 will not be taken, 1 is ongoing and 1 investment will be replaced with similar alternative project in the same power plant but as the replacement of the investment in the context of Article 10c is not allowed then any allowances will not be allocated to them.

In 2014 electricity producers received 5,135,166 allowances and in 2015 they received 4,401,568 allowances under the Article 10c derogation.

4.1.2.2. Effort Sharing Decision

The Effort Sharing Decision (Decision No 406/2009/EC – ESD) establishes annual targets for the GHG emissions of Member States between 2013 and 2020, which are legally binding and only refer 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 per cent below 1990 levels by 2020. Information on Estonia's annual reduction targets 2013–2020 is provided in Chapter 3.1.

4.1.3. Cross-cutting measures

4.1.3.1. General documents and EU assistance

The *Sustainable Development Act* was adopted by the Parliament in 1995. It establishes the principles for the sustainable use of natural environment and resources. The *Estonian National Strategy on Sustainable Development – Sustainable Estonia 21* was approved by the Parliament in 2005 and is the most general national strategy document aimed at developing the Estonian state and society until the year 2030.

More concrete long-term environmental development objectives are formulated in the *National Environmental Strategy until 2030* endorsed by the Parliament in 2007. Also in 2007 the Government approved the *Environmental Action Plan for 2007–2013* prepared by the Ministry of the Environment (MoE). The plan identifies basic activities that help to achieve the goals set in the longer-term environmental strategy. Among others, the plan establishes measures for a reduction in waste generation, balancing the use of forests, eliminating the use of substances depleting the ozone layer, developing an environment-friendly and comfortable public transport system, etc. The plan includes both EU-oriented and national activities, for example reducing the environmental impact of the energy sector and elimination of residual pollution. The estimated implementation costs of the action plan valid until 2013 amount to more than 4.88 billion EUR (in 2006 prices). The planned total budget for measures mitigating climate change and improving the quality of ambient air is 3.11 billion EUR (2006).The financing comes mainly from various EU funds, as well as from the state, local governments' budgets and companies.

In the *Government Action Program 2011–2015* high priority has been given to environment related issues. Two major goals related to GHG mitigation are set by 2015:

- to increase the share of renewables in final energy consumption up to 23.6 per cent
- to stabilize the total GHG emissions at the level of 2010 (20 Mt CO_2 equivalent)

The national reform program '*Estonia 2020'* was approved by the Government in April 2011. It is updated yearly by the end of April. The last update was done in April 2014. The programme sets 3 main targets regarding GHG emissions and environmental economy and energy:

1) The GHG emissions covered by the Decision no 406/2009/EC (Effort Sharing Decision – ESD) should not exceed 6,269 Gg in 2020. This is in accordance with the ESD target set to Estonia (11% increase by 2020 compared to 2005)
2) 25% share of renewable energy in final energy consumption by 2020
3) Keep the final energy consumption in the 2010 level (about 118 PJ)

The target of reaching the 25 per cent share of renewable energy in final energy consumption was already reached in 2012 (25.8 per cent). This means that reaching the 2020 target requires the 2012 level to be sustained.

Keeping the final energy consumption in the 2010 level by 2020 foresees the increase in energy efficiency in almost all subsectors. The most important are – households, industry, transport and public sector.

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 Low-Carbon Economy in Estonia*' in 2013. In the report it was concluded, that for Estonia the 75 per cent decrease in GHG emissions by the year 2050 (compared to 1990) would be the most optimal amount. On the basis of the report on *'Opportunities for Low-Carbon Economy in Estonia*', in the beginning of 2015 the MoE started to prepare *the Low Carbon Development Strategy*, with the aim to decrease the GHG emissions 80 per cent by 2050 compared to 1990. The document is expected to be endorsed by the Government in the end of 2016.

European Union Structural Assistance to Estonia

In the period of 2007–2013 Estonia was allocated more than 3.40 billion Euros from the structural assistance, out of which the Environmental Investment Centre (EIC) mediated 728.6 milion Euros to the environment sector.

For the programming period of 2014–2020, the EU support to Estonia via Partnership Agreement conforms 4.4 bln Euros, out of which 3.53 bln are Cohesion Policy funds, 725 mln EAFRD (European Agricultural Fund for Rural Development) and about 101 mln is EMFF (The european Maritime and Fisheries Fund). The amounts might be subject to change as the negotiations on the EMFF are still ongoing.

As a mediator of Estonian environmental fees, the EIC supported 832 initiatives in 2013, in the total amount more than 36 million Euros. The EIC mediated a total of 184.8 million Euros of foreign aid together with co-financing in 2013. In 2014, EIC supported environmental projects with 41 million Euros and mediated a total of 122.5 million Euros of foreign aid together with co-financing.

4.1.3.2. Fiscal measures

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

Excise duties

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 per cent 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 per cent 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 per cent, 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 4.1.

Table 4.1. Excise tax on fuels and energy (as of 1st of July 2015)

Fuel / energy type	Unit	EUR/unit
Unleaded petrol	1,000 l	422.77
Kerosene	1,000 l	330.10
Gas oil (diesel fuel)	1,000 l	392.92
Gas oil fuel for specific purposes	1,000 l	110.95
LPG	t	125.26
Gas oil (light fuel oil)	1,000 l	110.95
Heavy fuel oil	t	15.01
Shale oil	t	15.01
Coal, coke	GJ	0.30
Natural gas (as heating fuel)	1,000 m^3	28.14 (starting from 01.01.2016: 33,77€; starting from 01.01.2017: 40,52€)
Oil shale	GJ	0.30

Fuel / energy type	Unit	EUR/unit
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 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 0.3 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. In the case of CO_2 emissions in quantities larger than those provided in the emission permit, higher charge rates apply: since 1 January 2008 the penalty rate has been 100 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 per cent 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.*

4.1.4. Energy sector

In August 2013 the compilation of *National Development Plan for Energy Sector 2030+* (NDPES) was started with the decision of the Government. The plan deals with the developments of the following sectors: electricity, heat, fuels, transport and housing. The draft act was compiled in December 2014 and the plan was approved by the ministries in 2015 (draft act still to be proved by Government).

The NDPES aggregates different fields regarding energy sector. Therefore the plan replaces *National Development Plan for Energy Sector 2020, National Development Plan for Electricity Sector 2018, National Energy Technology Program* and *National Development Plan for Housing Sector 2008–2013*.

In addition, the NDPES determines the starting points of the following development plans that come from the European Union legislation and have to be reported to the European Commission: *National Renewable Energy Action Plan* (according to 2009/28/EC); *National Energy Efficiency Action Plan* (according to 2012/27/EU); *National Building Renovation Strategy* (according to 2012/27/EU). The target of aggregating different fields dealt with in the plan is to reduce the amount of documents regulating different aspects of energy sector and to rally the comprehensive planning of energy sector under one development plan.

The NDPES describes the strategic goals of Estonian energy policy until 2030 and the vision of energy sector until 2050. It also describes the measures to achieve the overall goals and subgoals. The purpose of energy sector is to ensure continuous energy (including fuels) supply with cheap prices and low environmental impacts to the consumers. There are mainly three subgoals set to help to achieve the overall purpose of the plan:

- to ensure continuous energy supply in Estonia;
- to optimize the energy supply and consumption;
- to improve the overall economic situation in Estonia

Estonia participates in different international cooperation forums for efficient achievement of energy related goals and to contribute to energy sector on international and regional level – International Energy Agency (IEA), Energy Charter, Baltic Sea Region Energy Cooperation (BASREC), International Renewable Energy Alliance (REN), World Energy Council (WEC).

The frameworks influencing the choices regarding energy sector are the *2020 EU climate and energy package*, *2030 EU climate and energy framework* and the *EU Roadmap for moving to a low carbon economy in 2050*.

The National Renewable Energy Action Plan until 2020 was approved by the Government in 2010 (with its implementation plan for years 2010–2013). This plan is a comprehensive document summarizing the national renewable energy policies, forecasting final energy consumption and setting out renewable energy targets and forecast trajectories until 2020. The action plan is one of the fundamental documents for achieving the European Union Renewables Directive (2009/28/EC) targets and gives a comprehensive outlook of the development of the renewables sector.

Estonia renewable energy 2020 targets are:

- Overall target: 25 per cent of renewable energy in final consumption;
- Heating and cooling: 18 per cent of demand met by renewable energy sources;
- Electricity: 5 per cent of electricity demand met by electricity generated from renewable energy sources;
- Transport: 10 per cent of energy demand met by renewable energy sources.

The support rates for renewable and efficient CHP based electricity are presented in Table 4.2.

Table 4.2. Support for renewable and efficient CHP based electricity production

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

The support is paid by the transmission network operator (AS Elering) and funded by all electricity consumers according to the volume of network services used and the amount of electricity consumed. In 2013, a total of 57.8 MEUR renewable energy support was paid (in 2011 it was 62.0 MEUR and in 2012 it was 67.0 MEUR). The tariff rate in 2013 for consumers was 0.870 euro cents per kWh (in 2011 it was 0.615 and in 2012 0.970 euro cents per kWh).

Oil shale is the main domestic fuel in Estonia, therefore to ensure the long-term balanced use of it, the *National Development Plan for the use of Oil Shale 2008–2015* was prepared to specify the plans for use of oil shale as a nationally strategic indigenous energy resource. These plans include also an assessment of the use of shale fuel oil and oil shale gas taking into account economic, social, security and environmental issues. In the Plan, the upper limit on the amount of annual mining of oil shale has been set at 20[12] million tons with the intention to reduce it to 15 million tons by 2015. The Plan was endorsed by the Parliament in October 2008. In current legislation, the limit of 20 million tons is set.

In April 2013, the Government approved the drafting of the *National Development Plan for the use of Oil Shale 2016–2030*. In February 2015, the draft version of the plan was practically finished as well as the discussions about the activities in the action plan. The document has been approved by the Government in December 2015.

The *National Development Plan for the use of Oil Shale 2016–2030* aims to ensure the sustainable and efficient mining and use of oil shale that will assure the sustainable development of oil shale industry. It also aims to minimize the environmental impacts of the oil shale industry. The three main strategic goals are to: increase the efficiency and decrease the environmental effects of oil shale mining, increase the efficiency and decrease the environmental impacts of oil shale use, research and development in the oil shale sector. Also the limit of annual mining of oil shale is still set at 20 million tons. Due to growing shale oil industry no longer the intention to reduce it to 15 million tons applies.

The *Transport Development Plan 2014–2020* was approved by the Parliament in February 2014. The main purpose of the *Transport Development Plan 2014–2020* is to allow for the movement of people and goods in convenient, quick, safe and lasting

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

way as the well- functioning transport system is crucial for the essential functioning of every-day life. There are different demands for the structure and the system in different environments: in urban areas the light traffic and public transport play the key role, whereas in rural areas the quality and safety of roads are the priority.

The main sub-goals set in the plan are:

- Convenient and smart mobility;
- Quality of roads and smooth traffic;
- Reduced road damage;
- Reduced environmental impact of transport sector;
- Comfortable and modern public transport;
- International connections supporting tourism and business;
- Increased international volume of freight transport.

Encouraging the use of renewable fuels in transport foresees, that the use of biomethane and electricity is preferred in transport. The production and use of biomethane is promoted with the creation of infrastructure and with the use of suitable fleet in public transport. Also, the state will ensure the operation of fast charging network for electric vehicles.

4.1.4.1. Energy industries

Electricity supply

According to the NDPES new electricity production units have to be competitive in open electricity market without any subsidies. The support schemes for new production units will be 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 estimated in the projections of the electricity supply are based on known investments with following measures:

- Support for renewable and efficient CHP based electricity production – The support rates are presented in Table 4.2.
- 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.
- 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.
- 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). The cost of investment is planned to be 640 MEUR. The plant is expected to start working in 2015. The new plant has been projected so, that it enables to use biomass as 50 per cent of the fuel input.

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

Table 4.3. Projected effects of the measures in electricity production, Gg CO_2 equivalent

	2015	2020	2025	2030
Support for renewable and efficient CHP based electricity production	885.9	1,010.1	1,124.9	1,154.1
Investments through GIS for construction of wind parks	66.0	66.0	66.0	66.0
Replacement of oil shale production units (2x215 MW)	619.7	632.7	552.4	9.8
Replacement of oil shale production unit (300 MW)	236.7	631.2	733.6	565.6

Heat supply

Heat supply, particularly district heating, is a sector with quite large potential for increasing energy efficiency, which in turn will result in lower GHG emissions. The goals set in the NDPES 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 per cent, the share of imported fuels less than 30 per cent and the use of primary energy less than 19 TWh per year by 2030.

The main measures taken into account in the projections include:

- Renovation of boiler houses – 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.
- 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.
- 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.
- Investments through Green Investment Scheme for reconstruction of boilerhouses and heat networks.
- 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.

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

Table 4.4. Projected effects of the measures in heat production in the WM scenario, Gg CO_2 equivalent

	2015	2020	2025	2030
Renovation of boiler houses	3.6	71.2	82.7	143.5
Renovation of heat networks	2.7	52.6	61.3	106.3

	2015	2020	2025	2030
Transition of consumers to local and place heating	1.1	21.6	25.2	43.8
Investments through Green Investment Scheme for reconstruction of boiler houses and heat networks	96.5	96.5	96.5	96.5
Investments through the European Regional Development Fund for reconstruction of boiler houses and heat networks	60.0	60.0	60.0	60.0

Table 4.5. Projected effects of the measures in heat production in the WAM scenario, Gg CO_2 equivalent

	2015	2020	2025	2030
Additional renovation of boiler houses	3.5	67.7	79.0	136.8
Additional renovation of heat networks	9.5	184.4	214.5	372.4
Additional transition of consumers to local and place heating	2.5	49.6	57.5	100.1

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

4.1.4.2. Manufacturing industries and construction

According to the *National Development Plan for the Energy Sector 2030+* projections in the manufacturing industries and construction sector are not divided into different scenarios. Only the most realistic scenario is described and used in the projections. Therefore no special measures, that could been evaluated regarding GHG emission reductions, are foreseen.

However, in the *Second National Energy Efficiency Action Plan* it is declared, that energy consumption in industry has become more efficient due to 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. Therefore it is concluded that energy efficiency measures for industry must focus primarily on improving of the skills and awareness of specialists. This is also confirmed in the *Third National Energy Efficie*ncy *Action Plan*.

4.1.4.3. Transport sector

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 following measures are included to the projections:

- Increasing the share of biofuels in transport sector – The main target of this

measure is to achieve the 10 per cent share of biofuels in transport sector by 2020.

- Increasing the fuel economy in transport – Includes developing support system for energy efficient cars and also support the use of hybrid buses, hybrid trolleys, electrical buses etc. The expected cost is at least 6 MEUR annually.
- Promoting the economical driving – Includes promoting the eco-driving and also developing light traffic systems. The expected cost of this measure is to be 14 MEUR annually.
- 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 in rush hours. The expected cost is about 0.5 MEUR annually.
- Improvement of the traffic system – Includes updating the parking policies in cities, planning the land use to reduce the use of private cars, restructuring the streets in cities, etc. The expected cost is about 16.7 MEUR annually.
- Developing 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.
- Road usage fees for cars and heavy duty vehicles – Based on the mileage, location, environmental aspects, etc. The expected cost is about 62 MEUR annually.
- Developing and implementing congestion charge system in Tallinn (the capital of Estonia) – The expected cost is about 13 MEUR annually.
- Developing the railroad infrastructure (includes the building of *Rail Baltic*) – The expected cost of *Rail Baltic* is 30 MEUR annually (on 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.

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

Table 4.6. Projected effects of the measures in transport sector in the WM scenario, Gg CO_2 equivalent

	2015	**2020**	**2025**	**2030**
Increasing the share of biofuels in transport	122.2	244.0	372.8	501.6
Increasing the fuel economy in transport	11.6	40.8	69.9	99.0
Promoting the economical driving	10.4	36.3	62.5	88.3
Reducing forced movements with personal vehicles in transport	4.4	15.4	26.4	37.4
Improvement of the traffic system	11.3	39.5	67.6	95.9
Developing convenient and modern public transport	6.3	22.2	38.0	53.8

Table 4.7. Projected effects of the measures in transport sector in the WAM scenario, Gg CO_2 equivalent

	2015	**2020**	**2025**	**2030**
Increasing the fuel economy in transport*	20.6	21.9	42.1	62.2
Promoting the economical driving*	24.0	31.3	60.2	88.9
Reducing forced movements with personal vehicles in transport*	17.2	18.5	35.7	52.7
Improvement of the traffic system*	80.7	92.5	178.0	262.8

	2015	2020	2025	2030
Developing convenient and modern public transport*	29.2	37.4	71.9	106.2
Road usage fees for cars and heavy duty vehicles	0.0	94.6	181.7	268.3
Developing and implementing congestion charge system in Tallinn (the capital of Estonia)	0.0	23.1	44.6	65.8
Developing the railroad infrastructure (includes the building of *Rail Baltic*)	0.0	11.0	21.2	31.4

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

4.1.4.4. 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 the other sector's WM scenario the following measures are taken into account:

- Reconstruction of public and commercial buildings – reconstruction of 10 per cent of the existing buildings in the 20 year period (energy efficiency class D).
- Reconstruction of private houses and apartment buildings – reconstruction of 10 per cent of existing private houses (energy efficiency class E) and 15 per cent of existing apartment buildings in the 20 year period (energy efficiency class E). The expected cost of the measure is about 3.5 MEUR annually.
- Implementation of the minimum requirements for nearly zero buildings.
- Promotion of use of energy efficient electrical appliances in residential sector.
- Investments through Green Investment Scheme to the improvement of energy efficiency in public buildings – Between 2010 and 2013, total of 540 public buildings were reconstructed. Total cost of the measure is 165.6 MEUR.
- Investments through Green Investment Scheme to the improvement of energy efficiency in residential buildings – Grants of 15 per cent to 35 per cent of the total cost of renovation was supported from this measure. The total cost of the measure is 28 MEUR.

Investments through Green Investment Scheme to street lighting reconstruction programme – In 2012, the Estonian Environmental Investment Centre launched a programme 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 succsessfully replaced.The expected energy saving is around 5 GWh per year. The total cost of the program is estimated to be over 10 MEUR.

In the other sector's WAM scenario the following measures have been taken into account:

- Reconstruction of public and commercial buildings – reconstruction of 20 per cent of the existing buildings in the 20 year period (energy efficiency class C);
- Reconstruction of private houses and apartment buildings – reconstruction of 40 per cent of existing private houses (energy efficiency classes C and D) and 50 per

cent of existing apartment buildings in the 20 year period (energy efficiency class C);

- Accelerated implementation of the minimum requirements for nearly zero buildings.

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

Table 4.8. Projected effects of the measures in other sectors in the WM scenario, Gg CO_2 equivalent

	2015	2020	2025	2030
Reconstruction of public and commercial buildings	0.3	0.9	1.4	1.8
Reconstruction of private houses and apartment buildings	0.5	1.7	2.5	3.3
Implementation of the minimum requirements for nearly zero buildings	1.5	5.3	7.9	10.5
Promotion of use of energy efficient electrical appliances in residential sector	47.7	44.9	38.7	30.8
Investments through Green Investment Scheme to the improvement of energy efficiency in public buildings	27.8	27.8	27.8	27.8
Investments through Green Investment Scheme to the improvement of energy efficiency in residential buildings	28.0	28.0	28.0	28.0
Investments through Green Investment Scheme to street lighting reconstruction programme	1.6	1.5	1.3	1.0

Table 4.9. Projected effects of the measures in other sectors in the WM scenario, Gg CO_2 equivalent

	2015	2020	2025	2030
Reconstruction of public and commercial buildings	0.8	2.8	4.3	5.7
Reconstruction of private houses and apartment buildings	10.5	36.9	55.3	73.7
Implementation of the minimum requirements for nearly zero buildings	2.3	7.9	11.9	15.8

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

4.1.5. IPPU sector

The *Industrial Emissions Act* (adopted on April 2013) enforces certain manufacturing enterprises to implement best available techniques and minimise emissions. The *Industrial Emissions Act* was implemented on the base of Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions. Until 31.05.2013 the Act of Integrated Pollution Prevention and Control was in force and was implemented until 07.01.2014 in certain cases (the law act was consistent with the Directive 2008/1/EC of the European Parliament and of the

Council of 15 January 2008 concerning integrated pollution prevention and control and earlier with the Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control).

The emission curbing measure on the basis of the *Industrial Emissions Act* of the Estonian Parliament and its forerunner *Act of Integrated Pollution Prevention and Control* is enforcing industries to use best available techniques. This measure is implemented by means of duty of integrated environmental permits and domestic reporting of emissions.

According to the integrated environmental permits most of Estonian mineral and chemical industries are already implementing best available techniques to assure minimal emissions from their manufacturing processes. Only one company has to implement better techniques to lessen CO_2 emissions from its manufacturing process and another company is going to update their manufacturing process for feasibility reasons. 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. Because most of the industrial processes which emissions are belonging to EU ETS, already have minimal possible CO_2 emissions, the effect of one industry minimising its emissions is very small.

The Regulation (EU) No 842/2006 on certain fluorinated greenhouse gases had direct effect on the F-gas emissions in 2013 (base year) and indirect effect on the 2015 emissions (because the stock of F-gases in equipment was built up while the Regulation (EU) No 842/2006 was in force).

The Regulation (EU) No 517/2014 on fluorinated greenhouse gases (came into force from 1st of January 2015) strictly imposes a schedule for phase-down of F-gases, 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 greenhouse gases 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.

The aforementioned measures and their effect is handled as one measure (named as „bans and duties from the Regulation (EU) No 517/2014"), because 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 industrial processes and product use sector, Gg CO_2 equivalent

	2015	**2020**	**2025**	**2030**
The obligation of implementing best available techniques	0.0	0.0	0.0	0.0
Bans and obligations from the Regulation No 517/2014 EU on fluorinated greenhouse gases	-2.6	1.6	44.5	77.2

4.1.6. Agriculture sector

In 2013 the *Climate Change Mitigation and Adaptation Action Plan in Agriculture sector 2012–2020* was drafted and approved by the Minister of Rural Affairs. The main goals of the plan are to limit the increase of GHG emissions from the agriculture sector, analyze the climate change assessment methodology and statistics increase the sequestration of GHGs and hedging the risks of climate change to agriculture.

Estonian Organic Farming Development Plan 2014–2020 (EOFD) is in particular needed to improve the competitiveness of organic farming and to increase the consumption of local organic food. The development plan shall address under the general subject of organic farming the following topics: organic plant production and livestock production, processing, distribution, consumption and catering, but also researches in organic farming, training and supervision. EOFD *and Estonian Rural Development Plan 2007–2013* (ERDP) have had a positive impact on the development of the organic sector. Strong emphasis has been placed on extension of organic plant production and livestock production, on training the people engaged in organic farming, on informing customers and on developing the control system of organic farming. The organic production support, paid within the framework of the agri-environment support, has been an important factor in the development of organic farming.

ERDP for 2014–2020 aimed to support Estonian rural development in a manner that is complementary to other measures of the European Union Common Agricultural Policy (CAP), cohesion policy and the European Common Fisheries Policy. Additionally, Estonian Ministry of Rural Affairs wants to help to 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.

In the ERDP there are two priorities that are directly addressed to reducing GHG emissions and increasing carbon uptake:

> Priority 4: Restoring, preserving and improving agricultural and forestry ecosystems. The objective is to ensure that environmentally friendly agricultural land use is taking into account regional specificities and the preservation of agriculture and forestry with biodiversity, traditional landscapes and high nature value is ensured.
>
> Priority 5: Promoting resource efficiency and supporting the transition to low CO_2 emissions and climate resilient economy in agriculture, food and forestry sectors. The objective is to make energy saving and energy efficiency investments in the agriculture and the food industry, reduce GHG and ammonia emissions and promote the conservation and capture of CO_2 in agriculture and forestry.

Climate change mitigation and adaptation has been considered in the development of several measures. The majority of environmental investment grants combined with different environmental awareness raising activities contribute directly or indirectly to

these efforts in the ERDP. Under *ERDP* the following priorities and measures strive to limit and reduce GHG emissions in the agricultural sector.

- Facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw material for purposes of the bio-economy - The main requirement underlined within this measure is to support the production of heat and electricity from biogas. The objectives are furthered by activities of article 17 in the development plan which include activity type "Investments to improve the productivity of agricultural enterprises" within the framework of which investments are endorsed to produce electricity, heat, liquid fuels or gas out of biomass. Despite of the vast potential, the use of manure as raw material for biogas plants is not a common practice in Estonia. Planned investments: 18 MEUR (2020).
- Reducing GHG and ammonia emissions from agriculture sector – The main goal is to include 49.6 per cent of the agricultural land currently in use under economizing agreements to reduce N_2O and CH_4 emissions by 2020. The objectives regarding this measure include promoting the use of biomass, producing renewable energy, investing in livestock buildings (including manure storage), increasing the technological capacity of agricultural enterprises.
- Fostering carbon conservation and sequestration in agriculture and forestry – The main goal is to include 14.8 per cent of the agricultural and forest land currently in use under economizing agreements to further carbon sequestration by 2020. The measure includes the requirements to reduce the tillage of histosols and to contribute into counselling and training activities to promote sustainable agricultural management.
- Organic farming - The objectives of the support for organic farming are: to support and improve the competitiveness of organic farming; to increase biological and landscape diversity and to maintain and improve soil fertility and water quality. Organic farm land constituted 15.3 per cent of the total agricultural land in Estonia in 2012. 75 per cent of organic farm land was grassland. Cost of measure will be approximately 92.2 MEUR.
- 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 measure is expected to be 583,000 EUR.
- Support for environmentally friendly management - The objectives are: 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 170 MEUR.
- Under the EU CAP the Greening measure aims to limit and reduce GHG emissions and to enhance carbon sequestration on croplands. The objective of the measure is to make farms with monocultures more environmentally friendly and sustainable. The expected cost of the measure is 900 MEUR.

The objective of *Estonian Dairy Strategy 2012–2020* is to increase the volume of milk production and processing and to ensure sustainability by the year 2020. The vision in the *Estonian Dairy Strategy* states that Estonian sustainable and competitive dairy sector is oriented toward the production of high value added milk products meeting market demand (incl. increasing volume of organic products) and towards export, supported by vertical and horizontal cooperation. Those Member States for which dairy production is important like Estonia attempt to plan strategically how to face the coming changes and to use the concurrent opportunities for dairy development. The problem analysis and purpose setting of the strategy was used as an input in the *ERDP 2014–2020.*

Strategic goal of the *Estonian Dairy Strategy 2012–2020* is to increase milk production and to improve the efficiency of production and growth in the number of dairy cows. This will have an impact on the greenhouse gases originating from the agricultural sector. The objective is to ensure the chain based sustainability of the dairy sector, to maintain the annual milk production in the short run and to increase it by a third in the long run, increasing the number of dairy cows and improving milk production. Sustainability, efficiency and increase will be achieved by the reconstruction of livestock buildings, increase in cowshed occupancy rate and energy efficiency, use of scientific cooperation for the improvement of animal genetic material and feeding and for the extension of the period to keep animals in the herd in an environmentally friendly way, preserving natural resources and in view of structural balance. By the current average milk yield and in order to increase milk production by a third the number of dairy cows must be increased by 33.5 thousand animals, this can bring about the need for max. 67 thousand hectares of agricultural land (presuming that the land quality rating will be the same).

National Development Plan for Energy Sector 2030+ describes the objectives of Estonia's energy policy until 2030 and the vision of energy management until 2050, objectives, sub-goals 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, including a 10 per cent renewables in transport sector.

The indicators and target levels regarding agriculture sector are presented in Table 4.11.

Table 4.11. Indicators and target levels set in Estonian Dairy Strategy 2012–2020, Rural Development Plan 2014–2020 and Estonian Organic Farming Development Plant 2014–2020

Indicator	**Baseline level**	**Target level 2020**
Agricultural land currently in use under economizing agreements to reduce N_2O and CH_4 emissions, ha		49.6 per cent
Agricultural and forest land currently in use under economizing agreements to further carbon sequestration, ha		14.8 per cent
Increase milk production by a third compared to 2011, tons	692,987 (2011)	923,983
Organically farmed land, ha	153,426 (2013)	180,000

The projected effects of the measures available in the agriculture sector are presented in Table 4.12.

Table 4.12. Projected effects of the measures in the agriculture sector, Gg CO_2 equivalent

	2015	2020	2025	2030
Facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw material for purposes of the bio-economy.	0.6	4.5	7.7	11.3

4.1.7. LULUCF sector

Land use, land-use change and forestry (LULUCF) sector comprises forest land, cropland, grassland, wetlands and settlements, therefore there are several cross-cutting as well as land category based strategic documents and policies addressing the LULUCF sector.

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

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

Subsequently, the measures related to the LULUCF sector are described. Although the cost of implementing the measures has been provided, quantitative impact of the expected effect on emissions and removals is not available.

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 achieve continuous carbon sequestration on forest land and therefore maintain the level of GHG removals by forests in Estonia.

The Estonian Forestry Development Programme until 2020 (*EFDP*), 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 4.13 the main indicators and target levels are presented for the current situation and for 2020.

Table 4.13. Indicators and target levels set in Estonian Forestry Development Programme until 2020

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

According to the *EFDP* 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 because of not using forest resources would be unreasonable waste of renewables.

Achieving the objectives of the *Forestry Development Plan* is supported by the *Estonian Rural Development Plan for 2014–2020* (*ERDP*) being enforced by the Ministry of Rural Affairs, 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 to 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.

Under the *Rural Development Programme 2014–2020* the following measures pursue limit and reduce GHG emissions and enhance carbon sequestration:

- 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 583,000 EUR.
- Support for the establishment of protection forest on agricultural land – With the establishment of protection 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.
- 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 24.5 MEUR.

- 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.

Measures included in the projections on grassland, wetland and grazing land management include:

- 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.
- 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. During the years 2006–2013 Estonia was able to meet the requirement. The new level on permanent grasslands will be determined by the basis of the applications submitted in 2015.
- 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 firests, degraded raised bogs still capable of natural regeneration) in protected areas. Cost of the measure is expected to be about 0.6 MEUR in 2014, 2.1 MEUR in 2015, 1.9 MEUR in 2016 and 2.7 MEUR in 2017.

The Estonian Forestry Development Programme until 2020 and *the Rural Development Programme 2014–2020* comprise the following measures that target sustainable use of forest, *inter alia* increase of forest carbon pools:

- 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 77,000 EUR in 2014, 64,000 EUR in 2015 and 500,000 EUR in 2016–2020.
- 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 915,000 EUR in 2014 and 2015 and about 4.6 MEUR in the period 2016–2020.

- 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 was 629,000 EUR in 2014.
- 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 65,000 EUR in 2014 and 2015 and 325,000 EUR in the period 2016–2020.
- Natura 2000 support for private forest land - Measure aims to maintain biological and landscape diversity in Natura 2000 areas covered with forests. Natura 2000 areas cover 16 per cent of Estonian forests. Cost of the measure is expected to be about 28 MEUR.
- Improvement of forest economic and ecological vitality - The overall objective of supporting forestry as 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 multifunctional role and its spiritual and cultural heritage. Cost of the measure is expected to be about 10 MEUR.

4.1.8. Waste sector

General waste related requirements and rules are stipulated in the *Waste Act.* This Act provides waste management requirements for preventing waste generation and the health and environmental hazards arising therefrom. Including measures for improving the efficiency of the use 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. Landfills closed for waste deposit by this date have to be conditioned in accordance with the requirements no later than 31 December 2015.

The *Waste Act* includes following policies:

- 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 per cent by 16 July 2010; 30 per cent by 16 July 2013 and 20 per cent by July 2020. However, reducing the amount of biodegradable waste deposited is also included in the *Estonian Waste Management Plan 2014–2020*. This management plan states, that in 2011, the amount of biodegradable waste in the total amount by weight of municipal waste deposited in landfills was 57 per cent. Nevertheless, there is no reason to speculate, that Estonia will not reach the target level of 20 per cent by July 2020.
- 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 per cent of the total weight of such waste per calendar year. The same target is also included in the *Estonian Waste Management Plan 2014–2020*. In 2013 the level of reusing and recycling of waste materials constituted 31.2 per cent.

The Local Government Organization Act is stipulating, that local government is responsible for the establishment of the waste management rules and the adoption and updating of a waste management plan. Most of local government waste management plans also stipulate prohibition of open burning of municipal solid waste.

During the period that was covered with the previous *National Waste Management Plan 2008–2013* waste management in Estonia had developed rapidly in many levels. There has been a significant increase of waste recycling with various options. By 2013, 95 per cent of Estonia was covered with organized waste transport system. Monitoring and surveillance system was improved and improved waste collection infrastructure helped to reduce the amount of waste randomly disposed. Also improvement of refundable packaging deposit system and general packaging collection system have important role in the reduction of randomly disposed waste.

In 2014, the updated *National Waste Management Plan 2014–2020* was endorsed by the Government. The objective of the management plan is sustainable waste management that follows waste hierarchy principle, mainly focuses on modern product design, clean resource saving production and the recycling of already produced materials. Also, the reduction of hazardous substances in materials and products. Target levels for waste management in the *Waste Management* Plan are presented in Table 4.14.

Table 4.14. Target levels in National Waste Management Plan 2014–2020

Indicator	Target level 2020
Recycling percentage of biodegradable waste in the total amount by weight of municipal waste.	13 per cent
Recycling percentage of biodegradable waste in the total amount by weight of municipal waste.	20 per cent
Recycling percentage of biodegradable waste in the total amount by weight of municipal waste.	50 per cent

The National Waste Management Plan 2014–2020 comprises following measures:

- Promoting the prevention and reduction of waste generated, including 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. Cost of the measure is expected to be 210000 EUR in 2014; 200,000 EUR in 2015; 365,000 EUR in 2016; 755,000 EUR in 2017 and 2.2 MEUR in the period 2018–2020.

- 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 statewide biodegradable waste collection and treatment network is especially important when reducing the GHG emission from solid waste disposal. Cost of measure is expected to be about 11.5 MEUR in 2014; 4.4 MEUR in 2015; 1.6 MEUR in 2016; 2.9 MEUR in 2017 and 12 MEUR in the period 2018–2020.
- 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. Cost of the measure is expected to be about 12.3 MEUR in 2014; 5 MEUR in 2015; 1.8 MEUR in 2016; 1.9 MEUR in 2017 and 5.6 MEUR in the period 2018–2020.

The National Environmental Strategy until 2030 includes a policy regarding to reducing landfilling waste. By 2030, landfilling waste is reduced by 30 per cent and the hazard of waste is reduced significantly. Reaching the target is supported by measures that are included in the *National Waste Management Plan 2014–2020*.

Compared to the NC6, where 6 small-scale CHP plants utilizing landfill gas were reported, there is one additional landfill recovering landfill gas to generate energy.

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. The use of Mechanical-biological treatment (MBT) systems and the completion of the Iru waste-to-energy unit have reduced the large-scale depositing of mixed municipal waste in landfills significantly. In Iru *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 Gg. Iru CHP plant is mostly burning Estonia's mixed municipal waste that is supported by imported waste to keep up the capacity target of 250 Gg.

As to promotion of sustainable waste management, during several years numerous projects have received investment support from national and international sources. As a rule, the granted support has been administered by the Environment Investment Centre (EIC). In 2013, EIC funded 96 waste related projects with a total amount of EUR 17.17 MEUR.

Projected effects of the measures that were able to be quantified are presented in Table 4.15. Both measures presented in Table 4.15 also include the GHG reduction which is achieved by implementing the measure of 'increasing reusing and recycling of waste materials'.

Table 4.15. Projected effects of the measures in the waste sector, Gg CO_2 equivalent

	2015	2020	2025	2030
Recycling or reusing waste at the maximum level	1.1	3.2	1.8	14.9
Prohibition concerning percentage of biodegradable waste deposited	1.9	2.5	2.8	1.1

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 NC6 and BR1.

The national inventory system of Estonia and changes in national inventory arrangements since NC6 and BR1 are described in Chapter 2.

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 2013, which emission data is based on the 2nd November 2015 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 2013

Sector	Gg CO_2 equivalent		Change from base year to latest reported year (per cent)
	1990	2013	
Energy	35,947.1	19,054.3	-47.0
IPPU	1,056.1	1,061.8	0.5
Agriculture	2,657.3	1,254.0	-52.8
Waste	369.1	370.9	0.5
Total (excluding LULUCF)	40,029.6	21,741.1	-45.7
Total (excluding LULUCF, with indirect CO_2)	40,050.4	21,754.9	-45.7
LULUCF	-7,636.9	-330.0	-95.7
Total (including LULUCF)	32,392.7	21,411.1	-33.9
Total (including LULUCF, with indirect CO_2)	32,413.5	21,424.9	-33.9

5. PROJECTIONS

The main objective of this chapter is to give an indication of future trends in GHG emissions in Estonia, given the policies and measures implemented and adopted within the current national climate policies. Projections are given for all greenhouse gases considered in the Kyoto Protocol, presented in the following sectors (CRF categories): energy (including transport); industrial processes and product use; agriculture; waste; and LULUCF. Projections of GHG emissions have been calculated for the period from 2015–2030 and 2013 has been used as a reference year.

Two 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 GHG projection tables include data from the 2015 National Inventory (submitted in 2ndof November 2015) and GHG data used in projections. Differences between the emissions reported in 2015 National Inventory and the GHG amounts used in projection are occurring because the projections were submitted before the official 2015 GHG Inventory submission (submitted 2th of November 2015).

When comparing to the previous National Communication (NC6), which is in accordance with the First Biennial Report (BR1), than the current Second Biennial Report (BR2) is including updated projections. The reason behind the updated projections is that according 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 BR2 and NC6 GHG projections are presented Chapter 5.1.

5.1. Methodology

5.1.1. Energy sector

GHG projections in the energy sector have been calculated using LEAP (*the Long-range Energy Alternatives Planning system*) program, developed at the Stockholm Environment Institute. LEAP is an integrated modelling tool which can be used to track energy consumption, production and resource extraction in all sectors of an economy. It can be used to account for both energy sector and non-energy sector GHG emission sources and sinks. In LEAP, different approaches are taken to model the demand and supply side. On the demand-side a spectrum from bottom-up, end-use accounting technique to top-down macroeconomic modelling is covered. The supply side offers a spectrum of physical energy and environmental accounting as well as simulation methodologies. Although LEAP includes a built-in technology and environmental database (Emission Factors), then country-specific issues have to be inserted separately.

Different studies were prepared in different subsectors in energy sector during the compilation of the *National Energy Sector Development Plan 2030+*. The results of these studies are used as an input to LEAP that then calculated the GHG emissions from the energy sector.

Balmorel model was used for the projections in the electricity sector that minimizes the total costs of the system. The main assumption was, that step-by-step, the use of oil shale will change from the electricity production to shale oil production. The occurring oil shale gas is all used for electricity production.

The projections in the heat sector are based primarily on the reconstruction rate of the buildings. The projections in the heat production are based on the analysis done in process of compiling the *National Energy Sector Development Plan 2030+*.

Methodology to project GHG emissions was further developed when comparing to the methodology used in NC6. NC6 projections for electricity, heat and shale oil production sectors were done using LEAP, taken into account legislation and future investment plans.

The projections in the transport sector are based on the analysis *National Energy Sector Development Plan 2030+ - transport and mobility scenarios*.

5.1.2. IPPU sector

The GHG emissions from industrial processes under categories mineral and chemical industry are projected considering the integrated environmental permits that are issued to the relevant industries (as required by *The Industrial Emissions Act*) and also the plant operators plans on production volumes and on implementation of new technologies.

The HFC emissions are calculated with a methodology similar to one used in Estonia's GHG inventory, considering the new bans of service and bringing on the market stipulated in the Regulation on fluorinated greenhouse gases (EU) No 517/2014.

The SF_6 emissions from switchgear are projected according to the electrical network operator's plans on installation of new pieces of switchgear. The emissions from the particle accelerators (for radiotherapy) are projected to stay the same.

The N_2O emissions from anaesthesia are projected to stay at the same level as in 2013. Although the use of medical N_2O shows a declining trend, the suppliers could not say how long and to which quantities the use of medical N_2O would decline.

A large part of emissions from solvent use depends and is calculated on the population. As the population is projected to decrease, the emissions from solvent use are projected to decrease accordingly.

Both the use of paraffin waxes and the use of lubricants was projected to stay at the 2011–2013 years average level. A large part of paraffin waxes as well as lubricants is consumed by enterprises and another significant part by population. It would be unlikely that use of these products would increase as no large growth of GDP is projected and the population is projected to decrease.

5.1.3. Agriculture sector

Emissions under the agricultural sector are calculated with the corresponding methodology used in the Estonian Greenhouse Gas Inventory. A more detailed description can be found in the *Estonian National Inventory Report 2015*.

Projections of GHG emissions from agricultural sector are based on projected animal population, milk yield, crops production, consumption of synthetic fertilizers and the share of anaerobic digestion in manure management.

Expert estimation by the Estonian Ministry of Rural Affairs on projected livestock numbers is based on the following assumptions: Since 2010 there has been a continuous growth in the number of cattle which is expected to continue as the agricultural producers have made considerable investments in the sector. Global demand for meat and dairy products along with suitable climatic conditions favour cattle production in Estonia to expand. With the supporting mechanisms of Common Agricultural Policy raising sheep and goats may be presumed to grow moderately. Demand after lamb and goat meat, wool and milk will grow. The number of horses, fur animals and rabbits is expected to remain at current level. Although the number of pigs is anticipated to also remain constant as the goal of *self-sufficient* local *pork* production has been reached, the future of the sector's future development remains unclear. There have been investments in the poultry production and future investments are foreseen, therefore moderate growth in the industry may be expected.

Main activity data for calculation of CH_4 and N_2O emissions from manure management are livestock population, data on animal waste management systems (AWMS) and milk yields. Data on AWMS for calculation of N_2O emissions from manure management were derived according to the scenarios of the *National Development Plan for Energy Sector 2030+*.

For calculation of N_2O emissions from manure management systems the projected data on livestock population, milk yield and production of biogas from pig and cattle manure were used. Estonia-specific volatile solids and nitrogen (N) excretion values of dairy cows have been calculated on the basis of projected milk yields.

The principal activity data for projecting N_2O emissions from agricultural soils subsector include the amount of synthetic N-containing fertilizers applied to soil and harvested crop yields. Emissions are calculated on the basis of the methodology used for the Estonian Greenhouse Gas Inventory. Data on crops production originate from the report *Analysis of the systematic development measures and the respective EU policy future directions of Estonian agriculture, forestry and conservancy* compiled by the Estonian University of Life Sciences. The study applies the model AGMEMOD in order to project the change in quantities of Estonian agricultural output for the period of 2010–2020.

An approximate estimate of the amount of urea applied to soils on an annual basis is obtained using domestic production records and import/export data. There is only one urea fertilizer producer in Estonia. Through personal contact this company has communicated future production numbers.

Methodology to project GHG emissions was further developed compared to the methodology used in NC6. NC6 agriculture sector projections were based on

information received from the Ministry of Agriculture (current Ministry of Rural Affairs) and expert judgements.

5.1.4. LULUCF sector

Projections in LULUCF are calculated using land use data from 1990–2013 and emissions/removals reported in the *National Inventory Report 2015* and CRF tables.

Projections of CO_2 are calculated as an average of:

- linear forecasts over the time series of 1990– 2013,
- average of time series of 1990–2013,
- average of time series of 2000–2013,
- estimation of reference year.

The LULUCF sector emissions are quite volatile during last decades. Year 2005 is the starting point of the current trend of all relevant factors. Both, intensive felling period and afforestation of agricultural areas, stopped at this time. The main reason for the use of multiple averages in projection calculations is to reduce the sudden or abnormal trends and tendencies. Methodology to project GHG emissions in LULUCF sector was further developed when comparing to the methodology used in NC6.

5.1.5. Waste sector

Emissions under the waste sector are calculated with the corresponding methodology used for the Estonian Greenhouse Gas Inventory. A more detailed description can be found in the *Estonian National Inventory Report 2015*. Waste sector projections have been divided by the GHG inventory classification.

Projections in the subcategory solid waste disposal on land are based on the *2006 IPCC Waste Model*. Calculating the amount of municipal waste, human population projection from Statistics Estonia and the annual real GDP growth rate from *EC Recommended parameters for reporting on GHG projections in 2015,* is used. The composition of municipal solid waste is projected based on values from *Mixed Municipal Solid Waste Composition Study* carried out in 2013 and the decrease percentage of biodegradable waste in the total amount by weight of municipal waste deposited in landfills by 2020.

Projections in the subcategory biological treatment of solid waste are based on the annual real GDP growth rate from *EC Recommended parameters for reporting on GHG projections in 2015.* This is applied to the previous year's biologically treated solid waste amount. While calculating, it is considered, that the biodegradable waste in the total amount by weight of municipal waste recycling percentage will reach 13 per cent by 2020 (*National Waste Management Plan 2014–2020*). The amount of biologically treated waste is increasing due to the increase of re-use and recycling of waste materials to the extent target of 50 per cent by 2020 (*Waste Act*). For applying the previously mentioned percentage, municipal solid waste data from *2006 IPPC Waste Model* is used.

Projections in the subcategory waste incineration and open burning, the amount of waste burned without energy recovery is projected using data from past 5 years. Only small amount of waste gets incinerated without energy recovery. For open burning, the assumption of no burning starting from 2030 is used. Open burning of municipal solid waste is prohibited, nevertheless an expert judgment is used to evaluate the amount of waste that might be open burned with the amount municipal solid waste generated from *2006 IPCC waste model*.

For the projections in the wastewater treatment and discharge subcategory, projections on population and historical data is used.

Methodology to project GHG emissions in waste sector was further developed when comparing to the methodology used in NC6 projections. NC6 waste sector projections were based on the *National Waste Management Plan for 2008–2013* and on expert judgements.

5.1.6. Key assumptions used in the projections

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

Table 5.1. Main assumptions used in the projections

	Historic	**Projection**			
	2011	**2015**	**2020**	**2025**	**2030**
Population, thousands	1,329.66	1,311.50	1,284.45	1,247.21	1,208.24
Gross domestic product (GDP), real growth rate, %		3.3	3.0	2.5	2.5
Gross domestic product (GDP), constant prices, constant EUR million (2010=t-10)		17,495.80	20,400.80	23,307.60	26,370.40
EU ETS carbon price, EUR/EUA		10.13	15.00	19.88	24.75
International (wholesale) fuel import prices: Electricity Coal, EUR/GJ		NA	3.31	3.40	3.44
International (wholesale) fuel import prices:-Crude Oil, EUR/GJ		NA	14.6	15.1	15.4
International (wholesale) fuel import prices:-Natural gas, EUR/GJ		NA	10.21	10.38	10.56
Final energy consumption:-Industry, TJ	23,858.91	26,431.71	28,336.00	29,633.00	30,934.00
Final energy consumption:-Transport, TJ	31,164.85	32,744.00	35,556.00	37,396.00	39,241.00
Final energy consumption:-Residential, TJ	43,155.76	40,400.29	43,376.00	43,502.00	43,628.00
Final energy consumption:-Agriculture/Forestry, TJ		4,730.00	4,945.00	5,212.00	5,480.00
Final energy consumption:-Services, TJ	17,316.00	16,551.29	17,137.00	17,190.00	17,244.00

	Historic	Projection			
	2011	**2015**	**2020**	**2025**	**2030**
Final energy consumption:- Other, TJ	270.45	189	188	190	192
Final energy demand for road transport, TJ	29,874.0	28,695.0	29,542.0	27,717.0	25,722.0
Livestock: Total cattle, thousands	238.3	261.4	268.9	270.3	273.7
Livestock: Sheep, thousands	93.96	94.1	94.2	95.3	96.5
Livestock: Swine, thousands	365.7	379	379	379	379
Livestock: Poultry, thousands	2,597.14	2,139.20	2,139.20	2,139.20	2,139.20
Nitrogen input from application of synthetic fertilizers, kt N	29.8	33.66	33.66	35.1	35.75
Municipal solid waste (MSW) generation, kt MSW	292.71	308.43	345.57	394.69	429.58

Data on the population for the period 2010–2030 was received from Statistics Estonia. Annual projected gross domestic product (GDP) growth rates for 2010–2015 are according to the projections of the Ministry of Finance from summer 2012. GDP growth rates for 2015–2030 are according to the 'EC- Recommendations for reporting on projections in 2015' provided by the European Commission.

To ensure the timeliness, completeness, consistency, comparability, transparency and accuracy of the projections, certain quality checks were carried out by the European Topic Centre on Air pollution and Climate change Mitigation (ETC/ACM) on behalf of the EEA (according to Regulation (EU) No 525/2013).

The ETS and non-ETS sector emissions are calculated using historical inventory data (proportion of different sectors), projections received from different companies belonging to the ETS, and the total projections in WM and WAM scenarios.

The methodology for sensitivity analysis is described in Chapter 5.2.7.

5.1.7. Comparison of projections between NC6 and BR2

In NC6, the projections on the GHG emissions of Estonia were compiled by the Estonian Environmental Research Centre. These projections had 2010 as a base year and were made up to 2030. Some of the main assumptions and results of the previous NC and current BR projections are presented in Table 5.2.

Table 5.2. Comparison of projections between previous NC and current BR

	2015	**2020**	**2025**	**2030**
NC6 Population, thousand people	1,332.4	1,328.3	1,315.9	1,296.4
BR2 Population, thousand people	1,311.5	1,284.5	1,247.2	1,208.3
NC6 Annual GDP growth rates, per cent	3.5	2.3	2.1	2.3
BR2 Annual GDP growth rates, per cent	2.3	2.1	2.3	1.9

	2015	2020	2025	2030
NC6 WM total emissions (without LULUCF), Gg CO_2 equivalent	18,089	17,060	16,535	16,165
BR2 WM total emissions (without LULUCF), Gg CO_2 equivalent	21,225	21,903	19,019	17,715
NC6 WAM total emissions (without LULUCF), Gg CO_2 equivalent	17,671	16,949	15,951	15,797
BR2 WAM total emissions (without LULUCF), Gg CO_2 equivalent	21,024	21,210	17,949	16,048

As seen in Table 5.2 the assumptions and the results of the two projections are somewhat different. The total WM and WAM scenario's GHG emissions in 2030 are higher in the NC6 than in the current BR (*ca* 104 Gg CO_2 equivalent in the WM scenario and 1,403 Gg CO_2 equivalent in the WAM scenario).

The total effect of implemented PaMs is presented in Chapter 5.3, Table 5.25.

5.2. Projections

5.2.1. Energy sector

The energy sector includes GHG emissions from 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 and fugitive emissions from natural gas distribution.

The chapter of energy sector projections is including both WM and WAM scenarios.

5.2.1.1. Energy industries

GHG emissions from energy industries originate from public electricity and heat production and from shale oil production.

Public electricity and heat production

The main electricity producer in Estonia is Narva Elektrijaamad AS (Narva Power Plants) including 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.

In recent years the share of electricity produced from renewable energy sources have grown rapidly due to support scheme implemented in 2007. According to the projections the share of oil shale used for electricity and heat production is expected to decrease and is almost zero post 2030. Projected gross production of energy (electricity and heat) is presented in Table 5.3.

Table 5.3. Projected gross production of electricity and heat, GWh

	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Electricity WM	13,275.0	13,275.0	12,483.6	13,281.1	11,492.8	10,382.8
Electricity WAM	13,275.0	13,275.0	12,460.8	13,191.9	11,492.8	10,299.2
Heat WM	9,006.0	9,006.0	8,820.9	9,339.4	9,388.7	9,438.7
Heat WAM	9,006.0	9,006.0	8,599.5	8,565.4	8,194.3	7,823.8

The share of renewable energy in consumption of energy used in the public electricity and heat production category is expected to increase from about 10 per cent in 2013 to about 40 per cent in the WM scenario and 39 per cent in the WAM scenario by the year 2030. Lower percentage in WAM scenario is caused by the lower electricity demand and production.

Table 5.4. GHG emissions from public electricity and heat production, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Public electricity and heat production	**CO_2 WM**	14,857.4	14,851.6	13,542.3	12,663.8	9,098.5	6,649.3
	CO_2 WAM	14,857.4	14,851.6	13,526.1	12,364.0	8,751.7	6,047.8
	CH_4 WM	0.5	0.5	1.1	1.3	1.5	1.8
	CH_4 WAM	0.5	0.5	1.1	1.2	1.4	1.7
	N_2O WM	0.1	0.1	0.1	0.2	0.2	0.3
	N_2O WAM	0.1	0.1	0.1	0.2	0.2	0.3
	WM Total CO_2 eq.	14,901.1	14,894.6	13,612.5	12,747.9	9,197.2	6,775.5
	WAM Total CO_2 eq.	14,901.1	14,894.6	13,596.3	12,444.0	8,846.2	6,164.6

The GHG emissions from public electricity and heat production are expected to decrease about 55 per cent in WM scenario and about 59 per cent in WAM scenario by 2030 compared to 2013. The projected GHG emissions from public electricity and heat production category are presented in Table 5.4 and Figure 5.1.

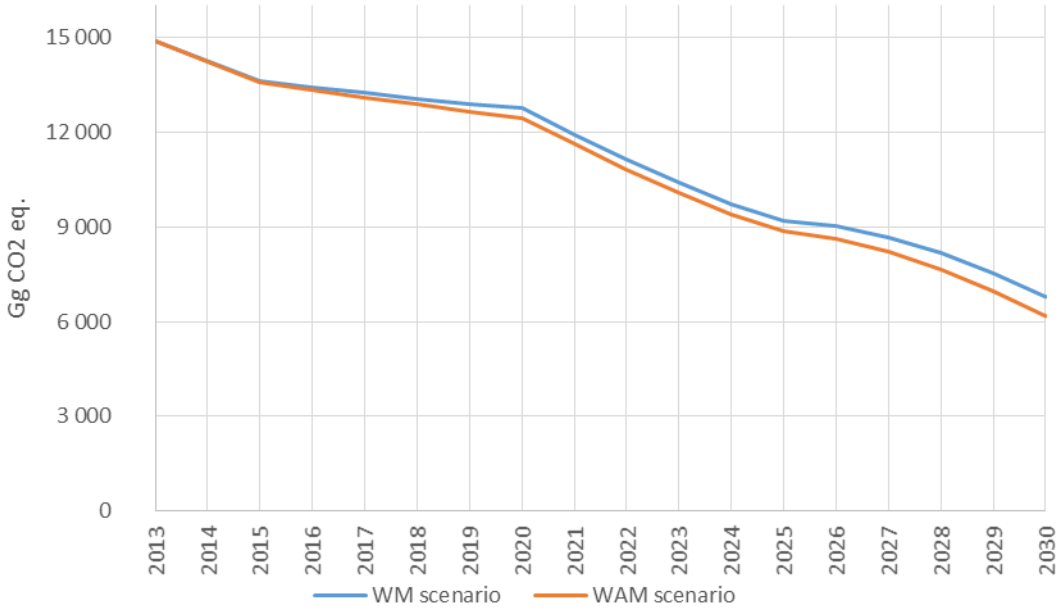

Figure 5.1. Total GHG emissions from public electricity and heat production, Gg CO_2 equivalent[13]

The decrease in GHG emissions from the public electricity and heat production category is mainly related to the increase in the share of renewable energy and decrease in shale oil combustion for electricity production. Also, due to the growing shale oil production, the share of oil shale gas for electricity and heat production is expected to increase.

Shale oil production

There are two different technologies in use for shale oil production in Estonia: technology for the processing of large-particle oil shale in vertical retorts with gaseous heat carrier (GHC); and technology for the processing of fine-grained oil shale with solid heat carrier (SHC). The GHC technology is a universal technology and suitable for retorting high-calorific oil shale. Thermal processing of oil shale using GHC technology takes place without any contact with the ambient atmosphere – therefore no pollutants are emitted. Direct GHG emissions only occur in SHC technology.

Since the mining limit of oil shale is set at 20 million tons in the legislation then due to the growing consumption in the shale oil industry the use for electricity production decreases. By 2030 practically all oil shale goes for shale oil production and almost no oil shale will be used for electricity production.

In the shale oil production category only one scenario (WM = WAM) is projected as the projections on the use of oil shale and production of shale oil are based on the visions of the companies. The projected use of oil shale for shale oil production is presented in Table 5.5.

[13] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

Table 5.5. Projected use of oil shale for shale oil production, TJ

	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Oil shale for shale oil production in SHC technologies	22,199	22,199	50,112	100,301	134,069	184,721
Oil shale for shale oil production in GHC technologies	26,486	22,034	25,352	25,352	25,352	25,352
Total oil shale for shale oil production	48,685	44,233	75,463	125,653	159,421	210,073

According to the projections, the use of oil shale for shale oil production is expected to grow over 4 times by the year 2030 compared to 2013.

Table 5.6. GHG emissions from shale oil production, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Shale oil production	**CO_2**	443.3	446.1	1,159.1	2,299.9	3,042.4	4,156.2
	CH_4	0.0	0.0	0.1	0.1	0.1	0.2
	N_2O	0.0	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	444.5	447.3	1,161.9	2,305.3	3,049.7	4,166.4

Due to projected increase in the use of oil shale for shale oil production, the GHG emissions from shale oil production category are also expected to increase in future years. The projected emissions from shale oil production are presented in Table 5.6 and Figure 5.2.

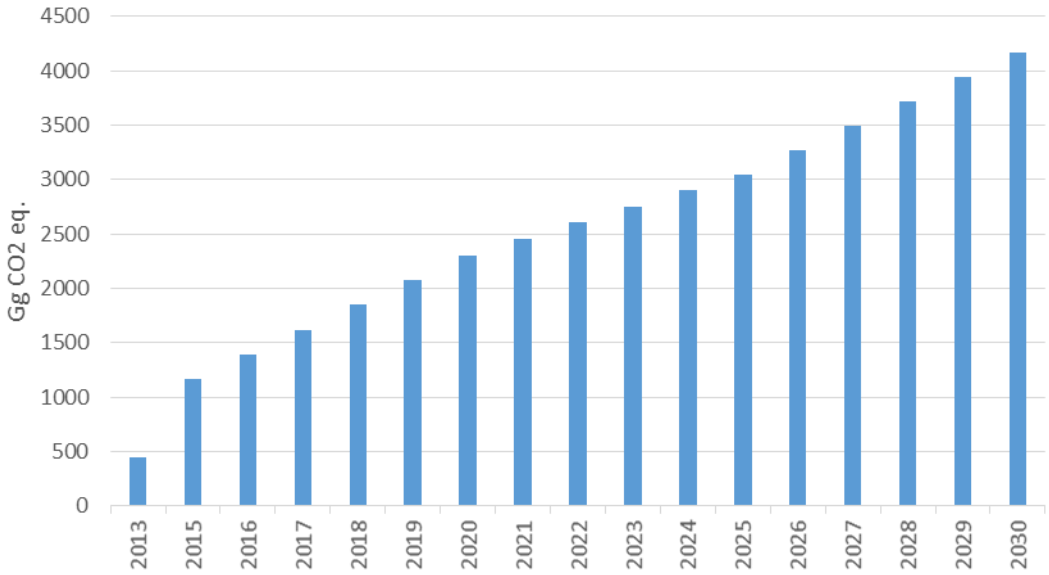

Figure 5.2. Total GHG emissions from shale oil production, Gg CO_2 equivalent[14]

Total GHG emissions from shale oil production category are expected to increase from 444.5 Gg CO_2 equivalent in 2013 to over 4,100 Gg CO_2 equivalent by 2030.

5.2.1.2. Manufacturing industries and construction

The manufacturing industries and construction sector consists of the following sub-sectors: iron and steel; non-ferrous metals; chemicals; pulp, paper and print, food beverages and tobacco; non-metallic minerals; other industries. The largest share of GHG emissions originate from non-metallic minerals (mainly cement production).

Only one scenario is projected (WM = WAM) in the manufacturing industries and construction category as there are no planned policies and measure. Projected fuel and energy consumption in this sector is presented in Table 5.7.

Table 5.7. Fuel and energy consumption in manufacturing industries and construction, TJ

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Manufacturing industries and construction	**Fuels**	9,782	10,992	10,541	9,841	10,316	10,795
	Electricity	7,753	7,753	8,559	10,575	10,921	11,265
	Heat	7,096	7,096	7,331	7,920	8,396	8,874
	Total energy	24,631	25,841	26,431	28,336	29,633	30,934

The overall energy consumption in the manufacturing industries and construction category is expected to grow about 20 per cent by 2030 compared to 2013. Although the share of fuels is expected to decrease then due to the projected increase in the

[14] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

share of oil shale used for cement production also the projected GHG emissions are expected to increase.

Total GHG emissions from the manufacturing industries and construction category are expected to increase about 12 per cent by 2030 compared to 2013. The projected GHG emissions are presented in Table 5.8 and Figure 5.3.

Table 5.8. GHG emissions from manufacturing industries and construction, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Manufacturing industries and construction	**CO_2**	732.0	732.0	720.7	750.2	786.0	822.0
	CH_4	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	740.9	740.9	729.0	757.3	793.3	829.6

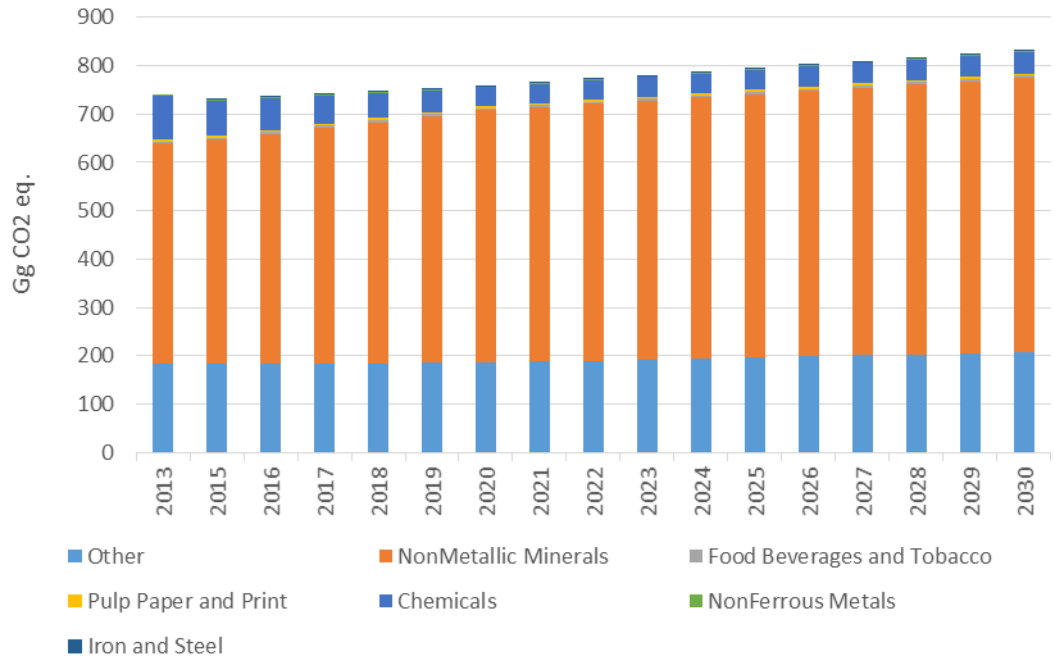

Figure 5.3. Total GHG emissions from manufacturing industries and construction, Gg CO_2 equivalent[15]

5.2.1.3. Transport (excluding international aviation and marine bunkering)

The main share of GHG emissions in the transport originate from road transport. Historically the share of road transport GHG emissions have been over about 95 per cent of total transport GHG emissions.

[15] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

There are different WM and WAM scenarios in the transport sector, as there are some additional measures planned compared to the implemented measures in the WM scenario.

Projected energy consumption in transport sector is presented in Table 5.9.

Table 5.9. Energy consumption in transport, TJ

	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Gasoline WM	9,967	9,967	11,430	12,358	11,339	10,321
Gasoline WAM	9,967	9,967	10,730	10,959	7,822	4,686
Diesel WM	20,822	20,822	19,088	19,020	19,269	19,516
Diesel WAM	20,822	20,822	17,330	15,683	14,097	12,512
Jet Kerosene WM	16	16	31	31	31	31
Jet Kerosene WAM	16	16	31	31	31	31
CNG WM	5	5	339	678	1,740	2,805
CNG WAM	5	5	519	1,035	1,872	2,748
Biofuels WM	129	129	1,629	3,261	4,665	6,072
Biofuels WAM	129	129	1,601	3,208	5,308	7,409
Electricity WM	191	191	225	206	350	494
Electricity WAM	191	191	245	245	630	1,014
Total energy WM	31,130	31,130	32,742	35,554	37,394	39,239
Total energy WAM	31,130	31,130	30,456	31,161	29,760	28,400

Total energy consumption is projected to increase about 26 per cent in the WM scenario by 2030 compared to 2013 and to decrease about 9 per cent in the WAM scenario by 2030 compared to 2013.

Table 5.10. GHG emissions from transport, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Transport	**CO_2 WM**	2.209.8	2,209.8	2,246.6	2,327.6	2,330.2	2,333.0
	CO_2 WAM	2.209.8	2,209.8	2,077.1	2,001.6	1,704.0	1,408.6
	CH_4 WM	0.2	0.2	0.2	0.3	0.3	0.4
	CH_4 WAM	0.2	0.2	0.2	0.3	0.3	0.3
	N_2O WM	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O WAM	0.1	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq. WM	2,241.9	2,232.6	2,282.4	2,365.3	2,370.7	2,376.3
	Total CO_2 eq. WAM	2,241.9	2,232.6	2,110.6	2,034.9	1,735.2	1,437.9

Total GHG emissions from the transport are expected to stay on the 2013 level by 2030 in the WM scenario and to decrease about 36 per cent by 2030 compared to 2013. The share of biofuels and electricity is expected to increase from 1 per cent in 2013 to 17 per cent in 2030 in the WM scenario and to 30 per cent by 2030 in the WAM scenario. The projected GHG emissions from transport sector are presented in Table 5.10 and Figure 5.4.

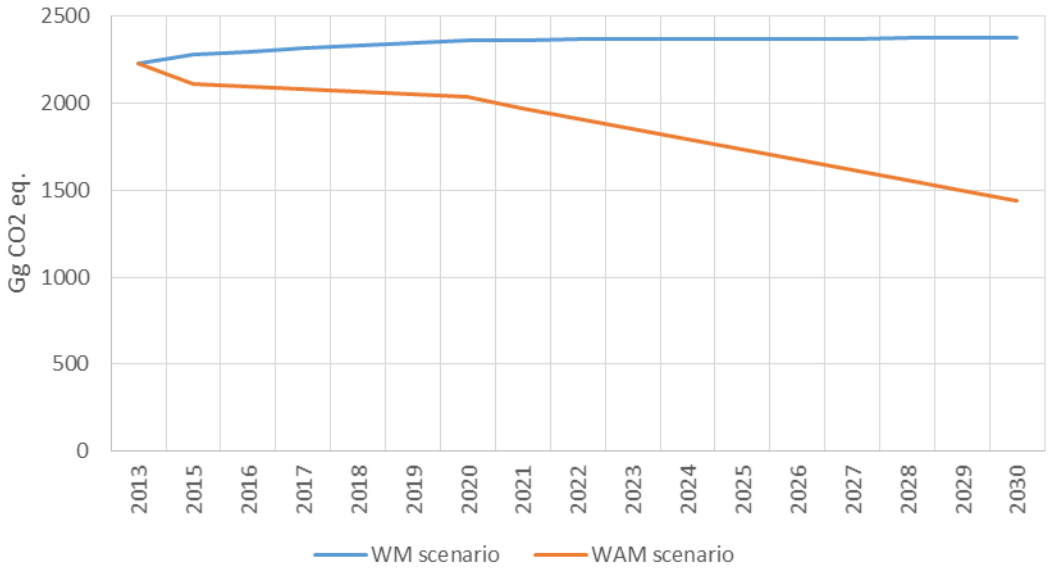

Figure 5.4. Total GHG emissions from transport, Gg CO_2 equivalent[16]

The share of road transport is expected to decrease from 96 per cent in 2013 to 93 per cent in 2030 in the WM scenario and to 92 per cent by 2030 in the WAM scenario. The share of railroad transport is expected to increase respectively to the decrease in road transport.

5.2.1.4. Other sectors

Other sectors include energy consumption in the commercial/institutional, residential and agriculture/forestry/fisheries sectors. Historically the most energy (including fuels) has been consumed in the residential sector. The share of biomass used in households was about 84 per cent of all fuels used in households in 2013. Diesel used in off-road machinery forms the largest share of fuels in the agriculture/forestry/fisheries sector. Projected energy consumption in other sectors is presented in Table 5.11.

[16] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

Table 5.11. Energy consumption in Other Sectors, TJ

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Commercial/ institutional	**Fuels WM**	1,221	1,201	1,146	1,138	1,135	1,132
	Fuels WAM	1,221	1,201	1,131	1,086	1,054	1,025
	Electricity WM	9,085	9,085	9,092	9,108	9,180	9,252
	Electricity WAM	9,085	9,085	9,030	8,892	8,874	8,856
	Heat WM	6,083	6,083	6,314	6,891	6,875	6,860
	Heat WAM	6,083	6,083	6,226	6,582	6,396	6,211
Residential	**Fuels WM**	18,812	18,813	19,196	20,495	20,433	20,371
	Fuels WAM	18,812	18,813	18,430	17,815	16,414	15,012
	Electricity WM	6,714	6,714	7,007	7,740	7,974	8,208
	Electricity WAM	6,714	6,714	6,976	7,632	7,992	8,352
	Heat WM	13,820	13,820	14,197	15,141	15,095	15,049
	Heat WAM	13,820	13,820	13,626	16,141	12,094	11,048
Agriculture/forestry/ fisheries	**Fuels WM**	3,513	3,512	3,495	3,488	3,965	3,904
	Fuels WAM	3,513	3,512	3,495	3,488	3,965	3,904
	Electricity WM	742	742	821	1,017	1,050	1,083
	Electricity WAM	742	742	821	1,017	1,050	1,083
	Heat WM	404	404	414	440	467	493
	Heat WAM	404	404	414	440	467	493
Other sectors Total	**Total energy WM**	60,374	60,374	61,682	65,458	66,174	66,352
	Total energy WAM	60,374	60,374	60,149	63,093	58,306	55,984

Total use of energy is expected to increase about 10 per cent by 2030 in the WM scenario and decrease about 7 per cent by 2030 in the WAM scenario compared to 2013. The share of fuels used in agriculture/forestry/fisheries is expected to increase in the WAM scenario due to additional energy efficiency measures in commercial/institutional and residential sectors. But the overall structure of the fuel consumption is expected to stay about the same for the period of 2013–2030. No major structural changes are projected.

Table 5.12. GHG emissions from other sectors, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Other sectors	**CO_2 WM**	504.0	504.0	495.9	512.1	526.5	540.8
	CO_2 WAM	504.0	504.0	488.2	484.9	485.4	486.1
	CH_4 WM	5.0	5.0	5.1	5.4	5.4	5.4
	CH_4 WAM	5.0	5.0	4.9	4.7	4.3	4.0
	N_2O WM	0.1	0.1	0.1	0.1	0.1	0.1
	N_2O WAM	0.1	0.1	0.1	0.1	0.1	0.1
	WM Total CO_2 eq.	672.0	672.0	660.2	669.5	683.5	697.5
	WAM Total CO_2 eq.	672.0	672.0	646.6	622.0	612.0	602.2

Total GHG emissions from other sectors are expected to increase about 4 per cent by 2030 in the WM scenario and decrease about 10 per cent in the WAM scenario compared to 2013. The projected GHG emissions from other sectors are presented in Table 5.12 and Figure 5.5.

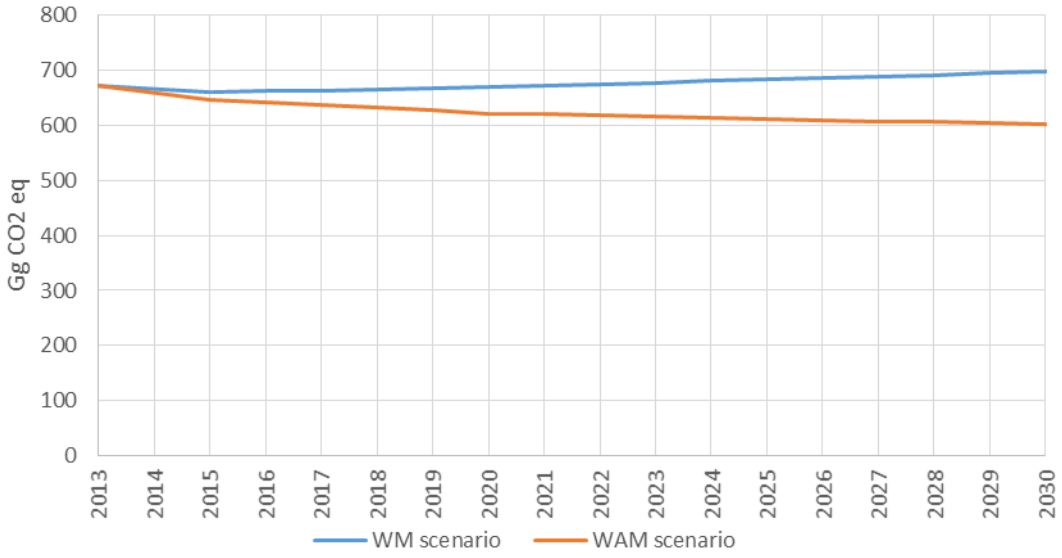

Figure 5.5. Total GHG emissions from other sectors, Gg CO_2 equivalent[17]

The share of GHG emissions from the residential sector was about 50 per cent of total emissions from other sectors in 2013 and it is expected to stay about at the same level by 2030. However, according to the WAM scenario, the share of GHG emissions from residential sector is expected to decrease to 44 per cent. At the same time, the

[17] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

share of GHG emissions from agriculture/forestry/fisheries sector is expected to increase from 41 per cent in 2013 to about 47 per cent by 2030 of the WAM scenario.

5.2.1.5. Fugitive emissions from natural gas distribution

Natural Gas is imported into Estonia from Russia and from the Inculkalns underground storage in Latvia. AS Eesti Gaas has two metering stations on the border of Estonia where the volumes of imported gas are measured. Gas is distributed to costumers through gas pipelines, distribution stations and gas pressure reducing stations. During these operations, some fugitive CH_4 emissions occur.

The projected CH_4 emissions from fugitive emissions are calculated based on the projected amounts of natural gas used in Estonia.

Table 5.13. GHG emissions from fugitive emissions from natural gas distribution, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Fugitive emissions from natural gas distribution	**CH_4 WM**	0.8*	3.8	4.9	4.5	3.8	3.5
	CH_4 WAM	0.8	3.8	4.9	4.0	3.4	2.6
	WM Total CO_2 eq.	21.4	94.0	122.1	111.8	96.2	87.5
	WAM Total CO_2 eq.	21.4	94.0	122.1	99.9	83.9	65.2

*In the projections, Estonia used the emission factor of Finland to calculate fugitive emissions from natural gas distribution. In the 2015 submission, IPCC 2006 Guidelines default value was used instead.

Total GHG emissions from fugitive emissions are expected to decrease about 7 per cent by 2030 in the WM scenario and about 31 per cent by 2030 in the WAM scenario compared to 2013. The projected GHG emissions are presented in Table 5.13 and Figure 5.6.

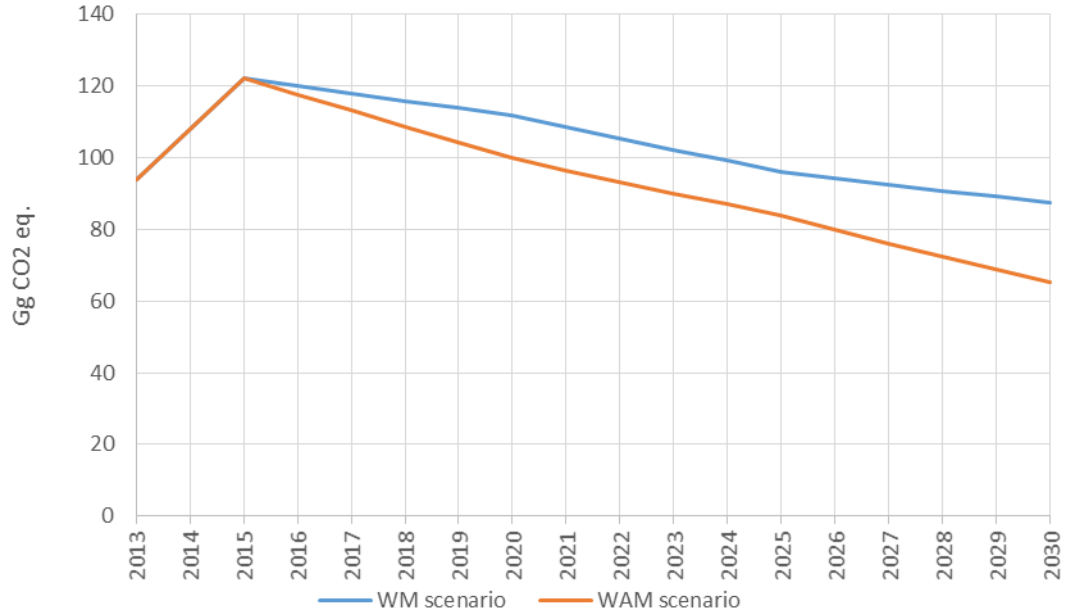

Figure 5.6. Total GHG emissions from fugitive emissions from natural gas distribution, Gg CO_2 equivalent[18]

Additional GHG emissions reduction in the WAM scenario is related to energy efficiency measures in the demand side and the fuel-switch in the energy production side that is projected to lead to reduction in the natural gas use.

5.2.1.6. Energy sector total

In Table 5.14 and Figure 5.7 the total GHG emissions from the energy sector are presented. Differences between the emissions reported in 2015 National Inventory and the GHG amounts used in projection are occurring because the projections were submitted before the official 2015 National Inventory submission (submitted on the 2nd of November 2015).

Table 5.14. GHG emissions from the energy sector, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Energy Total	**CO_2 WM**	18,778.8	18,775.7	18,178.5	18,567.3	15,797.5	14,515.4
	CO_2 WAM	18,778.8	18,775.7	17,985.0	17,914.3	14,783.5	12,934.8
	CH_4 WM	6.7	9.6	11.4	11.6	11.3	11.4
	CH_4 WAM	6.7	9.6	11.2	10.4	9.6	8.9

[18] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
	N_2O WM	0.3	0.3	0.4	0.4	0.4	0.5
	N_2O WAM	0.3	0.3	0.4	0.3	0.4	0.4
	WM Total CO_2 eq.	19,054.3	19,114.2	18,582.1	18,971.1	16,204.8	14,947.0
	WAM Total CO_2 eq.	19,054.3	19,114.2	18,380.7	18,277.5	15,134.6	13,280.2

Total GHG emissions from the energy sector are expected to decrease about 22 per cent by 2030 in the WM scenario and about 31 per cent in the WAM scenario compared to 2013. The share of CH_4 emissions is expected to increase due to the growing share of wood consumption in the overall energy balance.

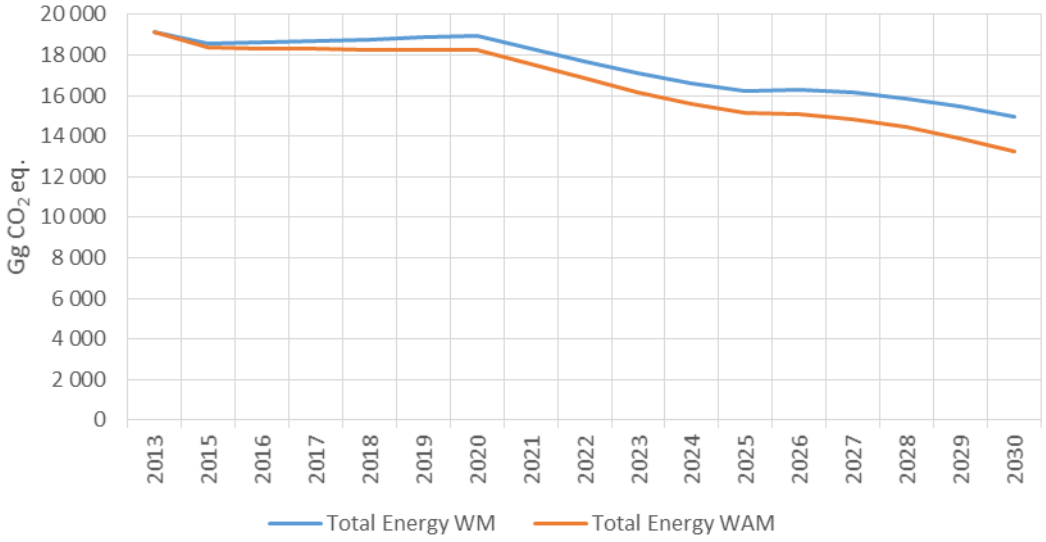

Figure 5.7. Total GHG emissions from the energy sector, Gg CO_2 equivalent[19]

5.2.2. IPPU sector

The chapter of industrial processes and product use sector projection is including WM scenario. Since there are no additional measures planned in the IPPU sector, then the WAM scenario emissions are equal to WM scenario emissions.

Mineral and chemical industry are the sources of CO_2 emissions in industrial processes sector. Data from 9 companies is included in the projections.

[19] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

In the mineral industry sector the largest part of the emissions (about 57.5 per cent in 2013) originates from cement production. Other sources of CO_2 emissions come from limestone use for flue gas desulphurisation, lime buring, soda ash use, glass production, bricks and tiles production.

Ammonia production is the only source of GHG emissions under chemical industry branch. Due to low market prices of ammonia there was no ammonia production in 2014 and no production is will probably occur in 2015. But it is expected, that the production of ammonia will continue in the future years.

The third largest source of greenhouse gases under industrial processes and product use sector is consumption of HFC-s as substitutes for ozone depleting substances. The consumption of HFC-s in Estonia depends on import. F-gases are imported either in bulk by trade or industry for domestic productive consumption (manufacturing) – filling of newly manufactured products, refilling of equipment – or in pre-charged equipment.

Smaller quantities of GHG-s originate from the sectors: non-energy products from fuels (CO_2) and solvent use (NMVOCs) and other product manufacture and use (SF_6 and N_2O).

Differences between the emissions reported in 2015 National Inventory and the GHG amounts used in projection are occurring because the projections were submitted before the official 2015 National Inventory submission (submitted on the 2nd of November 2015).

Table 5.15. WM scenario GHG emissions from industrial processes and product use sector, Gg

		2013 (2015 NIR)	**2013 (proj)**	**2015**	**2020**	**2025**	**2030**
Mineral industry WM	**CO_2**	694.5	694.5	820.2	846.1	811.9	811.9
Chemical industry WM	**CO_2**	154.0	154.0	0.0	252.1	252.1	252.1
Non-energy products from fuels and solvent use WM	**CO_2 eq.**	3.7*	22.1	22.3	22.0	21.6	21.2
Product uses as substitutes for ozone depleting substances WM	**HFCs (CO_2 eq.)**	203.6	208.0	210.6	206.3	163.4	130.8
Other product manufacture and use WM	**SF_6 and N_2O (CO eq.)**	5.9	6.0	6.1	6.6	7.0	7.3
WM Total CO_2 eq.	**Total CO_2 eq.**	1,061.8	1,084.6	1,059.2	1,333.1	1,256.1	1,223.3

* In projections, Estonia has estimated indirect CO_2 from NMVOCs under non-energy products from fuels and solvent use (solvent use). Estonia did not report indirect CO_2 from NMVOCs for the year 2013 under non-energy products from fuels and solvent use (solvent use) subsector in GHG inventory. These indirect CO_2 emissions were reported under CRF 2 industrial processes and product use.

CO_2 emissions from mineral industry are projected to increase until the year 2025 due to larger production volumes planned by some industries and then decrease because one industrial company is implementing new technology in 2020.

CO_2 emissions from chemical industry is expected to increase about 64 per cent by 2030 compared to 2013.

GHG emissions from subsector other product manufacture and use – is expected to increase 22 per cent by 2030 compared to 2013 due to ongoing increase of SF_6 containing switchgear in the future decades as estimated by the electricity network operators.

GHG emissions from product (HFC) uses as substitutes for ozone depleting substances are projected to decrease about 37 per cent by 2030 compared to 2013, as a result of the bans of the Regulation (EU) No 517/2014.

Also GHG emissions from non-energy products from fuels and solvent use are projected to decrease about 4 per cent by 2030 compared to 2013.

The projected GHG emissions from IPPU sector are presented in Table 5.15 and Figure 5.8.

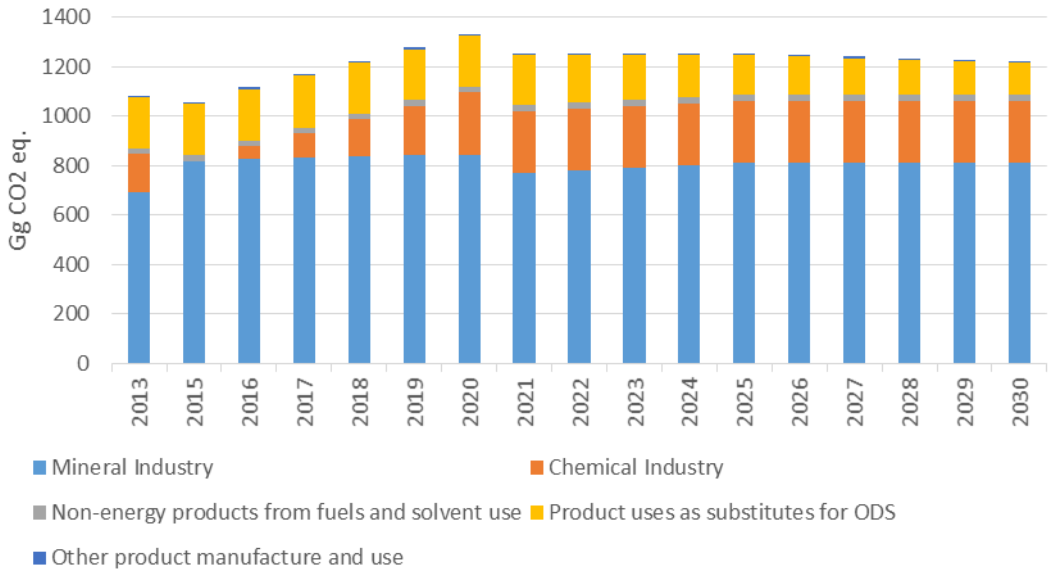

Figure 5.8. Total WM scenario GHG emissions from IPPU sector, Gg CO_2 equivalent[20]

Total GHG emissions from the industrial processes and product use sector are expected to increase about 12 per cent by the year 2030 compared to 2013. The main

[20] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

reason behind the increase is related with increasing production volumes of cement, lime and ammonia.

5.2.3. Agriculture sector

The chapter of agriculture sector projection is including WM scenario and contains CH_4 emissions from enteric fermentation of domestic livestock, CH_4 and N_2O emissions from manure management systems, direct and indirect N_2O emissions from agricultural soils and CO_2 emissions from liming and urea fertilization. Direct N_2O emissions include emissions from synthetic and organic fertilizers applied to agricultural soils, emissions from animal waste, emissions from crop residues, cultivation of organic soils and emissions caused by mineralized nitrogen resulting from loss of soil organic carbon stocks in mineral soils through land-use change or management practices. Indirect N_2O emissions include emissions from atmospheric deposition and leaching and run-off.

The GHG emissions from agriculture sector are expected to increase about 9 per cent by 2030 compared to 2013. The projected emissions are presented in Table 5.16 and Figure 5.9.

An increasing trend in GHG emissions in the agriculture sector (Table 5.16, Figure 5.9) is mainly caused by enteric fermentation, manure management and agricultural soils subsectors due to the growth in livestock numbers and an increased milk yield. The rise in emissions from managed agricultural land is also contributed by expected increase in the use of synthetic fertilizers.

Since there are no additional measures foreseen in the agriculture sector, then the projections of emissions in the WAM scenario are expected to be the same as projected emissions in the WM scenario.

Differences between the emissions reported in 2015 National Inventory and the GHG amounts used in projection are occurring because the projections were submitted before the official 2015 National Inventory submission (submitted on the 2nd of November 2015).

Table 5.16. Total GHG emissions from agriculture in WM scenario, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Enteric fermentation WM	**CH_4**	22.2	20.8	22.7	24.3	24.5	25
	Total CO_2 eq.	555.1	521.2	567.2	608.6	613.6	625
Manure management WM	**CH_4**	2.7	2.7	2.6	2.8	2.8	2.7
	N_2O	0.2	0.2	0.2	0.2	0.2	0.2
	Total CO_2 eq.	141.8	133.3	134	139.7	137.3	135.5
Agricultural soils WM	**N_2O**	1.8	1.8	1.9	1.9	2	2
	Total CO_2 eq.	547.7	547.7	564.5	577.4	590.4	600.6
Liming WM	**CO_2**	9.0	9.0	9.0	9.0	9.0	9.0
Urea application WM	**CO_2**	0.4	0.4	0.0	1.2	1.2	1.2

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Agriculture Total WM	**CO_2**	9.4	9.4	9	10.2	10.2	10.2
	CH_4	24.9	23.5	25.3	27.1	27.3	27.7
	N_2O	2.1	2.1	2.1	2.2	2.2	2.2
	Total CO_2 eq.	1,254.0	1,211.6	1,274.8	1,335.9	1,351.5	1,371.3

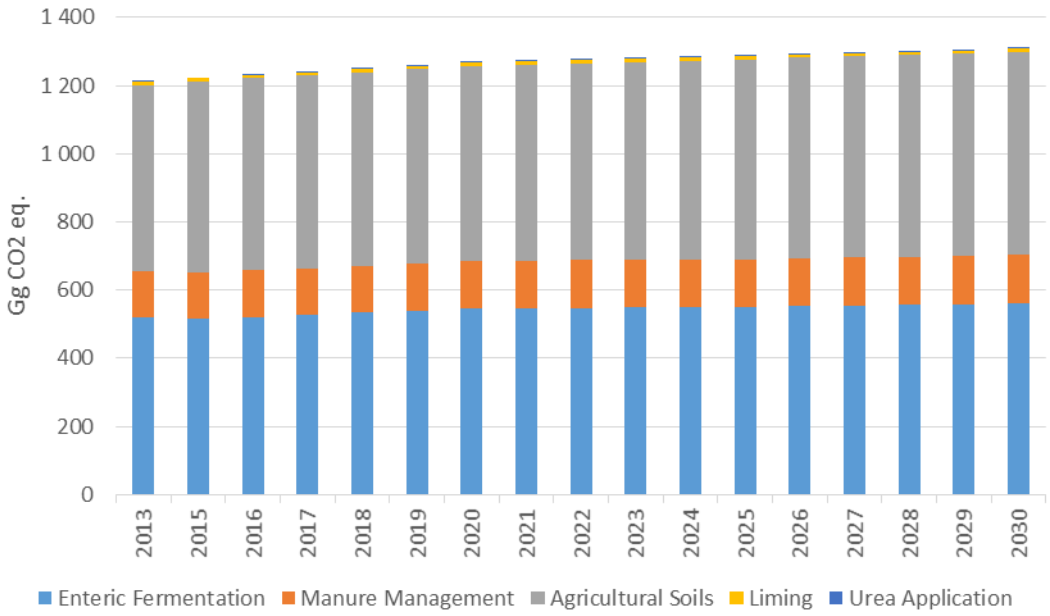

Figure 5.9. Total GHG emissions from agriculture in WM scenario 2013–2030, Gg CO_2 equivalent[21]

5.2.4. LULUCF sector

The chapter of LULUCF sector projection is including WM scenario and contains of emissions and removals of GHG-s from forest land, cropland, grassland, wetlands, settlements and other land. There are a number of factors that have affected the use of land during the last 25 years. The most important of these is the land reform, but also accession to the European Union, economic rises and falls.

Table 5.17. Projected land use in the LULUCF sector (thousand hectares)

Land use class	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Forest land	2,288.0	2,288.0	2,288.8	2,285.3	2,285.5	2,285.7
Cropland	1,041.2	1,041.2	1,045.9	1,046.0	1,044.9	1,043.5
Grassland	333.7	333.7	332.8	331.4	330.0	328.6
Wetlands	499.1	499.1	498.8	498.9	499.2	499.4
Settlements	308.1	308.1	305.9	307.4	309.7	312.1

[21] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

Land use class	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Other land	52.7	52.7	53.6	53.6	53.5	53.3
Total	**4,522.7**	**4,522.7**	**4,522.7**	**4,522.7**	**4,522.7**	**4,522.7**

Predicted area of land use by classes is presented in Table 5.17. Forest area grew steadily until 2004. 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. Infrastructure and settlements area extend continuously, at the expense of all other land use classes.

Since there are no additional measures foreseen in the LULUCF sector, then the projections of emissions in the WAM scenario are expected to be equal to projected emissions in the WM scenario.

Differences between the emissions reported in 2015 National Inventory and the GHG amounts used in projection are occurring because the projections were submitted before the official 2015 National Inventory submission (submitted on the 2nd of November 2015).

Table 5.18. Total GHG emissions and removals from LULUCF sector in WM scenario, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Forest land	**CO_2**	-1,638.3	-1,633.9	-2,369.4	-2,316.8	-2,056.3	-1,761.3
	CH_4	0.0	0.0	0.01	0.01	0.01	0.01
	N_2O	0.0	0.0	0.0	0.0	0.0	0.0
Cropland	**CO_2**	145.7	144.0	141.5	147.4	154.7	162.2
	N_2O	0.018	0.018	0.015	0.015	0.016	0.017
Grassland	**CO_2**	403.7	498.1	242.7	182.8	186.5	200.8
	CH_4	0.0	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	**CO_2**	1,099.4	168.8	163.4	165.5	169.4	173.5
	CH_4	0.003	0.003	0.003	0.003	0.003	0.003
	N_2O	0.005	0.005	0.005	0.005	0.005	0.005
Settlements	**CO_2**	352.6	353.0	312.8	319.5	337.9	358.3
Other land	**CO_2**	26.1	26.1	33.8	38.6	41.8	44.8
HWP	**CO_2**	-726.5	-660.3	-706.4	-756.5	-799.4	-841.0
LULUCF Total	**CO_2**	-337.1	-1,104.2	-2,181.7	-2,219.5	-1,965.4	-1,662.7
	CH_4	0.003	0.003	0.009	0.010	0.009	0.008
	N_2O	0.02	0.02	0.02	0.02	0.02	0.02
	Total CO_2 eq.	**-329.9**	**-1,097.1**	**-2,175.4**	**-2,213.1**	**-1,958.8**	**-1,655.8**

The LULUCF sector is expected to stay GHG sink category according to the projections (Table 5.18, Figure 5.10).

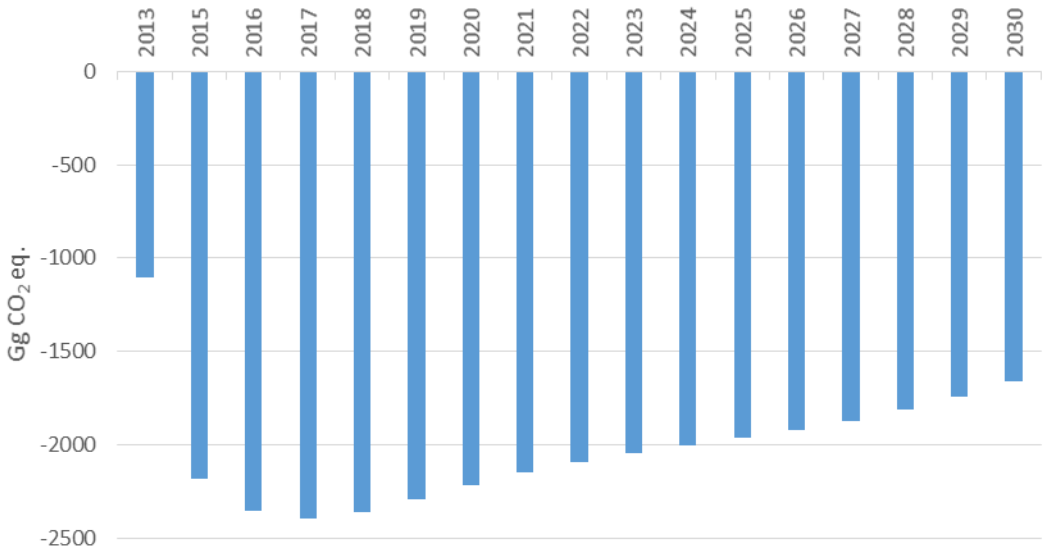

Figure 5.10. Total GHG emissions from the LULUCF sector, Gg CO_2 equivalent[22]

5.2.5. Waste sector

The chapter of waste sector projection is including WM scenario and consists of CO_2, CH_4 and N_2O emissions. CO_2 emitted from the waste incineration category. The main share of CH_4 from the waste sector comes from solid waste disposal on land. N_2O is emitted from wastewater treatment and discharge, biological treatment and waste incineration.

Since there are no additional measures planned in the waste sector then the WAM scenario emissions are equal to the WM scenario (Table 5.19, Figure 5.11) emissions.

Differences between the emissions reported in 2015 National Inventory and the GHG amounts used in projection are occurring because the projections were submitted before the official 2015 National Inventory submission (submitted on the 2nd of November 2015).

Table 5.19. Total GHG emissions from waste sector in WM scenario, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Solid waste disposal on land	**CH_4**	9.7	9.6	8.2	6.2	3.8	2.4
	Total CO_2 eq.	242.5	240.5	204.4	154.3	95.1	60.1
Biological treatment of solid waste	**CH_4**	0.7	0.7	0.8	0.9	1.0	1.1
	N_2O	0.1	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	34.1	34.1	37.8	42.6	46.2	48.5

[22] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Waste incineration and open burning	**CO_2**	0.3	0.3	0.2	0.1	0.1	0.0
	CH_4	0.0	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	0.9	0.8	0.7	0.5	0.3	0.0
Wastewater treatment and discharge	**CH_4**	2.5	1.4	1.4	1.4	1.4	1.4
	N_2O	0.1	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	93.4	64.3	66.3	65.9	65.4	64.8
Waste total	**CO_2**	0.3	0.3	0.2	0.1	0.1	0.0
	CH_4	12.9	11.7	10.4	8.5	6.2	4.9
	N_2O	0.2	0.2	0.2	0.2	0.2	0.2
	Total CO_2 eq.	370.9	339.7	309.2	263.3	207.0	173.5

The decrease in GHG emissions from the waste sector is mainly related to the decrease in the percentage of biodegradable waste in the total amount of solid waste disposed in landfills and waste incinerated in Iru CHP plant.

Increase in GHG emissions from biological treatment of solid waste is correlated to the decreased amount of biodegradable waste in the total amount of solid waste disposed in landfills.

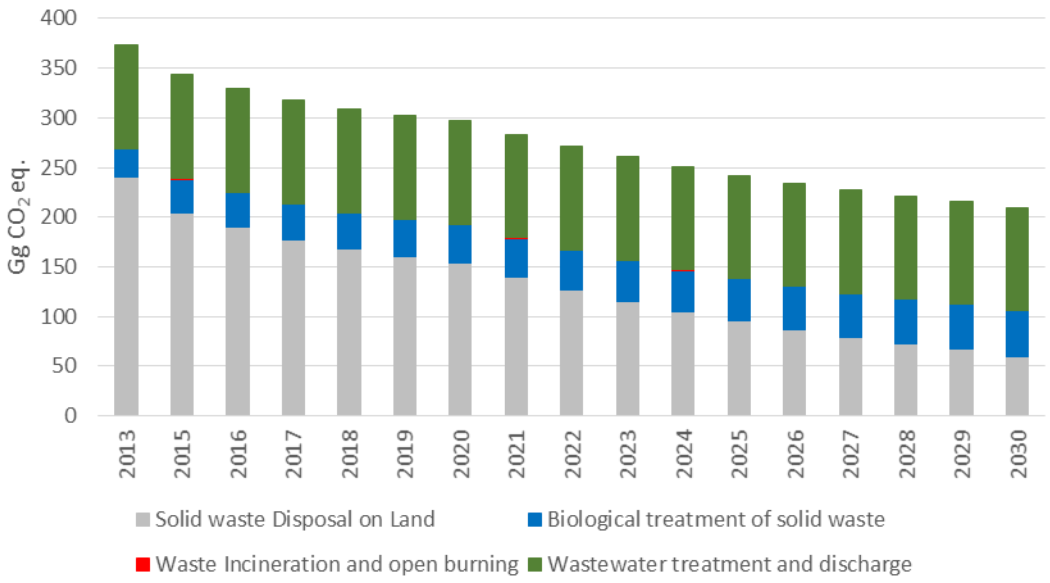

Figure 5.11. Total GHG emissions from waste in WM scenario, Gg CO_2 equivalent[23]

[23] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

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

Total GHG emissions in the WM and WAM scenarios are presented in Table 5.20 and Figure 5.12.

Table 5.20. Total GHG emissions in Estonia, Gg

	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Energy WM	19,054.3	19,114.2	18,582.1	18,971.1	16,204.8	14,947.0
Energy WAM	19,054.3	19,114.2	18,380.7	18,277.5	15,134.6	13,280.2
IPPU WM	1,061.8	1,084.6	1,059.2	1,333.1	1,256.1	1,223.3
Agriculture WM	1,254.1	1,211.7	1,274.8	1,336.0	1,351.6	1,371.4
LULUCF WM	-329.9	-1,097.1	-2,175.4	-2,213.1	-1,958.8	-1,655.8
Waste WM	370.9	339.7	309.2	263.3	207.0	173.5
Total (without LULUCF) WM	21,741.09	21,750.0	21,225.4	21,903.5	19,019.5	17,715.0
Total (without LULUCF) WAM	21,741.09	21,750.0	21,023.9	21,209.8	17,949.3	16,048.2
Total (with LULUCF) WM	21,411.12	20,652.9	19,050.0	19,690.3	17,060.7	16,059.2
Total (with LULUCF) WAM	21,411.12	20,652.9	18,848.5	18,996.7	15,990.5	14,392.4

The GHG emissions are expected to decrease about 19 per cent in the WM scenario (without LULUCF) and about 26 per cent in the WAM scenario (without LULUCF) by 2030 compared to 2013 and about 25 per cent in the WM scenario (with LULUCF) and about 33 per cent in the WAM scenario (with LULUCF) by 2030 compared to 2013.

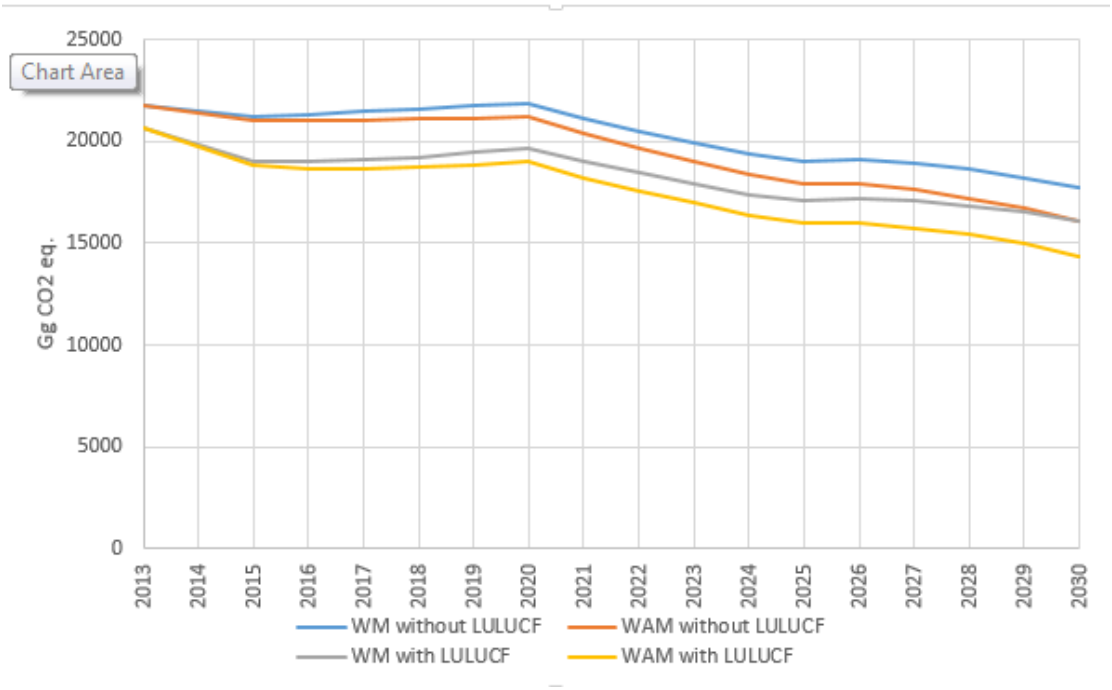

Figure 5.12. Total GHG emissions of Estonia (with and without LULUCF), Gg CO_2 equivalent[24]

The Effort Sharing Decision (Decision No 406/2009/EC – ESD) establishes annual targets for the GHG emissions of Estonia between 2013 and 2020, which are legally binding and only refer to GHG emissions that are not included within the scope of the EU ETS (non-ETS). These emissions include GHG emissions from transport, buildings, agriculture, and waste. The GHG emissions from non-ETS sectors can increase 11 per cent by 2020 compared to 2005 level.

The non-ETS projections in the WM scenario and WAM scenario compared to the ESD targets are presented in Figure 5.13.

[24] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

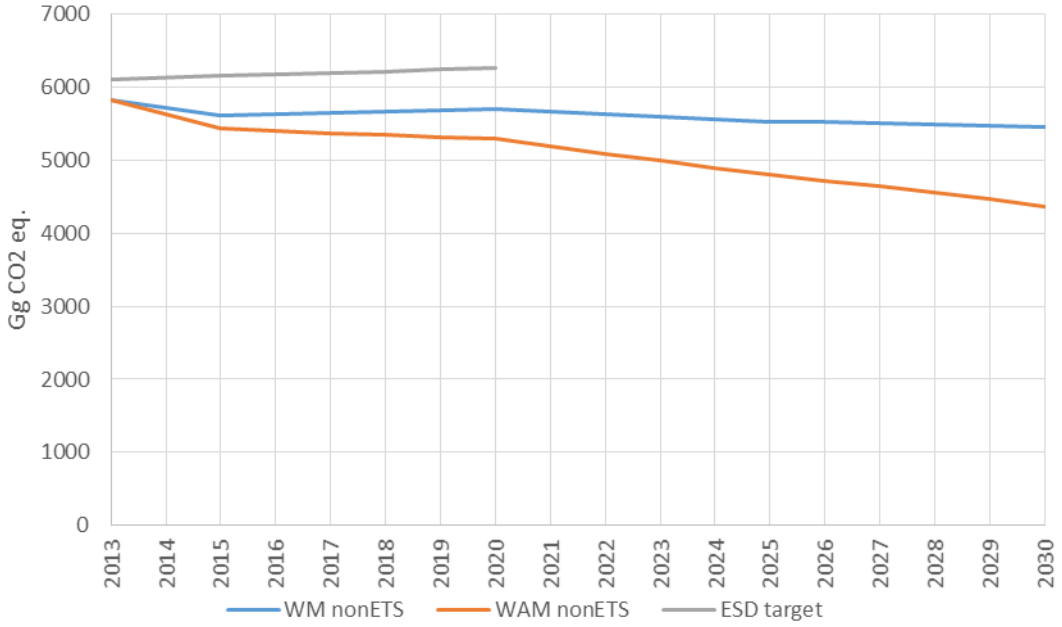

Figure 5.13. Non-ETS projections in WM and WAM scenarios compared to the ESD target, Gg CO_2 equivalent[25]

As seen from the figure above, GHG emissions from both WM and WAM scenarios meet the ESD target for Estonia in the period 2013–2020. In the WM scenario, the emissions are about 9 per cent lower than the ESD target in 2020 and in the WAM scenario about 16 per cent lower.

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.

5.2.7.1. 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 10 additional SHC technology shale oil production plants, only 6 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[26]), only 15 million tons of oil

[25] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).
[26] 20 million tons of geological oil shale equals approximately to 25 million tons of commercial oil shale.

shale will be used for shale oil production. This means, in turn, that the amount of oil shale gas used for electricity production is less than in 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 Table 5.21 and Figure 5.14.

Table 5.21. GHG emissions from the energy sector in the WM scenario and in the SEN scenario, Gg CO_2 equivalent

	2013 (2015 NIR)	2013 (proj.)	2015	2020	2025	2030
Energy WM	19,054.2	19,114.2	18,582.1	18,971.1	16,204.8	14,947.0
Energy SEN		19,114.2	18,582.1	18,611.0	15,844.2	12,652.8
Difference (WM-SEN)		0.0	0.0	360.2	360.6	2,294.1

The difference between the WM and the SEN scenarios is 2294.1 Gg CO_2 eq in 2030. This means, that when the plans of the companies do not realize, then the emissions from the energy sector could be about 15.3 per cent lower in 2030.

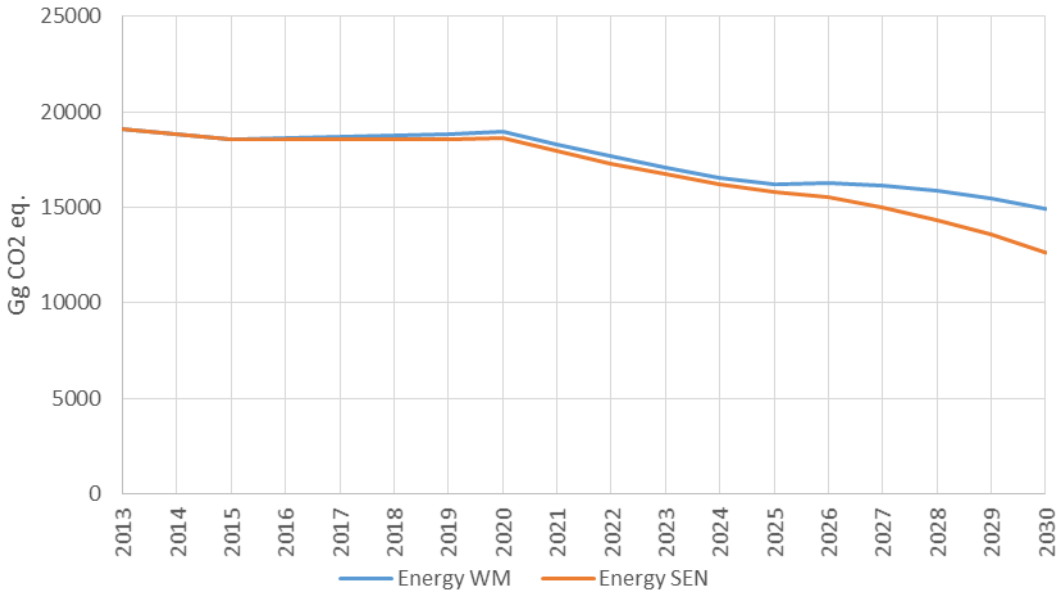

Figure 5.14. Total GHG emissions from the energy sector in the WM scenario and in the SEN scenario, Gg CO_2 equivalent[27]

5.2.7.2. SEN in the IPPU sector

For sensitivity analysis it was assumed that the ammonia production in Estonia will not recover, as the ammonia prices will stay low in the world (SEN scenario). This

[27] The year 2013 in the figure indicates the value used in projections (not the 2013 value in 2015 NIR).

has a major impact on the industrial processes and product use sector, as the share of chemical industry in Estonia is about 20 per cent when the plant works on full load. The results of the WM and SEN scenarios in the IPPU sector are presented in Table 5.22.

Table 5.22. GHG emissions from the IPPU sector in the WM scenario and in the SEN scenario, Gg CO_2 equivalent

	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
IPPU WM	1,061.8	1,084.6	1,059.2	1,331.1	1,256.1	1,223.3
IPPU SEN		1,084.6	1,059.2	1,081.0	1,004.0	971.2
Difference (WM-SEN)		0	0	250.1	252.1	252.1

The difference between the WM and SEN scenarios is 252.1 Gg CO_2 equivalent in 2030. This means that in case the ammonia production does not recover in Estonia, then the GHG emissions from the IPPU sector could be about 21 per cent lower in 2030.

5.2.7.3. SEN in the waste sector

The main share of GHG emissions in Estonia's waste sector is emitted from solid waste disposal on land. The CH_4 emission in this sector is highly correlated with the amount of waste burned in Iru CHP plant and the amount of waste re-used and recycled. Iru CHP plant's *Air pollutants emissions reduction action plan 2013–2030* estimates, that the total amount of mixed municipal waste for burning is 250 Gg annually. In addition to the local mixed municipal waste, in 2013 16 per cent of burned wastes were imported. In the SEN scenario (see Table 5.23) it is assumed, that Iru Plant will increase the waste import, so that ½ of the total waste burned is local and ½ imported.

Table 5.23. GHG emissions from solid waste disposal on land in the alternative scenario, Gg CO_2 equivalent

	2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
Waste WM	370.9	339.7	309.2	263.3	207.0	173.5
Waste SEN		339.7	349.9	315.7	261.7	231.5
Difference (WM-SEN)		0.0	-40.7	-52.4	-54.8	-58.0

The difference in GHG emissions between the alternative scenario and the WM scenario is 58 Gg CO_2 equivalent. This shows clearly the impact of the municipal solid waste use for energy production on GHG emissions in Estonia.

5.2.8. International bunker fuels

International bunkers cover international aviation and navigation according to IPCC Guidelines. GHG emissions from international bunkers are not included in national totals. Projections for international bunkers are presented in Table 5.24.

Table 5.24. Total GHG emissions in international bunkers sector, Gg

		2013 (2015 NIR)	2013 (proj)	2015	2020	2025	2030
International maritime transport	**CO_2**	1,278.4	1,346.7	1,235.9	1,235.9	1,235.9	1,235.9
	CH_4	0.1	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.1	0.1	0.0	0.0	0.0
	Total CO_2 eq.	1,291.9	1,352.1	1,240.8	1,240.8	1,240.8	1,240.8
International aviation	**CO_2**	88.3	88.2	104.9	104.9	104.9	104.9
	CH_4	0.0	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	89.1	89.1	104.9	104.9	104.9	104.9
International bunkers total	**CH_4**	0.1	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.1	0.1	0.0	0.0	0.0
	Total CO_2 eq.	1,381.1	1,441.2	1,345.8	1,345.8	1,345.8	1,345.8

The total GHG emissions from international bunkers are expected to decrease by around 6.6 per cent by 2030 compared to 2013. The projected decrease is caused by the decrease of the amount of fuel used in maritime transport.

5.3. Assessment of aggregate effect of policies and measures

The total effect of planned PaMs is calculated as the difference between the WM and WAM scenarios and is presented in Table 5.25.

Table 5.25. Total effect of planned PaMs, Gg CO_2 equivalent

	2015	2020	2025	2030
GHG	201.5	693.7	1,070.2	1,666.8

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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