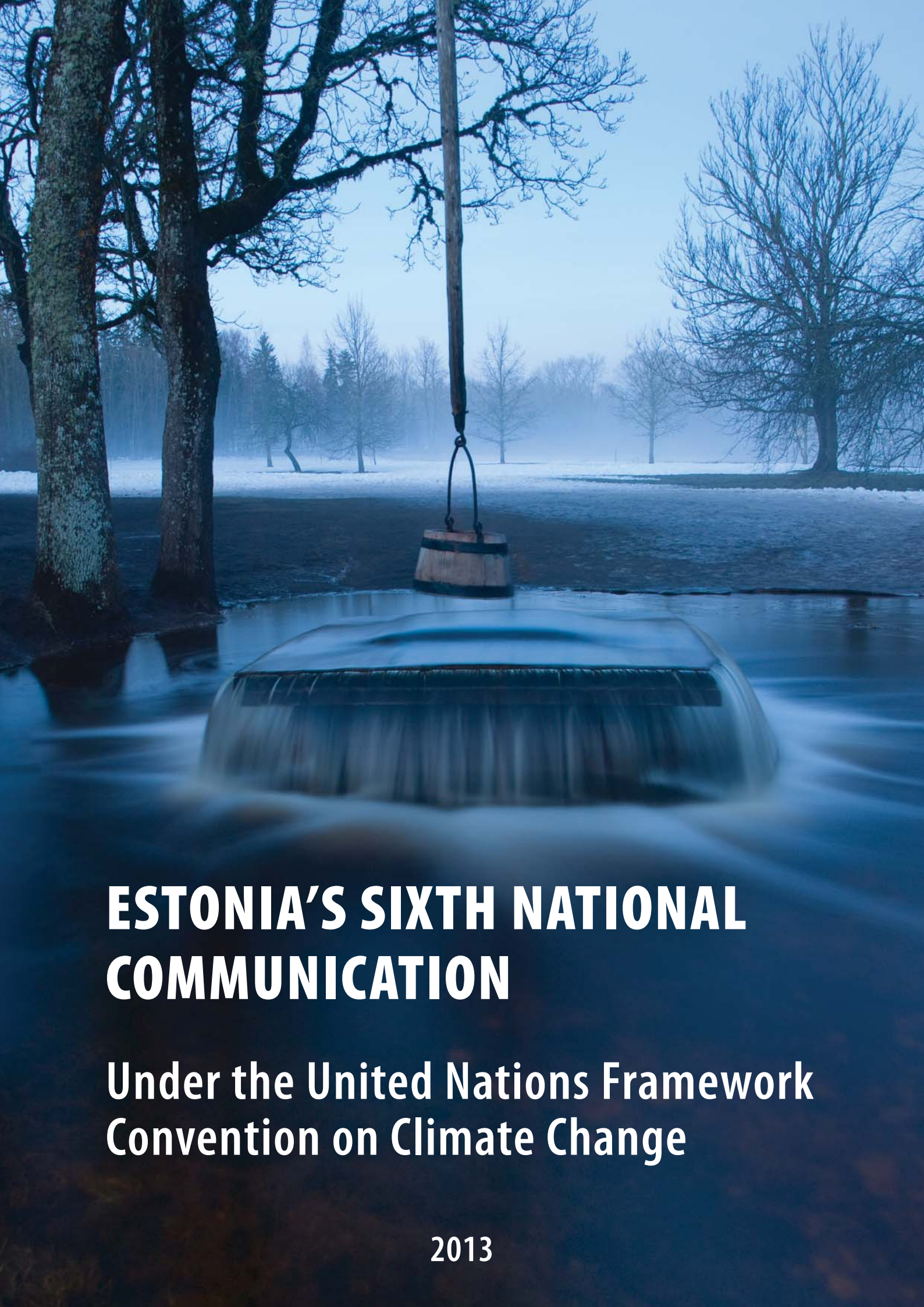

ESTONIA'S SIXTH NATIONAL COMMUNICATION

Under the United Nations Framework Convention on Climate Change

2013

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Estonia
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Forword

I am pleased to present Estonia's Sixth National Communication under the Framework Convention on Climate Change.

Estonia signed the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992 and acceded to the Kyoto Protocol in 1998. The Protocol was ratified by the Estonian Parliament in September 2002. According to the Kyoto Protocol, Estonia had to reduce its GHG emissions by 8 per cent in comparison with its 1990 level between 2008 and 2012.

Estonia has reduced its greenhouse gas emissions by almost 50 per cent compared to 1990, successfully decoupled its greenhouse gas emissions and economic growth and fulfilled the emission reduction target under the Kyoto Protocol. Nearly 90 per cent of emissions originate from fuel combustion, which is why the energy sector is driving the emissions trend. Estonia is participating in two Kyoto flexible mechanisms – international emissions trading and joint implementation.

The European Union adopted a legislative Climate and Energy package in 2008 that commits the EU and its Member States to reducing greenhouse gas emissions by at least 20 per cent by 2020. The reduction in activities encompassed by the EU Emissions Trading Scheme (ETS) is jointly determined at the EU level. Most energy sector emissions in Estonia are included in the EU ETS and therefore addressed centrally. Estonia's national target for sectors outside the emissions trading scheme is an 11 per cent increase in emissions by 2020 compared to the 2005 level. This target is related, for example, to the transport, agriculture and waste sectors.

Estonia will continue its efforts to reduce greenhouse gas emissions in future. This report contains a description and assessment of implemented and planned policies and measures and greenhouse gas projections for greenhouse emissions up to 2030. According to the reported projections the emissions will continue to decrease and the targets in 2020 will be met.

The national communication describes Estonia's vulnerability and the actions taken with regard to adapting to climate change. The report also provides an overview of climate change research, systematic observation and activities to reduce climate change denial and scepticism by means of education, the participation of the general public and awareness-raising.

Minister of the Environment
Keit Pentus-Rosimannus

Tallinn, December 2013

Contents

Abbreviations

AAU	Assigned Amount Unit
AEA	Annual Emission Allocation
BAT	Best Available Technique
bbl	Barrel
boe	Barrels of oil equivalent
BSRN	Baseline Surface Radiation Network
CAP	Common Agricultural Policy
CDM	Clean Development Mechanism
CFBC	Circulating fluidized bed combustion
CHP	Cogeneration of heat and power
CITL	Community Independent Transaction Log
COP 8	8th Conference of the Parties
CRF	Common Reporting Format
CSEUR	Consolidated System of European Union Registries
DES	Data Exchange Standard
DH	District heating
DLIS	Draft Legislation Information System
EC	European Commission
EEIC	Estonian Environment Information Centre
EERC	Estonian Environmental Research Centre
EIC	Environmental Investments Centre
ELMO	Estonian Electromobility Programme
EMP	Electric Mobility Programme
EMS	Environmental management system
EPBD	Energy performance of buildings
EERC	Estonian Environmental Research Centre
ERC	Estonian Research Council
ERDF	European Regional Development Fund
ERU	Emission Reduction Unit
ESD	The Effort Sharing Decision
ESF	European Social Fund
EtEA	Estonian Environment Agency
ETS	Emission Trading Scheme
EU	European Union
EUREM	European Energy Manager
F-gas	Fluorinated greenhouse gas
FACCE	Agriculture, Food Security and Climate Change
FADN	Farm Accountancy Data Network
FP	Framework Programme
FSS	Farm Structure Survey

GCOS	Global Climate Observing System
GDP	Gross domestic product
GEF	Global Environmental Facility
GHC	Gaseous heat carrier
GHG	Greenhouse gas
GIS	Green Investment Scheme
GRETA	Greenhouse Gas Registry for Emission Trading Arrangements
HFC	Hydrofluorocarbon
HOB	Heat-only boiler
IED	Industrial Emissions Directive
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standardisation Organisation
ITL	Independent Transaction Log
JI	Joint Implementation
KP	Kyoto Protocol
LEAP	Long-range Energy Alternatives Planning System
LULUCF	Land use, land-use change and forestry
MBT	Mechanical biological treatment
MER	The Ministry of Education and Research
MEUR	Million euros
MoE	Ministry of the Environment
MoEAC	Ministry of Economic Affairs and Communications
MWe	Electrical power
MWth	Thermal power
NAP	National Allocation Plan
NC	National Communication
NDPES	National Development Plan for Electricity Sector
NGO	Non-governmental Organization
NEEAP	National Energy Efficiency Action Plan
NIR	National Inventory Report
NMVOC	Non-methane volatile organic compounds
NREAP	National Renewable Energy Action Plan
PaMs	Policies and Measures
PFC	Perfluorocarbon
PP	Power plant
PTIS	Public Transport Information System
QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RCM	Regional climate models
RDF	Refuse derived fuel
RDP	Rural Development Plan

RES	Renewable energy source
SEECA	Strategy for Energy Efficiency through Climate Agreements
SF6	Sulphur hexafluoride
SHC	Solid heat carrier
SPA	Sale and purchase agreement
SRF	Solid recovered fuel
TA	Target Area
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
VA	Voluntary agreement
VOC	Volatile organic compound
WM	With Measures
WAM	With Additional Measures
WCRP	World Climate Research Programme
WMO	World Meteorological Organisation

EXECUTIVE SUMMARY

1.1. National circumstances

In 2013, the population of Estonia was 1.29 million and the population density was 29.8 persons per km^2, which makes Estonia one of the least inhabited countries in Europe after Finland. In 2013 43.2 per cent of the country's population was living in Harju County.

Estonia can geographically be described as an extensive peninsula stretching between the Gulf of Finland and the Latvian capital Riga. It is located between latitudes 57°30' N and 59°49' N and longitudes 21°46' E and 28°13' E and marked by conditions typical of the Boreal bio-geographic region. The total area of Estonia is 45,227 km^2, including 42,692 km^2 of land area. Almost half of the land area is covered by forests (ca 49 per cent), one-third is agricultural land (cropland 24 per cent and pastures 6 per cent), around 4 per cent is under settlements and the rest of the territory is covered by swamps and bogs. There are about 1,450 natural and man-made lakes in Estonia (5.6 per cent of the country's territory).

Estonia belongs to the Atlantic continental region of the temperate zone. The summers are moderately warm (the mean air temperature in July is 16-17 °C) and winters are moderately cold (the mean air temperature in February is between –2.5 to –7 °C). Since annual precipitation exceeds evaporation approximately twofold, the climate is excessively damp.

GDP per capita in Purchasing Power Standards (PPS) has undergone noticeable growth since 2002. A decade ago Estonia's GDP per capita in PPS was 50 per cent of the EU27 average, but by 2012 this figure had grown to 69 per cent. In 2012, GDP at current prices was EUR 17.4 billion. Despite the recession, the structure of GDP has remained quite stable in recent years. The biggest contributor is manufacturing, which amounts to 15.4 per cent of GDP. Besides industry, the main sectors in the Estonian economy are wholesale and retail trade (12.3 per cent) and real estate (11.3 per cent). Estonia's economy is highly export-oriented. Manufacturing of machinery and equipment, the wood industry and food and beverage manufacturing have the highest share of the country's industry. Total industrial production has grown rapidly: the pre-recession level was exceeded in 2011.

Estonia ranks among the first ten EU countries in terms of primary energy production per capita, but is on the average level among the EU states regard to the generation of electricity per capita (9.2 MWh). Oil shale, natural gas, and shale oil serve as the primary fuels for power plants. With each year the share of renewables has grown in the Estonian energy balance. In 2011, electric energy produced from renewable resources increased to 12.7 per cent of total production. In the context of climate policy, energy consumption in Estonia's housing stock is significant: household energy consumption as a ratio of total energy consumption is one of the highest in the EU. The share of final energy consumption in buildings is more than 50 per cent of the total. Building energy consumption was 85 PJ in 2010 – 25 PJ of electricity consumption and 60 PJ of heating. By type of energy, purchased heat (district heating) and wood have the biggest share in household energy consumption.

While in 2001, 249 million passengers used the services of Estonian transport enterprises, in 2012 the figure was 201 million, i.e. 19 per cent less. Less use is made of public transport in Estonia than

in other European countries. Between 2006 and 2012, the number of passengers travelling by train dropped by 17 per cent. However, this trend is expected to change as all trains currently in use are to be replaced, which is expected to make railway transport more comfortable for travellers. Population mobility has tripled in the 2000s as a result of commuting and seasonal migration, causing a significant increase in transport energy use.

In 2011, around 21.7 million tonnes of waste was generated in Estonia. At the same time the amount of municipal waste generated annually was 293 kg per capita. Since 2008 the generation of such waste has diminished slightly compared to economic growth. The share of waste deposited in landfill compared with waste generated has significantly decreased, primarily with regard to waste not generated by the oil shale industry. Only five landfill sites remain for disposal of municipal waste in Estonia.

1.2. Greenhouse gas inventory information

Estonia's total greenhouse gas emissions in 2011 were 20,955.58 Gg CO_2 equivalent, excluding net emissions from LULUCF (land use, land-use change and forestry). Emissions decreased by 48.31 per cent from 1990-2011 but increased by around 5 per cent between 2010 and 2011. The major decrease between 1990 and 2011 was caused by structural changes in the economy after 1991 when Estonia regained its independence.

In 2011, the main greenhouse gas in Estonia was carbon dioxide (CO_2), accounting for 89.87 per cent of all GHG emissions (excluding LULUCF), followed by nitrous oxide (N_2O) on 4.79 per cent and methane (CH_4) on 4.57 per cent. F-gases (HFCs, PFCs and SF_6) collectively accounted for 0.77 per cent of overall GHG emissions.

The energy sector is by far the largest producer of GHG emissions in Estonia. In 2011 the sector contributed 89.05 per cent of all emissions, totalling 18,661.63 Gg CO_2 equivalent (Table 1.1). 99.6 per cent of emissions in the sector originated from fuel combustion – just 0.4 per cent were from fugitive emissions. A substantial amount of energy-related emissions in Estonia are caused by extensive consumption of fossil fuels in power and heat production. 70.59 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 48.10 per cent compared to 1990.

Table 1.1. Greenhouse gas emissions and removals by sector in 1990, 1995, 2000 and 2005-2011, Gg CO_2 equivalent

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	Change, per cent[1]
Energy	35,956.90	17,596.48	14,770.96	16,020.66	15,385.39	18,270.54	16,745.77	14,129.73	17,767.99	18,661.63	-48.10
Industrial processes	1,048.23	675.54	705.92	807.11	871.47	1,059.00	1,051.13	451.04	493.86	613.82	-41.44
Solvent and other product use	26.44	26.02	26.76	26.16	26.35	24.43	21.96	18.49	17.39	18.86	-28.69

[1] Change from base year (1990) to latest reported year (2011).

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	Change, per cent[1]
Agriculture	3,166.84	1,483.71	1,203.70	1,170.78	1,166.40	1,209.27	1,329.85	1,230.60	1,256.59	1,270.52	-59.88
Waste	343.72	256.49	434.83	452.93	479.04	483.74	468.96	431.72	452.94	390.76	13.69
Total (excl. LULUCF)	40,542.14	20,038.23	17,142.17	18,477.64	17,928.66	21,046.97	19,617.67	16,261.58	19,988.77	20,955.58	-48.31
Land use, land-use change and forestry	-8,848.70	-10,596.46	1,099.71	-5,037.42	-6,989.58	-8,112.22	-8,125.30	-7,342.13	-5,941.64	-4,262.81	-51.83
Total (incl. LULUCF)	31,693.44	9,441.77	18,241.88	13,440.22	10,939.07	12,934.75	11,492.37	8,919.45	14,047.13	16,692.77	-47.33

The total greenhouse gas emissions reported in the agriculture sector of Estonia were 1,270.52 Gg CO_2 equivalent in 2011. The sector contributed around 6.06 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 – 32.3 per cent and 31.5 per cent respectively. Emissions from the agricultural sector declined by 59.88 per cent by 2011 compared to the base year (1990).

In 2011 the industrial processes sector contributed 2.93 per cent of all GHG emissions in Estonia, totalling 613.82 Gg CO_2 equivalent. The most significant emission sources were CO_2 from cement and lime production at 1.99 per cent and 0.11 per cent respectively, and HFC emissions from refrigeration and air conditioning equipment at 0.71 per cent of total GHG emissions. F-gas emissions as a whole comprised 0.77 per cent of total GHG emissions. Emissions from the industrial processes sector decreased by 41.44 per cent compared to 1990.

The solvent and other product use sector contributed 0.09 per cent of all greenhouse gas emissions in Estonia, totalling 18.86 Gg CO_2 equivalent in 2011. Indirect CO_2 emissions from paint application and other (CRF 3.D.5) contributed the main share of total emissions from the sector – 29.86 per cent and 28.19 per cent respectively. Emissions from the solvent and other product use sector declined by 28.69 per cent by 2011 compared to the base year (1990).

In 2011 the waste sector contributed 1.87 per cent of all greenhouse gas emissions, totalling 390.76 Gg CO_2 equivalent. Solid waste disposal on land contributed the most to total emissions in the waste sector in Estonia. The total CO_2 equivalent emissions from the waste sector in 2011 increased by 13.69 per cent compared to 1990.

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 2011 the LULUCF sector acted as a CO_2 sink, with total uptake of 4,262.81 Gg CO_2 equivalent. Uptake of CO_2 decreased by 51.83 per cent compared to the base year (1990).

Greenhouse gas inventory system

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 United

Nations Framework Convention on Climate Change (UNFCCC) Secretariat and the European Commission. Estonia's 2013 GHG inventory submission was compiled in collaboration between the MoE, the Estonian Environmental Research Centre (EERC), the Estonian Environment Information Centre (EEIC) and Tallinn University of Technology (TUT).

The MoE contracted EERC to prepare the estimates for the energy, industrial processes, solvent and other product use, agriculture and waste sectors and to coordinate inventory. The EERC signed a contract agreement with the Department of Chemistry at TUT to prepare the estimates for the agriculture sector. The EERC, as the inventory coordinator, was responsible for compiling the National Inventory Report (NIR) 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 Department of National Forest Inventory at the EEIC was responsible for the LULUCF and KP LULUCF sectors.

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

The methodologies, activity data collection and emission factors are consistent with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1996) and IPCC Good Practice Guidance (IPCC 2000), IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (IPCC 2003) and 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006).

The quality requirements set for annual inventories are continuous improvement, transparency, consistency, comparability, completeness, accuracy and timeliness.

1.3. Policies and measures

The highest legislative body in Estonia is The Parliament (Riigikogu). The Government of Estonia is the supreme executive body and the highest executive body responsible for carrying out the national environmental policy is the Ministry of the Environment (MoE). The Ministry of Economic Affairs and Communications (MoEAC) is responsible for energy related issues, including energy efficiency and conservation, also for the use of renewable energy sources. Financing institution KredEx, that belongs to the administrative area of Ministry of Economic Affairs and Communications is responsible for analysing and surveying energy and climate related activities and promoting sustainable development with relevant supporting investments. Ministry of Agriculture advises the Government in the field of agriculture and rural life. Responsibility on taxation and use of state budget funs lies on the Ministry of Finance.

During the period that has elapsed since Estonia regained its independence, great progress has been made in developing legislation. Estonian legal acts were amended in the process of integration with the EU, and today the country's legislation (including that on environmental management) is harmonized with the *acquis communautaire* of the EU.

Since regaining its independence in 1991, Estonia has entered into a number of bilateral or trilateral environmental agreements and has become a party to many environmental conventions and protocols.

Estonia signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) on 3 December 1998. The Protocol was ratified by the Estonian parliament in September 2002. According to the Kyoto Protocol, Estonia had to reduce its GHG emissions 8 per cent in comparison with the 1990 level, during the period 2008 to 2012.

The most general national strategy document aimed at developing the Estonian state and society until the year 2030 is The *Estonian National Strategy on Sustainable Development*. The *Ambient Air Protection Act* regulates activities, which discharge emission of pollutants into the ambient air, damage to the ozone layer, and appearance of factors causing climate change.

Estonia's second *National Long-term Development Plan for the Fuel and Energy Sector until 2015 (*approved by the Parliament in 2004) was replaced in 2009 with *National Development Plan of the Energy Sector until 2020*. On the basis of this document, the next programmes have been prepared: *Development Plan for Electricity sector until 2018, Oil Shale Development Plan 2007-2015, Development Plan for Deployment of Biomass and Bioenergy 2007-2013, National Energy Efficiency Programme 2007-2013, National Renewable Energy Action Plan up to 2020.* The new development plan for energy sector until 2030 is under development.

Shale oil production is a rapidly growing branch of industry in Estonia. The quantities of oil shale used for producing shale oil has been growing year by year.

According to Directive 2006/32/EC, the 2016 target for the final energy consumption in Estonia is to achieve 9.9 PJ savings as a result of the energy conservation measures implemented in the period 2008-2016.

In 2010 a new financial opportunity arose with the successful selling of surplus AAUs (Assigned Amount Units). In September 2010, KredEx started to issue renovation grants in the amount of 15-35 per cent in residential sector. In the public sector, the renovation process is arranged by the Riigi Kinnisvara AS (RKAS) under the supervision of the Ministry of Finance.

Directive 2010/31/EU on energy performance of buildings requires EU member states to develop and implement measures to reconstruct public buildings to become nearly zero-energy buildings. Minimum requirements for nearly zero-energy buildings are enforced with Regulation no. 68 of the Government (adopted August 30. 2012).

The main national programme in the transport sector is *Transport Development Plan for 2006-2013*. In March 2011 the Government decided to launch the *Electric Mobility Programme* (EMP) for Estonia combining the extensive introduction of electric vehicles with the financing available in frames of the Kyoto Protocol mechanisms. In 2013, the *Transport Development Plan for 2014-2020* was under development.

The use of environmentally friendly methods in agriculture is encouraged in the *Rural Development Plan 2007-2013*(RDP) that is the implementation document of the *Rural Strategy 2007-2013*. The RDP was prepared for supporting the regionally balanced development of rural areas through the EU Common Agricultural Policy (CAP) measures.

In September 2011, a special commission was established to launch preparations for the drafting of the rural development plan for the period 2014-2020 (Order of Minister of Agriculture No 117, 13.09.2011).

The *Organic Farming Development Plan 2007-2013* sets the objective to increase organically farmed area from 72,800 ha to 120,000 ha by the end of the year 2013.

In 2008, a strategy document *National Waste Management Plan 2008-2013* was endorsed by the Government. In May 2012, the Minister of the Environment initiated the preparation of the *National Waste Management Plan* for the period 2014-2020.

According to the *Forest Act* and the *Sustainable Development Act*, forestry development plan is to be done in every ten years. *Estonian Forestry Development Programme until 2020*, approved by the Parliament in 2011, is the official sustainable development strategy for Estonian forest sector. The programme determines objectives and describes measures and tools for achieving them for the period 2011-2020.

1.4. Projections and the total effect of policies and measures

Projections are given for all greenhouse gases considered in the Kyoto Protocol. Projections are divided into the following sectors: energy (including transport); industrial processes (including F-gases); solvent and other product use; agriculture; waste; land-use, land-use change and forestry.

Projections are calculated for the years 2015, 2020, 2025 and 2030. 2010 is the base year.

Two scenarios are presented in Chapter V (Figure 1.1). The 'With Measures' (WM) scenario evaluates future greenhouse gas emission trends under the current policies and measures. The second scenario, 'With Additional Measures' (WAM) includes all policies and measures applied in the WM scenario and additional measures that are planned, but have not been implemented or adopted.

Projections in the energy sector are calculated using LEAP (Long Range Energy Alternatives Planning System) program. The estimated final consumption of fuels in the future years are based on the projections of Ministry of Economic Affairs and Communications presented in the *National Renewable Energy Action Plan* (NREAP) of Estonia. Projections in industrial processes sector are based on data received from companies that are included in industrial processes sector. Emission projections from consumption of halocarbons and SF_6 are based on expert judgement.

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 (including public electricity and heat production and shale oil production); manufacturing industries; and construction, transport and other sectors (including commercial/institutional, residential and agriculture/forestry/fisheries).

Projections in solvent and other product use sector are calculated based on historical data (2005-2010) and are also based on the projection of population.

Projections in agriculture sector are based on the information received from Ministry of Agriculture and also expert judgement.

Projections in LULUCF are calculated using land use data from 1990 to 2010 and emissions reported in the *National Inventory Report 2012* and CRF tables.

Projections in waste sector are based on *National Waste Management Plan* for years 2008-2013 and on expert judgement.

Total GHG emissions of Estonia in WM scenario (without LULUCF) are expected to decrease about 19 per cent by 2030 compared to 2010 (19,962 Gg CO_2 equivalent in 2010 and 16,165 Gg CO_2 equivalent in 2030).

Total GHG emissions of Estonia in WAM scenario (without LULUCF) are projected to decrease 21 per cent by the year 2030 compared to 2010 (19,962 Gg CO_2 equivalent in 2010 and 15,797 Gg CO_2 equivalent in 2030).

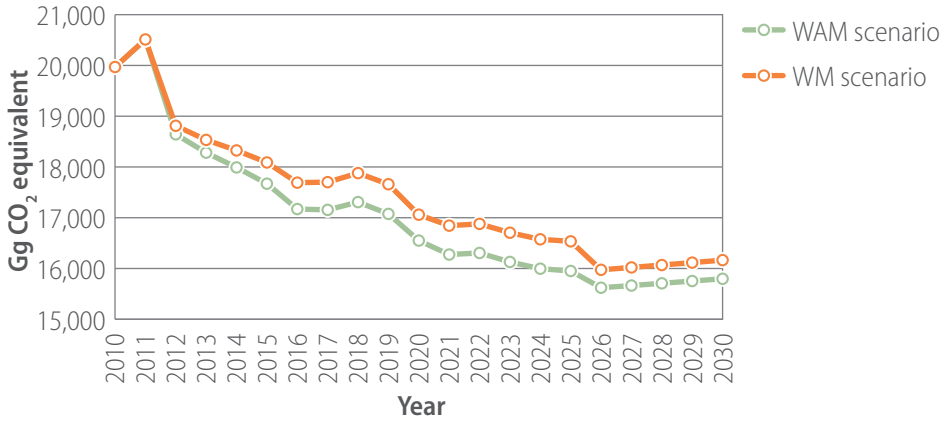


Figure 1.1. Total GHG emissions in WM and WAM scenarios (without LULUCF), Gg CO_2 equivalent

1.5. Vulnerability assessment, climate change impacts and adaptation measures

Even though climate change is not likely to be as extreme in Estonia as in many other countries in the EU (notably in southern Europe) and around the world, and although some effects can be considered positive, we expect a continued rise in temperatures and a resulting decrease in ice and snow cover; more frequent heat waves and droughts in summer; more health problems and forest fires caused by longer heat waves; more storms and power failures; more floods; changes in vegetation, species and habitats; invasions of alien species (incl. new plant pests and infectious agents); and other adverse effects. The Chapter VI discusses the possible impact of climate change on coastal areas, water management, forestry, peatlands, agriculture, the energy sector, industry, construction and infrastructure, public health and tourism. Detailed sector-specific analyses of possible climate change impact in Estonia still need to be carried out.

Air temperature has increased at a more rapid rate in Estonia in the second half of the 20th century than the global average. Climate warming was especially intense from 1966-2010. In the period 1966-2010, it is also apparent that the increase in annual precipitation is statistically significant in some Estonian meteorological stations and insignificant in others. Precipitation has increased in certain areas – north-eastern Estonia, southern and south-eastern Estonia, along the shores of Lake Peipus and in the coastal areas on the Gulf of Riga. No significant increase has been noted in observation stations elsewhere.

To date, there have not been many risk analyses concerning vulnerability to climate change in Estonia. In the European Environment Agency report 'Climate Change, impacts and vulnerability to climate change in Europe 2012', Estonia is considered to be among countries with no or marginal potential vulnerability to climate change. From 2009 to 2011 an EU project 'Baltic Challenges and Chances for local and regional development generated by Climate Change – BalticClimate' was implemented to enable municipalities, regions and local stakeholders in the Baltic Sea region to deal

with the issue of climate change in an integrated, cooperative, and sustainable way, in terms of day-to-day business as well as long-term strategies. The focus was on small and medium sized cities and rural areas and their surrounding regions within the Baltic Sea Region. Out of the identified climatic and socioeconomic stressors the activities, or sectors, that were seen to be most sensitive were the agricultural sector and the infrastructure. These areas were by far, influenced by the most stressors, which in turn made them highly sensitive. The agricultural sector was seen as being affected through decreased productivity, changing species, increasing periods of rain and loss of nutrients. In the case of infrastructure no similar details were elaborated on how it would be affected.

To date, Estonia has largely been engaged in preparing for emergencies and mitigating climate change (reducing greenhouse gas emissions) and has no separate strategy or action plan for adaptation to the impact of the climate change. Various projects have been and continue to be implemented, and the effects of climate change have been discussed in numerous research papers, but the information is scattered between areas and agencies. In preparing to adapt to climate change, Estonia has actively dealt with ensuring preparedness for emergencies and crisis management at the national level.

A big step forward in order to take effective adaptation measures in a timely manner in all areas and at all administrative levels, the drafting of the Estonian national strategy and action plan for adapting to climate change was commenced in 2013 in the framework of the project titled 'Elaboration of Estonia's draft national climate change adaptation strategy and action plan'. The project will eventually enhance Estonia's preparedness and capacity to respond to the impacts of climate change at local, regional and national level, developing a coherent approach and improving coordination.

1.6. Financial resources and transfer of technology

Estonia is not an Annex II party therefore the provisions of Article 4.3, 4.4 and 4.5 are not applicable. Information on activities, actions and programmes undertaken in fulfilment of its commitments under Article 10 are included in the relevant sections of the NC6 (see Annex II). Estonia´s contribution to fast start finance projects is covered in Subchapter 9.8.1.

1.7. Research and systematic observation

In the 'Knowledge-based Estonia' strategy, the Government set the goal of bringing the total cost of research and development (R&D) to 1.9 per cent of GDP by 2010 and to 3 per cent of GDP by 2014. Upon preparing the competitiveness strategy 'Estonia 2020', the reference levels of Estonian R&D activities were adjusted: 2 per cent of GDP by 2015 and 3 per cent of GDP by 2020. Above all, thanks to the doubling of the R&D volume of the private sector, R&D investments rose to 2.37 per cent of GDP in 2011. This level exceeds the EU average and is characteristic of developed industrialised countries.

Scientific research and development projects in Estonia are financed from different financial resources, including from the state budget (e.g. R&D funding under the Ministry of Education and Research), the EU Cohesion Fund, European Regional Development Fund, European Social Fund etc.

The Estonian Environment Agency, Tartu Observatory, the Institute of Ecology and Earth Sciences of the University of Tartu, the Laboratory of Atmospheric Physics of the University of Tartu, the Estonian Marine Institute of the University of Tartu, the Estonian University of Life Sciences, the Institute of Ecology of Tallinn University, the Marine Systems Institute of Tallinn University of Technology, the Centre for Nonlinear Studies of the Institute of Cybernetics of Tallinn University of Technology, the Geological Survey of Estonia, the Tallinn Centre of the Stockholm Environmental Institute and the Estonian Environmental Research Centre have conducted research related to climate and climate change. A detailed list of researches and studies on impacts of climate change, adaptation and mitigation are given in Chapter VIII.

Climate observations comprise of systematic meteorological, atmospheric, oceanographic and terrestrial monitoring. Ensuring operative and continuous provision of meteorological and hydrological forecasts, warnings and monitoring of data for the public and for authorities is the strategic objective of the Estonian Environment Agency (EtEA) weather service. The main objectives of the environmental monitoring of the EtEA are forecasting changes in environmental factors and the state of the environment (by means of continuous monitoring and assessment of environmental factors and the status of the environment) with the help of the elaborated system of indicators and forecast models.

The Estonian Environmental Research Centre (EERC) is the leading institution in Estonia for the research of the International Cooperation Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems. Development and maintenance of Estonian Air Quality Management System is an important task of the EERC Air Quality Management Department.

Other institutions involved in climate observations include Tartu Observatory, the Estonian Marine Institute of the University of Tartu and the Marine Systems Institute of Tallinn University of Technology.

1.8. Education, training and public awareness

The results of two major surveys conducted in the last few years – the survey of the environmental awareness of Estonian citizens carried out in 2012 and the Eurobarometer survey of attitudes of European citizens towards climate change in 2011 – indicate that although Estonians consider themselves to be generally environmentally aware, their interest tends to be limited to what takes

place close to where they live, whereas a lot of Estonians view the consequences of climate change as a threat that is distant in both space and time.

The development of climate education is mostly observable in general education, which increases environmental awareness and sustainability. The topic of climate change is included in the national curricula of basic schools and upper secondary schools. Although it is not possible to study climate change as a separate field of specialisation at Estonian universities, many Bachelor's or Master's programmes in environmental studies *inter alia* include topics related to climate change. Numerous upper secondary schools and vocational educational institutions offer courses in environmental studies or give special consideration to issues related to the environment in their curricula.

Citizens have started having a say and participating in shaping their physical and social environment more actively. A growing number of people are grasping the importance of individually contributing to the protection of the environment, including combating climate change. The "Let's Do It!" clean-up campaign that was launched as part of a civic initiative can be highlighted as an example, with over 40,000 volunteers across Estonia taking part in 2013. On the whole, several non-governmental organisations play an important role in educating Estonians in the field of climate change. In addition, the government has turned its attention to more systematic promotion of environmental education. The Ministry of the Environment (MoE) has organized lectures about climate to various stakeholders as well as basic and upper secondary school students and the ministry cooperates with Estonian Public Broadcasting to produce scientific programmes and show quality films related to climate and geography to a wider audience. Various training programmes have been held whose target groups have been journalists, entrepreneurs and drivers. The main topics under discussion included energy conservation, economical driving and air pollution. The main source of information concerning climate policy and its implementation, providing an overview of climate change-related issues is the MoE website www.envir.ee.

In the last decade, various IT solutions have been implemented to ensure better access for the Estonian public to environmental information. A special electronic system called the Draft Legislation Information System (DLIS) has been created to approve draft legislation. Public servants of the state use the information system to approve draft legislation and submit it to the Government. Citizens are able to express their opinions concerning the content of draft legislation and suggest proposals to the Government via the website https:// www.osale.ee/.

A lot of work has also been performed at the local level: for example, three cities (Tallinn, Kuressaare and Rakvere) have joined the Covenant of Mayors and thereby assumed the obligation to reduce CO_2 emissions by 20 per cent by 2020 compared to the base year 2007. Estonia has also participated in several education cooperation projects and has co-financed assistance projects aimed at developing countries with the purpose of raising awareness of climate change.

11

NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

2.1. Government structure

The institutional structure of the Estonian state is set out by the Constitution adopted in 1992. Estonia is a parliamentary democracy with the **Riigikogu** (the Estonian Parliament) exercising supreme legislative power, the President of the Republic acting as the head of state and the Government of the Republic exercising executive power. The **Riigikogu** is a single-chamber parliament whose main task is to fulfil the function of establishing normative acts. Another important task of the Riigikogu is the approval of the annual state budget. A member of the Riigikogu has the right to request explanations from the Government of the Republic and its members and other high-ranking public servants. This enables members of parliament (MPs) to observe the activities of the executive power (the government) and the abovementioned senior state officials.

The Head of State of Estonia is the **President** of the Republic, who is elected indirectly by the parliament or, if no candidate wins a two-thirds majority therein, by an electoral college composed of MPs and representatives of local councils. Estonia holds presidential elections every five years. The President proclaims the laws passed in the Riigikogu and ratifies or denounces treaties. He or she represents Estonia in international relations, appoints Estonian diplomats and receives the credentials of diplomats from other countries. It is also his or her role to appoint the Prime Minister, other ministers, the President of the Bank of Estonia and several other senior public servants. The President has an Academic Advisory Board.

The **Government** of the Republic is comprised of the Prime Minister and other ministers. The ministers are divided into those who run ministries ('portfolio ministers') and those who do not run ministries ('ministers without portfolio'). The Cabinet contains up to 15 ministers, including the Prime Minister. At present there are 11 portfolio ministers and one minister without portfolio (the Minister for Regional Affairs).

The Government has executive power in the state. The definition of such executive power includes, within a limited scope, legislative drafting and administration of justice. In order to implement laws, they must often be further specified. This is done through regulations of the Government of the Republic and ministers. Executive power is divided between two functions: governing and administration. The Government of the Republic has the function of coordinating and supervising the institutions of the executive power of the state.

The next level of government in Estonia is **local government**. Pursuant to the Constitution, municipalities enjoy autonomy from the central government. The state is divided into 15 counties. However, these do not constitute a separate level of regional government, but act instead as representatives of the central government in the respective regions.

There are 226 local government units, including 193 municipalities and 33 cities. However, the functions of all municipalities are the same by law: they are primarily responsible for education, public works, housing, local road maintenance and primary level health care. Local government units are financially heavily dependent on the central government. The size of the subsidies

from the central government to local government equals one-third of the income earned by the municipalities themselves.

2.1.1. Implementation of climate policy within government structure

In Estonia there are two principal ministries responsible for climate and energy policy: the Ministry of the Environment and the Ministry of Economic Affairs and Communications. The Ministry of the Interior is in charge of risk assessments of emergency situations and relevant response plans.

Coordination lies with the **State Chancellery**, whose task is to support the Government of the Republic and the Prime Minister in policy drafting and implementation. There are two offices in the State Chancellery involved in climate policy: the Strategy Office, which coordinates the drafting and implementation of the Government's action plans as well as strategic development plans to increase the country's competitiveness and promote sustainable development; and the **European Union Secretariat**, which coordinates the development of Estonia's positions on issues relating to the European Union and the transposition of European Union legislation. It also advises and supports the Prime Minister on issues relating to the European Union and in the preparation of European Council summits.

The **Ministry of the Environment** is primarily responsible for the implementation of UNFCCC, the Kyoto Protocol and relevant legal acts of the European Union. Within the ministry, the Climate and Radiation Department is responsible for the practical implementation of climate policy. The ministry develops Estonia's climate policy by preparing environmental action plans and strategies and drafts the legislation required for the implementation of its own as well as UN and EU climate policy. The ministry also coordinates the preparation of annual GHG inventories, National Communications, the implementation of joint implementation projects, International Emissions Trading and the European Union emission allowance trading scheme (EU ETS). Another major institution in the climate context under the Ministry of the Environment is the Estonian Environment Agency Weather Service – a government service that performs meteorological and hydrological measurements, issues weather forecasts, prepares the climatological survey of Estonia and more.

In order to assemble everything needed to organise the area of the environment and basic information that is of high quality at both the domestic and international level, the state system for the organisation of environmental monitoring has been restructured. In 2010 the Estonian Environment Information Centre (EEIC) was established when two environmental institutions were merged following reorganisation. The new agency consolidated the former Estonian Environment Information Centre and the Centre of Forest Protection and Silviculture into a single organisation. As a result of the merger of the Estonian Meteorological and Hydrological Institute and the Estonian Environment Information Centre, the Estonian Environment Agency was formed in 2013. This agency is the legal successor to its predecessors.

The **Ministry of Economic Affairs and Communications** develops and implements national economic policy and prepares economic development plans in fields that have a direct impact

on climate change: industry, trade, energy, housing, building, transport and traffic management. (Examples include Estonia's Electric Energy Development Plan, Fuel and Energy Management Long-Term Development Plan, Energy Saving Programme, Renewable Energy Development Plan and Transport Development Plan.)

In summer 2009 the Ministry of Economic Affairs and Communications was ordered by the Riigikogu to establish an Energy and Climate Agency (known by its Estonian acronym KENA). The activities of the agency were to focus on two areas: analysing trends in energy and the climate; and applying measures of sustainable development. The agency operated as part of the KredEx Credit and Export Guarantee Fund for just 18 months, when its functions were divided up between other agencies following internal restructuring in KredEx in 2010.

In addition to the abovementioned ministries, the **Ministry of the Interior**, **Ministry of Agriculture**, **Ministry of Education and Research**, **Ministry of Social Affairs** and **Ministry of Foreign Affairs** are involved in different aspects of the climate issue at the state level. Regulation of crisis management and rescue work is, in principal, the task of the Ministry of the Interior, which is also responsible for risk assessments of emergency situations (including storms, floods and extreme weather conditions) and drafting relevant response plans.

If one ministry has a leading role in a certain climate-related strategy or development plan, the other ministries involved participate in working groups for the development of such strategies. In recent years local governments have also become more active in integrating climate aspects into spatial planning and transport management. Moreover, participation in different projects that have an impact on reducing GHG emissions has increased. Several local governments that are prone to flooding have developed detailed adaptation and action plans to deal with storms and floods.

2.2. Population profile

In Estonia, the rapid and irreversible decline in mortality and fertility characteristic of demographic modernisation lasted until the 1930s. This period is often considered the borderline that marks entry into a modern demographic regime. In Estonia's case, the beginning of this regime coincided with the loss of statehood. Since independence was restored fertility has been characterised by a significant shift in the timing of births. One outcome was a steep reduction in overall fertility rates in the early 1990s, but from 2007-2010 the rate reached slightly more than 1.6 children (78-79 per cent of the recovery level) and since then has fluctuated around that level (2012 = 1.59 children per woman of fertile age).

Starting in the late 1990s another societal change began to have an impact on the population's long-term health: life expectancy rose from a low 60.5 years for men and 72.7 years for women in 1994 to 71.2 years for men and 81.8 years for women in 2011. One of the features of the population's contemporary health is the large gap between the life expectancy of men and women, which remains

around 10 years. Another feature is that despite the favourable trends shown in the rapid increase in expected years of life (at birth), this has not translated into an increase in healthy years of life. According to data from the 2011 census, males born in that year were only expected to live healthily for 52 years and females for 57. The increase in healthy years of life has not been as rapid as might be expected and thus the gap between Estonia and both Northern and Western Europe remains to be overcome – especially in the case of men.

One of the local features of societal change since World War II has been the enormous turnover of migratory flows originating from territories in the former Soviet Union. By the early 1990s this had resulted in one of the largest populations of foreign origin in Europe, although numbers reduced following the withdrawal of the Soviet Army and return migration. According to the 2011 census, the first generation foreign-born population of immigrant origin formed around 13 per cent of the Estonian population, while the third generation population of foreign origin formed almost 37 per cent. Another feature of contemporary migration flows is that emigration flows today no longer consist of people who remain in foreign countries for the rest of their lives – they more closely resemble a process of commuting between countries, depending on the life phase of the population groups involved. On the one hand, increased emigration flows represent larger birth cohorts reaching active ages in obtaining education and realising abroad the skills they have acquired. On the other hand, immigration flows reflect to a large extent return migration, where Finland and Russia are the main departure countries.

Demographic processes in today's Estonia have led to the active aging of the population. This implies that population decline and aging will persist, and carefully planned efforts for the adaptation of societal institutions to demographic changes will be required. In combination with Estonia being one of the least inhabited countries (see map about density of Estonian population in Figure 2.1) in Europe, this makes social inclusion one of the main challenges in contemporary Estonia.

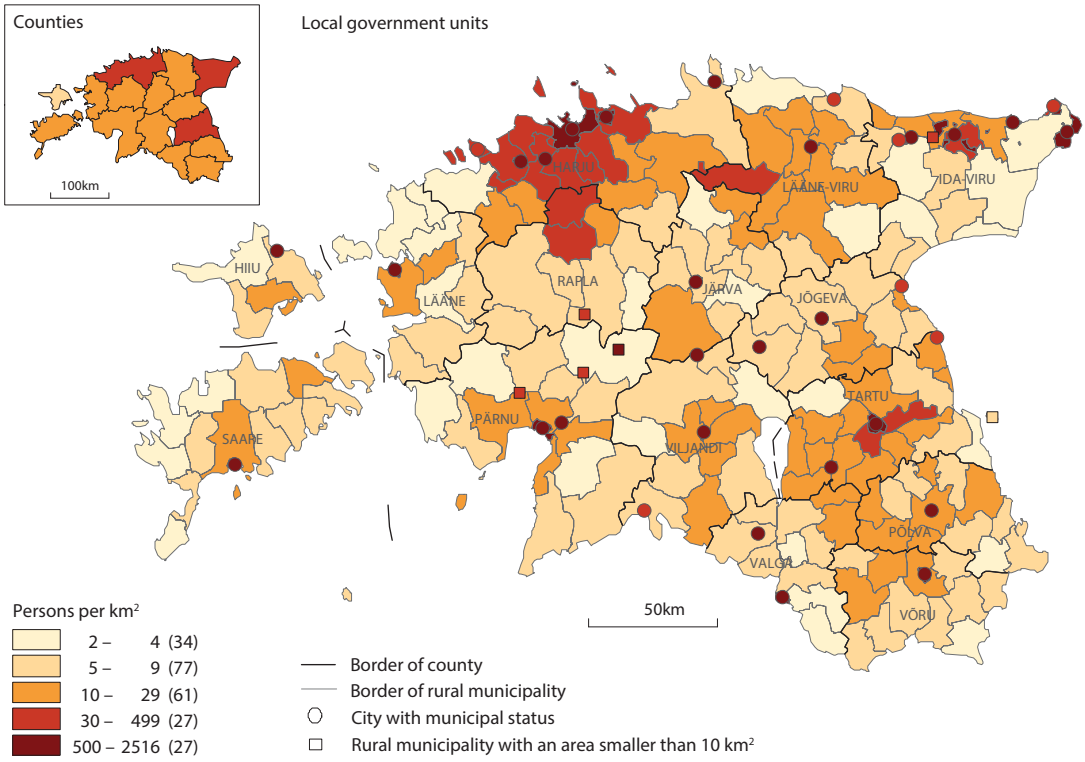


Figure 2.1. Density of Estonian population by local government and county 2011
Source: Statistics Estonia

2.3. Geographic profile

Located on the Baltic Sea, Estonia is the northernmost and also the smallest country in the Baltic States, in terms of both population and area (45,227 km²). Along with the Western Estonian archipelago and the numerous islands in its coastal waters, Estonia can geographically be described as an extensive peninsula stretching between the Gulf of Finland and the Latvian capital Riga. The country has a variety of geographical features that form the basis of its climatic values: a long coastline; a high number of islets (*ca* 1,620); large, untouched bogs (*ca* 15 per cent of its territory); a large number of lakes (*ca* 1,450) and rivers; a very flat relief (with almost two-thirds of the country lying less than 50 metres above sea level and the highest point being Suur Munamägi at 317 metres above sea level); and unique base rock openings – limestone cliffs – all along the northern coast of the mainland and the largest islands.

Estonia's neighbours are Russia to the east, Latvia to the south, Sweden to the west (across the Baltic Sea) and Finland to the north (across the Gulf of Finland). Its land border is 645 km long, with half of it running along rivers and lakes.

Located between latitudes 57°30' N and 59°49' N and longitudes 21°46' E and 28°13' E, Estonia is marked by conditions typical of the Boreal bio-geographic region. However, due to the strong

influence of the Baltic Sea, half of the country can be considered to have boreo-nemoral and the other half more continental boreal conditions.

Almost half of the land surface is covered by forests (*ca* 47 per cent). Of the remainder, around one-third is agricultural land (cropland 28 per cent and pastures 7 per cent), 2 per cent is under settlement and the rest is covered in mires and bogs. There are around 1,450 natural and man-made lakes in the country (representing 6 per cent of its territory).

Compared with other territories of a similar size situated north of the 57th parallel, Estonia's biological diversity is among the richest. This is due to the varied climatic conditions, the existence of island and continental sectors, the abundance of sea and inland waters and the variety of base rocks with correspondingly diverse soil conditions, all of which paved the way for the evolution and development of a wide diversity of ecosystems. 40,000 species are thought to exist in Estonia, although only 26,600 of them have been identified. Invertebrates (animals without backbones) constitute approximately 50 per cent of all biota.

Although Estonia is a relatively small country by area, it has a comparatively large proportion of unspoiled protected nature. This is mainly due to the low population density – only slightly more than 30 inhabitants per km^2. This figure itself is highly polarised, being almost two-thirds in urban and only one-third in rural areas. Very few countries in Europe can afford to have more than 15 per cent of their land under nature protection. In total, 570 plant, mushroom and animal species are protected by law in Estonia, while 18 per cent of land is under legal protection.

Sea-level rise due to thermal expansion and the melting of glaciers, ice caps and ice sheets may be one of the main impacts of climate change for Estonia. Accelerated sea-level rise could strongly affect the territory of the country because of its relatively long coastline and extensive low-lying coastal areas.

2.4. Climate profile

The main factor influencing Estonia's climate is the country's geographical position. Estonia belongs to the mixed-forest sub-region of the Atlantic continental region of the temperate zone and lies in the transition zone between maritime and continental climates.

According to the Köppen climate classification, the western part of Estonia belongs to the Cfb zone (a marine climate with mild winters) while the eastern part of the country belongs to the Dfb zone (a humid continental climate with severe winters).

Local climatic differences are due, above all, to the neighbouring Baltic Sea, which warms up the coastal zone in winter and later has a cooling effect, especially in spring. The topography, particularly the uplands in the south-eastern part of Estonia, plays an important role in the distribution and duration of snow cover.

As a result of these factors, summers are moderately warm (the mean air temperature in July being 16-17 °C) and winters are moderately cold (the mean air temperature in February being between -2.5 and -7 °C). The highest daily temperature ever recorded is +35.6 °C and the lowest -43.5 °C.

Since annual precipitation is approximately double that of evaporation, the climate is excessively damp. Mean annual precipitation is *ca* 550-700 mm, ranging from 520 mm on some islands to almost 740 mm in the uplands. Seasonal variation in precipitation is similar throughout the country, the driest months being February and March. From then on, precipitation gradually increases until July and August, after which it decreases towards winter and spring. The lowest annual precipitation can be less than 350 mm on the coast, but inland regions sometimes have more than 1,000 mm. The highest daily rainfall ever recorded is 148 mm and the highest annual rainfall a total of 1,158 mm.

Snow cover becomes established earliest in the Haanja, Pandivere and Otepää uplands, usually in early December, and remains there until the end of March. On the islands of Saaremaa and Hiiumaa, permanent snow cover predominantly forms in mid-January. In some years, permanent snow cover does not form at all.

The prevailing winds are south-westerly, southerly and westerly. Winds from the north are more frequent in spring and early summer. Average wind velocity is 5-7 m/sec in coastal areas and 3-5 m/sec inland. The strongest winds occur in the autumn and winter months, especially in November, December and January (with an average velocity of 4.6 m/sec). The weakest winds are felt in summer (July/August, with an average velocity of 2.5-3.6 m/sec).

Mean annual total solar radiation in Estonia is 3,300-3,600 MJ/m^2, while sunshine duration varies from 1,650 hours inland to 1,900 hours on the islands.

The sum of effective temperatures (over 5 °C) is up to 1350° in northern Estonia and up to 1500° in the southern part of the country.

Extreme weather events

A number of extreme weather conditions have been experienced in recent years: for instance, in 2010 a severe thunderstorm (known as a 'derecho') struck Estonia and later the same year the country was hit by the violent snowstorm Monika. Both of these imposed significant costs on the country's households and businesses.

The winters of 2009/2010 and 2010/2011 brought extremely low temperatures and heavy snowfall. New snow cover records were set in many parts of the country. With a mean national temperature of -7.5 °C, 2009/2010 was the 8th-9th coldest meteorological winter (December-February) in the last 50 years.

Record warm summers occurred in 2010 and 2011 (July-August). In August 2010 a weather station in Narva-Jõesuu in north-eastern Estonia registered an official air temperature of 35.4 °C, which

was just 0.2 °C below the country's highest ever temperature reading. The average air temperature of 18.6 °C made 2010 the warmest summer in Tartu since records began in 1866.

In 2011 Estonia experienced its warmest autumn in the past 50 years, while 2012 was the wettest for the same period.

2.5. Economic profile

From 2000-2007, Estonia's economy experienced one of the highest growth rates of any emerging market. The bubble then burst, and in the two years that followed the country's economy shrank by *ca* 18 per cent. Domestic demand decreased and export demand also plunged.

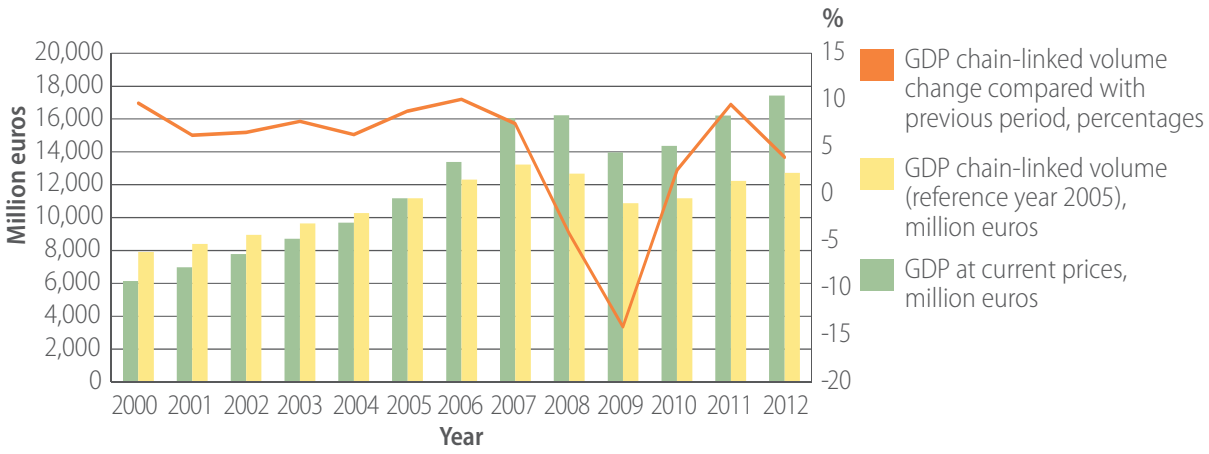


Figure 2.2. Growth in Estonian GDP 2000-2012, million euros
Source: Statistics Estonia

GDP per capita in Purchasing Power Standards (PPS) has undergone noticeable growth since 2002. A decade ago Estonia's GDP per capita in PPS was 50 per cent of the EU27 average, but by 2012 this figure had grown to 69 per cent. GDP in domestic currency calculated in current prices has gone through massive growth because of high inflation levels in recent years. From 2002-2012 the value of GDP has more than doubled.

In 2012, GDP at current prices was EUR17.4 billion (Figure 2.2) and gross national income (GNI) was EUR16.6 billion. Following the recession the GDP growth rate accelerated to 9.3 per cent in 2011, which was the highest in Europe. 2012 saw GDP grow by 3.9 per cent. Recent years have also changed the main GDP growth drivers. During the recession the main contributor to GDP growth was exports, but in 2012 and 2013 external demand has grown weaker and domestic demand has become more important.

Despite the recession, the structure of GDP has remained quite stable in recent years. The biggest contributor is manufacturing, which amounts to 15.4 per cent of GDP. Besides industry, the main sectors in the Estonian economy are wholesale and retail trade (12.3 per cent) and real estate (11.3 per cent).

Foreign investments made in Estonia from nearby countries have integrated Estonia's economy more closely with those of the Nordic countries, with Sweden and Finland maintaining solid leads (27.6 per cent and 23.3 per cent of all foreign direct investments respectively). Finland's share has remained relatively stable in recent years, although Sweden's has fallen by around 10 per cent due to the banking sector. 56 per cent of Swedish investments are in financial mediation, while 24 per cent of Finnish investments are made in the manufacturing sector.

The domestic market in Estonia is small and has limited growth potential. As such, economic growth is directly dependent on exports of goods and services to foreign markets. Estonia's main exports markets are its neighbouring countries – Sweden, Finland, Russia and Latvia – which account for more than half of Estonian goods exports. The percentage of export in Estonia's GDP in 2012 was 92.5 per cent, which was the highest in the last 20 years (Figure 2.3).

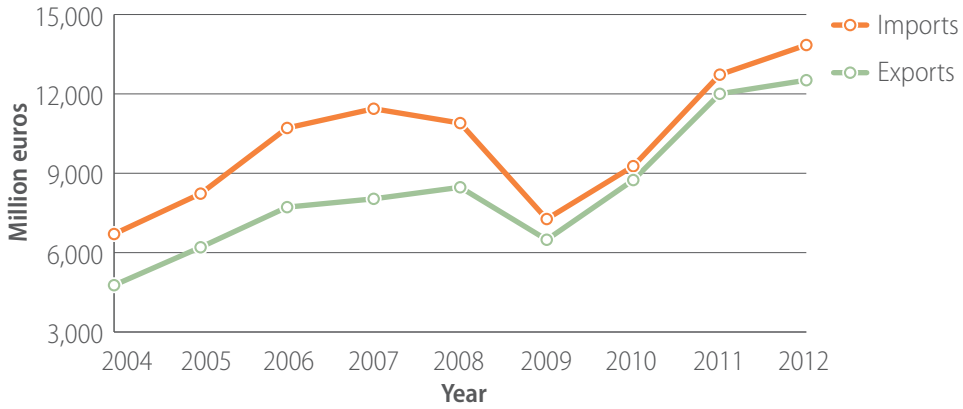


Figure 2.3. Foreign trade by year 2004-2012, million euros
Source: Statistics Estonia

2.6. Energy

The main purpose of the fuel and energy sector is to supply the country with high-quality fuel, electricity and heat to ensure the optimal functioning and development of the fuel and energy sector. Its main tasks are to reduce the environmental impact of the sector, to enhance the efficiency of energy production and consumption and to increase the use of renewable energy sources. Oil shale, as Estonia's primary natural resource, ensures the country's energy security, but at the same time has a negative impact on the environment.

Estonia ranks among the top ten EU Member States in terms of primary energy production per capita, exceeding the other Baltic States by around three times. Primary energy production in Estonia continued to increase in 2012, reaching an all-time high, with its main source being oil shale (Figure 2.4). At the same time, the production of oil shale has also increased since 2000. Compared to 2007 prior to the recession, 14 per cent more oil shale was produced in 2012. Besides electricity production, oil shale is also used to produce shale oil, the production volumes of which have been growing steadily in recent years. Production of electricity totalled 12,000 GWh in 2012 – 7 per cent

less than in 2011 and 2 per cent less than in 2007. This fall in electricity generation was caused by higher imports, which were caused by lower energy prices in Finland. Estonia has a long-standing tradition of using hydro and wind power. In 2007 the share of electricity generated from renewable sources was just 1.5 per cent of total electricity consumptionbut by 2012 this figure had risen to 15.2 per cent.

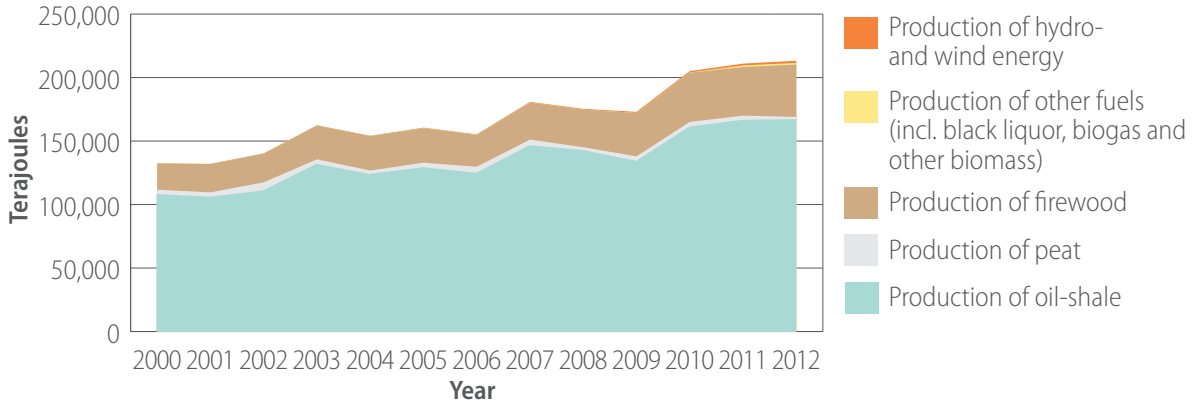


Figure 2.4. Production of Primary energy 2000-2012,TJ
Source: Statistics Estonia

Estonia ranks as average among EU Member States in regard to the generation of electricity per capita (9.2 MWh). This indicator is higher than those of the other two Baltic States, but due to their natural hydro resources Latvia and Lithuania have a significant advantage in the generation of renewable energy: in Latvia, for example, hydro energy accounts for more than half of all electricity production.

Oil shale, natural gas and shale oil serve as primary fuels for power plants. Compared to 2007, 6 per cent less oil shale was used for electricity production in 2012. At the same time, the use of natural gas decreased by 61 per cent.

Power plants continued to pursue combined heat and power (CHP) generation, which is cleaner in environmental terms. CHP plants can be operated on the basis of different fuels, but at a stable thermal load. In 2012 there were 38 CHP turbines in Estonia, producing 9.7 per cent of all electricity. Technologies based on the back-pressure steam turbine, on the condensation turbine as well as internal combustion engine turbine were used in energy production.

Natural gas, firewood and shale oil were mainly used in the heating plants, with half of the heat generated being based on the use of natural gas.

2.6.1. Energy taxes and subsidies

Energy taxation is a substantial source of revenue for the state. Fuel excise, electricity excise and other taxes related to fuels and energy generate almost 10 per cent of all tax revenue annually. Energy taxation is also a central instrument of energy and environment policy. It aims to curb the growth of energy consumption and steer the production and use of energy towards alternatives that create fewer emissions. Electricity is taxed through an excise which amounts to EUR 4.47 per MWh.

The electricity excise was levied for the first time in 2008. The use of renewable energy sources is subsidised in Estonia. For example, using such sources (with the exception of biomass) to produce electric energy is subsidised at the rate of EUR 53.70 per MWh.

2.6.2. Trade

Estonia is a net energy exporter. In 2012 the country exported 4.8 TWh of electricity, which was 6 per cent less than the previous year, but 1.7 times that of 2007. Its biggest export partners are Latvia and Lithuania, where there is a substantial energy deficit due to the closure of the Lithuanian nuclear plant in 2009. The main import partner for electric energy in recent years has been Finland, due to cheap hydro energy in certain periods. Other energy products that Estonia imports are natural gas, liquid fuels, coal and coke. Natural gas imports have decreased year by year because of the high price and low level of competitiveness compared to such local energy sources as biomass (Table 2.1).

Table 2.1. Consumption of fuels, thousand tonnes

	2007	2008	2009	2010	2011	2012
Coal and coke, thousand tonnes	130	129	87	60	69	64
Oil shale, thousand tonnes	16,810	15,704	13,768	17,888	18,739	17,527
Peat, thousand tonnes	455	294	264	353	304	264
Peat briquette, thousand tonnes	13	17	10	11	12	13
Firewood, 1000 m^3 solid volume	3,743	3,613	3,774	4,415	4,348	4,495
Natural gas, million m^3	1,003	961	653	701	632	657
Liquefied gas, thousand tonnes	8	8	6	8	7	9
Heavy fuel oil, thousand tonnes	6	5	5	5	2	1
Shale oil, thousand tonnes	77	76	70	81	65	67
Light fuel oil, thousand tonnes	110	104	76	85	74	67
Diesel oil, thousand tonnes	528	500	466	520	572	601
Gas/Diesel oil, thousand tonnes	638	604	542	605	646	668
Motor gasoline, thousand tonnes	323	320	293	276	261	252
Aviation fuels, thousand tonnes	49	28	33	37	34	37
Other fuels, thousand tonnes of coal equivalent	260	242	262	298	0	0

Source: Statistics Estonia

The first 350 MW submarine cable between Estonia and Finland went into operation in 2006, substantially extending energy trading possibilities. The Estlink cable is operated by the AS Nordic Energy Link company, founded by Baltic and Finnish power companies. In early 2014 the new 650 MW Estlink 2 cable between Estonia and Finland will become operational, increasing total transmission capacity to 1000 MW.

2.6.3. Opening up of the electricity market

When the EU electricity market was opened fully in 2007, Sweden, Finland and the United Kingdom were among the first countries to make the transition to the open market. Across the EU, the opening of electricity markets applied to large-scale consumers first and then to all market participants.

In 2003, after Estonia signed the treaty of accession to the EU, it was agreed that the country would open up its electricity market partially in 2009 and then completely in 2013. Partial opening took place in April 2010, when all consumers with consumption of over 2 GWh per year were given the opportunity to choose their supplier and were no longer bound to buy electricity at a regulated price. Since the beginning of 2013 the Estonian market has been 100 per cent open and electricity is now offered by various sellers.

2.6.4. Renewables

With each year the share of renewables has grown in the Estonian energy balance. In 2011, electric energy produced from renewable resources increased to 12.7 per cent of total production (Figure 2.5). In 2011 the biggest rise occurred in the share of wind energy, which grew by 32.5 per cent, the production of hydro energy grew by more than 10 per cent and production from biomass by more than 5 per cent compared to the previous year. In 2007, the share of electricity generated from renewable sources was just 1.5 per cent of total electricity consumption, but this figure had risen to 6.2 per cent by 2009 and 15.2 per cent by 2012. This growth occurred due to the expansion of existing wind parks and the commissioning of new wood fuel-based CHP plants.

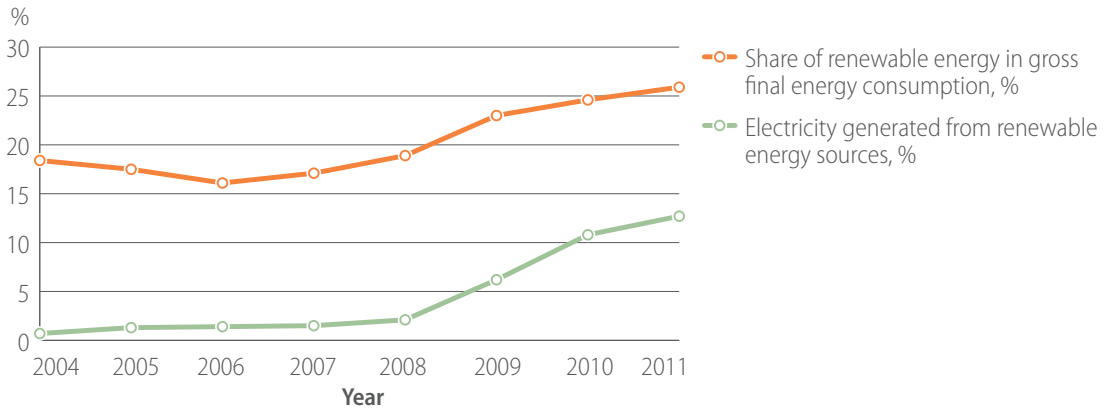


Figure 2.5. Use of renewables 2004-2011, per cent
Source: Statistics Estonia

2.7. Transport

Estonia's transport network consists of the infrastructure needed for road, rail, water and air traffic. The total length of national roads as of 1 January 2013 was 16,469 km, i.e. 28.1 per cent of the Estonian road network, which covers 58,768 km. Local and private roads covered 42,299 km, accounting for 72 per cent of the total network. 10,849 km (65.9 per cent) of national roads were sealed. The density of national roads is 364 km per 1,000 km^2, while the density of the entire registered network is 1,300 km per 1,000 km^2. The rail transport system in Estonia consists of *ca* 2,164 km of railway lines, of which 1,540 km are currently in public use. 132 km of track have been electrified. The infrastructure of the railway network is mostly owned by the state and is regulated and monitored by the Estonian Railway Inspectorate.

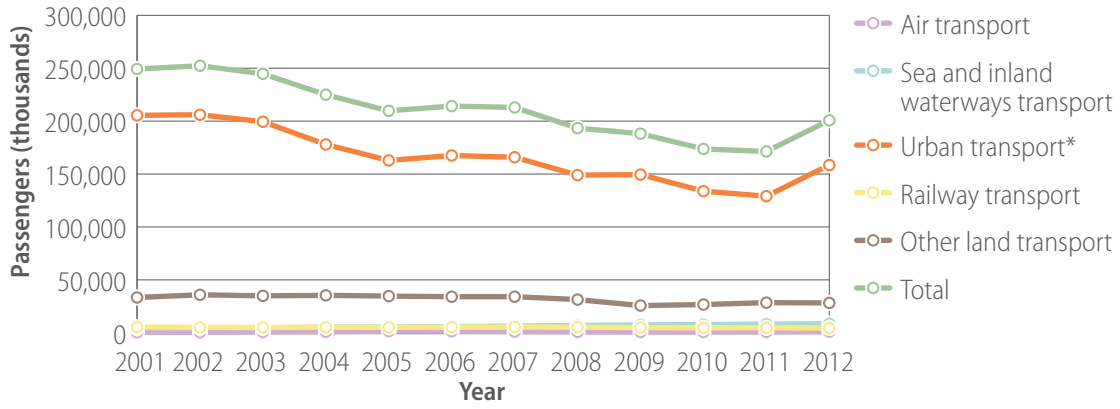
Estonia has a relatively long coastline (measuring 3,794 km) and a dense network of ports. The Port of Tallinn is one of the biggest in the region. There are 48 ports in the State Port register with a maximum depth of over 17 m.

Estonia has 12 airports with sealed runways. Around 2.3 million passengers were served at the country's airports in 2012 – 14.7 per cent more than in 2011, and the highest figure ever. Over 2.2 million of those passengers were served at Tallinn Airport (representing a rise of 15 per cent in 2011), making it easily the busiest airport in the country.

2.7.1. Passenger transport

While in 2001, 249 million passengers used the services of Estonian transport enterprises, in 2012 the figure was 201 million, i.e. 19 per cent less (Figure 2.6). In Estonia, the main form of public transport used by passengers is buses, followed by trains. More passengers used city transport (buses, trams and trolley buses) in 2012 compared to 2011, but bus lines within counties and municipalities lost passengers during the year. Less use is made of public transport here than in other European countries. Between 2006 and 2012, the number of passengers travelling by train dropped by 17 per cent. However, this trend is expected to change as all trains currently in use are to be replaced, which should hopefully make railway transport more comfortable for travellers.

8.6 million passengers visited Estonian ports in international traffic in 2012 – more than ever before. The number of cruise tourists also continued to grow, reaching 425,000 during the year.



*Transport for urban lines include passenger buses, trams and trolley buses

Figure 2.6. Passenger transport by type of transport 2001-2012, thousand passengers
Source: Statistics Estonia

2.7.2. Freight

After several years of recession-induced decline in Estonia's transit volumes, road and rail freight turnover showed signs of recovery in 2010. Transport enterprises carried 3 per cent more goods in 2011 than in the previous year, i.e. 81 million tonnes (Figure 2.7). Road transport enterprises carried 31 million tonnes of goods, while more than 48 million tonnes of cargo was transported on railways. The goods sent by rail were mainly delivered to Russia, Latvia and Lithuania. The majority of goods

arriving by rail came from Lithuania, Russia and Belarus. Sea transport enterprises carried 1.7 million tonnes of goods, which is more than one-fifth less than in 2010.

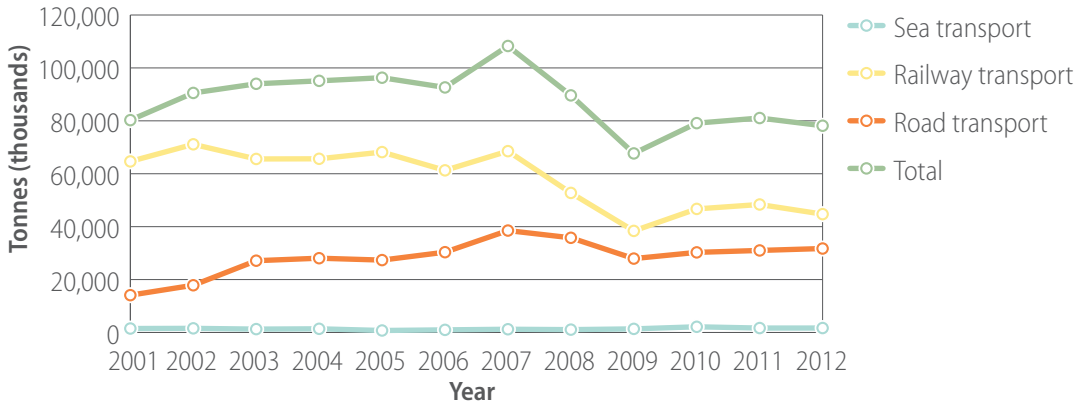


Figure 2.7. Transport of goods by type of transport 2001-2012, thousand tonnes
Source: Statistics Estonia

2.8. Industry

Estonia's economy is highly export-oriented. Manufacturing of machinery and equipment, the wood industry and food and beverage manufacturing have the highest share of the country's industry (Figure 2.8). Over the years, high-tech and knowledge-intensive industries have been gaining a higher share in industrial production. Total industrial production has grown rapidly: the pre-recession level was exceeded in 2011 (Figure 2.9).

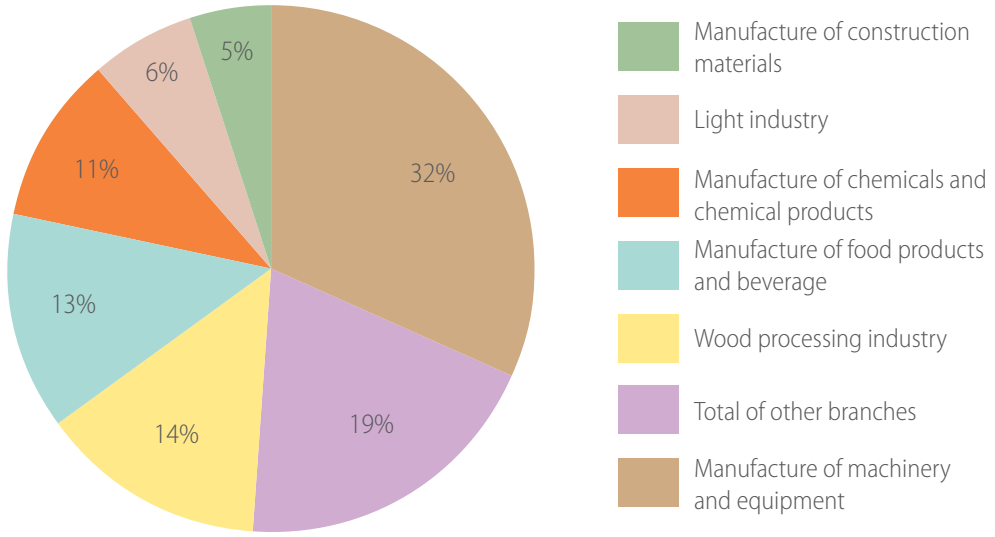


Figure 2.8. Structure of Estonian manufacturing industry by value added 2012, per cent
Source: Statistics Estonia

***** Industrial production is compiled as a "fixed base year Laspeyres type volume-index". The current base year is 2005 (Index 2005 = 100)

Figure 2.9. Estonian industrial production 2005-2012
Source: Statistics Estonia

The largest proportion of Estonian industry is manufacturing. There are more than 5,500 companies in the national manufacturing sector, most of which are small or medium-sized enterprises. More than 200 companies have at least 200 employees, but they employ more than half of all workers in the sector. The biggest employers are well-known foreign companies like Ericsson, ABB, PKC and Stora Enso.

Estonia has a somewhat higher share of industry in the total economy than the EU average. The share of value added in manufacturing is at the same level as Finland or Sweden (*ca* 16 per cent), while employment in the sector is higher in Estonia than the EU average, indicating the country's lower productivity per employee in this sector.

As a whole, the manufacturing sector is the biggest employer in Estonia, accounting for around 20 per cent of all workers. While the number of employees has decreased over the past 10 years, total production has increased because of rising productivity. Most new jobs in the sector have been created by the metal industry and in the manufacturing of electrical equipment. Measured by output, the fastest growth has been in manufacturing of electronics. During the recession, employment also fell in manufacturing, but the sector was one of the first to start recovering. Exports played a crucial role in the recovery period. The main export markets are Finland and Sweden, which are also the most important foreign direct investors in the sector.

Estonia's industrial production experienced a noticeable slump during the financial crisis which was caused by modest demand in manufacturing. However, recovery was fast: from 2009-2011 manufacturing output grew by more than 50 per cent. The main driver for growth was the manufacturing of computers, electronics and optical devices, where output grew almost five-fold during the period. Industrial growth slowed down in 2011 and 2012, but total output was higher than before the recession.

2.9. Waste

The development and goals of waste management in Estonia since 2009 have been based on the National Waste Management Plan approved by the Government of the Republic. EU directive

2008/98/EC on waste of the European Parliament and of the Council entered into force in 2008, replacing the existing waste framework, hazardous waste and waste oil directives. The new waste framework directive emphasises the need for waste prevention activities and promotes other high-priority options in the waste hierarchy such as preparing for re-use and recycling operations. At the same time, the directive sets concrete numeric targets for the recycling and recovery of both municipal waste and construction and demolition waste. Transposition of the requirements of the framework directive into Estonian law was completed with the amendments to the Estonian Waste Act in 2011.

Around 21.7 million tonnes of waste was generated in Estonia in 2011. Over the last decade total waste generation has steadily increased, excluding certain years during the recession. From 2007-2009 more than 85 per cent of waste was generated by industry, whereby 79 per cent of total waste generation took place in the oil shale industry and energy production.

Generation of municipal waste makes up just 3 per cent of total waste generation in Estonia. In 2011 the amount of municipal waste generated annually was 293 kg per capita. Since 2008 the generation of such waste has diminished slightly, in absolute numbers and relatively, compared to economic growth. This can be explained by the increase in sorting and the separate collection of different waste categories, incl. packaging waste, and enforcement of the ban on acceptance and disposal of unsorted municipal waste in landfill in 2008. A substantial amount of separately collected waste is biodegradable – paper and cardboard, kitchen waste etc. Separate collection of municipal waste is arranged by local authorities, which have continuously increased this form of collection and developed a network of waste amenity sites (waste stations) all over the country.

The share of waste deposited in landfill compared with waste generated has significantly decreased, primarily with regard to waste not generated by the oil shale industry (Figure 2.10). Only five landfill sites remain for disposal of municipal waste in Estonia. The depositing of mixed municipal waste in landfill has also decreased in recent years due to the development of the mechanical and biological treatment (MBT) of waste by a number of waste management companies. Once a new incinerator for municipal waste with a yearly capacity of 220,000 tonnes is put into operation in Iru power station (operated by Eesti Energia) in 2013, the amount of waste containing organic combustible materials disposed of in landfill should be reduced to a minimum in subsequent years.

One of the main preconditions for reducing waste disposal is to promote waste recovery. Before 2005 an average of 20 per cent of generated waste was recovered, but in the following five years this figure rose to around one-third. In 2011 the total recovery rate reached 55 per cent. As in previous years, nearly 100 per cent of wood waste is recovered. Recovery of other categories of biodegradable waste – such as garden and park waste, sewage sludge, wood processing waste and paper and cardboard – has expanded.

EU directive 1999/31/EU on landfills set out to reduce the amount of biodegradable municipal waste going into landfills by up to 75 per cent of the total amount (by weight) between 1995 and 2010. This target was met in Estonia before the deadline, as was the subsequent target for 2013 (a 50 per cent reduction). Once the new incinerator at Iru power station is fully operational, Estonia will likely be able to fulfil the 35 per cent requirement set by the EU for 2020. According to the Estonian Waste

Act, the content of biodegradable waste in disposed municipal waste must be less than 30 per cent by weight starting from 2013 and less than 20 per cent by 2020.

At the same time, waste framework directive 2008/98/EU establishes new targets for EU Member States in the recycling of municipal waste: by 2020, preparing for re-use and recycling should account for 50 per cent by weight; neither incineration nor energy recovery will be included. A sorting study of mixed municipal waste in Estonia has shown that the share of biodegradable fractions in mixed waste in 2010 was nearly 60 per cent by weight. The share of bio-waste (kitchen, garden and park waste) among this was around 50 per cent, or 30 per cent of total mixed waste. It can be concluded that achieving this recycling goal is not practically possible without the prioritised development of separate collection and recycling for biodegradable waste, including bio-waste. The National Waste Management Plan 2014-2020 foresees, among other things, wider implementation of technology for the composting and anaerobic digestion of biodegradable waste and the use of the materials produced. To promote the recycling of biodegradable waste, the Ministry of the Environment has developed special 'end-of-waste' quality criteria according to which it is possible to produce compost manufactured as a treatment product of biodegradable waste (excluding sewage sludge). Similar criteria will be developed for other products made from biodegradable waste.

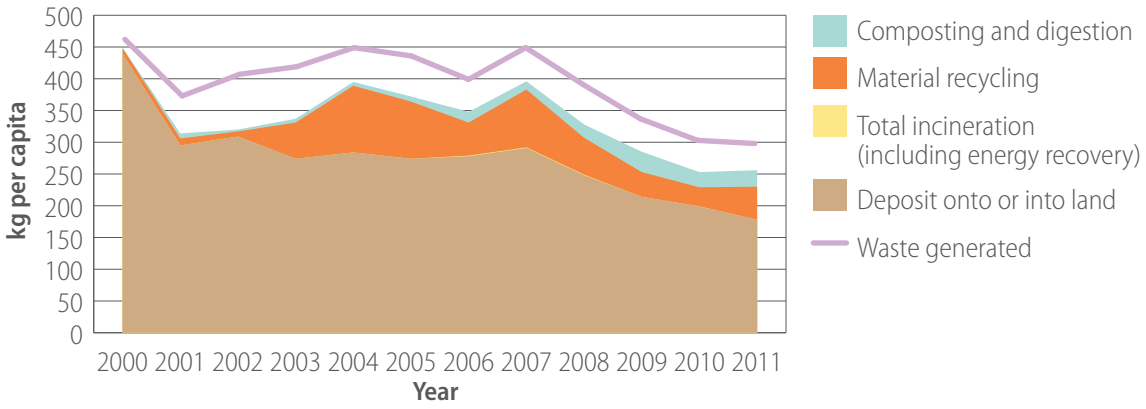


Figure 2.10. Municipal waste generation and treatment by type of treatment method, kg per capita
Source: Eurostat

2.10. Building stock and urban structure

Urban developments in Estonia are characterised by the concentration of the population in Tallinn and Tartu and partly in county towns where housing stock has been growing and improving, including in terms of energy efficiency. By contrast, rural areas and small towns are marked by marginalisation and the aging of housing stock. New construction is not covering the decrease in residential housing stock. Population mobility has tripled in the 2000s as a result of commuting and seasonal migration, causing a significant increase in transport energy use.

There were 657,791 dwellings in Estonia in 2011. The average floor area per capita has risen from 24 m^2 to 30.5 m^2 since 2000. Residential buildings are assumed to account for 50-60 per cent of total housing stock. The average dwelling size increased from 59-69 m^2 between the 2000 and 2011 censuses, which

has increased households' energy use. Among housing stock, 71 per cent are apartments, 25 per cent are single-family homes and around 3 per cent are semi-detached or terrace houses (Figure 2.11). By proportion of inhabitants living in apartments (65 per cent) Estonia ranks second in the EU after Latvia, forming two-thirds of housing stock. The legacy of Soviet mass housing – apartment buildings mainly constructed in the 1970s and 1980s – will require special attention and measures when developing and implementing climate policies. In the 2000s housing stock has increased in Harju, Tartu, Pärnu and Saaremaa counties, but has decreased in other counties. Housing geography clearly expresses suburbanisation and the expansion of the Tallinn metropolitan region.

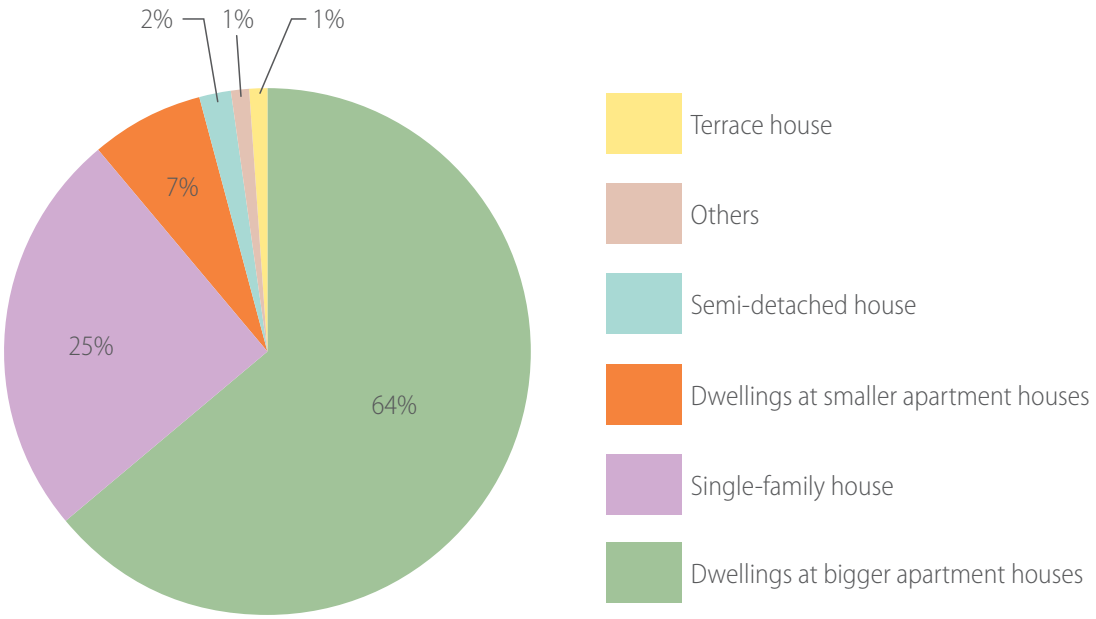


Figure 2.11. Dwellings by type of building 2011, per cent
Source: Statistics Estonia

Residential construction reached its peak in 2007, when 7,100 dwellings covering 567,000 m^2 received planning permission. Although still affected by the recession, the construction market started to rally in 2012, posting a 7 per cent rise in the issuing of residential building permits and with 1,990 dwellings covering 233,400 m^2 receiving planning permission. The multiple support measures of energy efficiency in housing assisted this growth in construction. In general, the aging of housing stock has continued and housing quality has deteriorated further. In the context of climate policy, energy consumption in Estonia's housing stock is significant: household energy consumption as a ratio of total energy consumption is one of the highest in the EU. In 2010, household consumption represented 35 per cent of total energy consumption per cent in Estonia, compared to 27 per cent in Europe.

The share of final energy consumption in buildings is more than 50 per cent of the total. Building energy consumption was 85 PJ in 2010 – 25 PJ of electricity consumption and 60 PJ of heating. By type of energy, purchased heat (district heating) and wood have the biggest share in household energy consumption (Figure 2.12). Taking into account the further concentration of the population in Tallinn's metropolitan region, the sustainability of district heating is critical in many towns. As such, there is a need to seek alternative technologies. Since 97 per cent of housing stock is privately owned, direct intervention in housing and energy policy by the state and local governments is restricted.

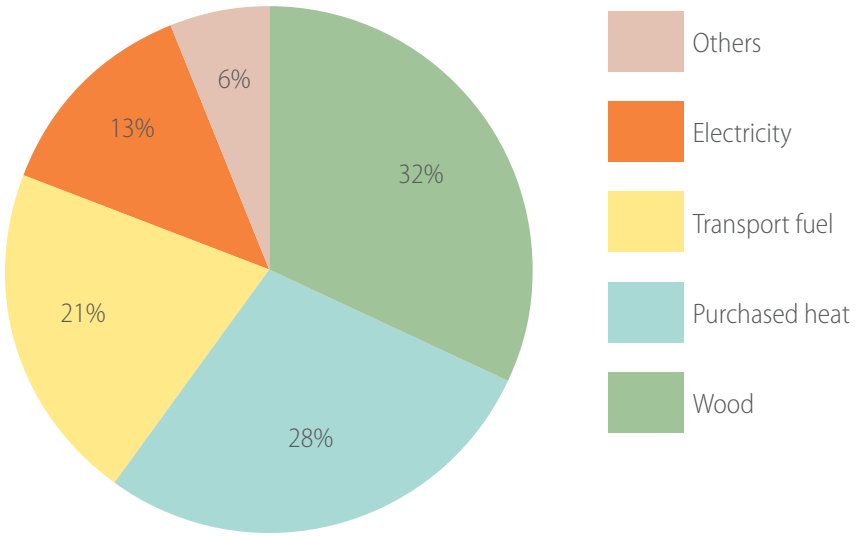


Figure 2.12. Energy consumption of Estonian households by type of energy or fuel 2010, per cent
Source: Statistics Estonia

2.10.1. Urban system

Neither Estonia's regional policy nor massive investments of European funds have been able to tackle the urban and economic expansion of Tallinn (with 41.7 per cent of the country's population living in Harju County). Urban sprawl around Tallinn and Tartu affects the environment and increases energy consumption due to commuting. The challenges of urban development in the two cities are related to compact urban form, re-use of plots and the development of public urban spaces. To date, planning based on detailed plans has been unable to combine technical, energy, social, environmental and economic aspects of urban development. Comprehensive and integrated spatial planning should eschew energy-inefficient, insular locations for new settlements in favour of the compact urban model. In remote rural areas, climate policy should take into consideration peripheral processes, which affect almost half of all Estonia land and nearly 140,000 of its inhabitants.

2.11. Agriculture

The value added produced by agriculture and hunting in Estonia's economy in 2010 was around EUR 236.45 million, which constituted *ca* 1.9 per cent of the total gross value added of all sectors. The primary sector is closely related to the food industry. The gross value of this industry (including drinks and tobacco) was around EUR 272.26 million in 2010, which was 2.2 per cent of the total gross value added of all sectors. There has been a decline in the agricultural sector compared to 2007, when the respective figure was 2.1 per cent, and slight growth in the food industry, where the share of gross value added in 2007 was 2.0 per cent.

In 2010, based on data from the Agricultural Census (AC), there were 19,613 agricultural holdings in Estonia. 91 per cent of these holdings (17,886) were privately owned and the remaining 9 per

cent (1,727) were owned by legal entities. 39 per cent specialised in crop production, 26 per cent in livestock farming and 17 per cent in mixed production.

According to the 2010 AC, 8,074 agricultural holdings in Estonia exceeded the threshold of economic size (standard output: EUR 4,000) defined for the purpose of the Farm Accountancy Data Network (FADN). According to FADN, the population of agricultural holdings covers 97.8 per cent of the standard output of Estonia's agricultural production, 41 per cent of the total number of agricultural holdings and 89 per cent of the agricultural area utilised.

There were 940,930 ha of utilised agricultural land in Estonia in 2010, including 68 per cent under arable land, 32 per cent under permanent grassland, 0.3 per cent under permanent crops and 0.2 per cent under kitchen gardens. 43 per cent of arable land (640,038 ha) was used for cereal production, 16 per cent for industrial crops and 32 per cent for green fodder.

In 2011 there were 238,300 head of cattle (including 96,200 dairy cows), 365,700 pigs, 88,200 sheep and goats and 2,032,900 poultry in Estonia. Compared to 2004 the number of cattle had decreased by 5 per cent (including dairy cows by 17 per cent) and poultry numbers had fallen by 7 per cent, while the number of pigs had grown by 8 per cent and sheep herds were twice as large. According to the 2010 EU Farm Structure Survey (FSS), 48 per cent of holdings with livestock farming reared cattle, 26 per cent sheep and goats, 16 per cent pigs, 51 per cent poultry and 22 per cent bees. The main area for cattle rearing is central Estonia. Sheep and goats are reared in the western and southern parts of the country.

According to the Estonian University of Life Sciences, the most important output from agriculture in 2010 was milk (26 per cent), followed by cereals (16 per cent). The share of crop output was 41 per cent and animal output 48 per cent; the remainder was agricultural services and non-agricultural inseparable secondary activities (11 per cent).

Estonia has implemented the EU Common Agricultural Policy (CAP) since 2004. Support is divided into two pillars: under the first, the single area payment scheme is fully financed from the EU budget and complementary national direct payments (coupled and decoupled from production) are financed from the Estonian budget; while under the second, support for rural development is co-financed from the Estonian budget. In 2010 the total amount of aid was EUR 125,307,598, of which direct payments were 56 per cent.

2.12. Forest

According to the National Forest Inventory (NFI), the total forest land area of Estonia in 2011 was 2,221,900 hectares, which represents approximately half of the country (Figure 2.13). According to the definition of forest that Estonia has adopted for reporting under the Kyoto Protocol, the total area is in fact slightly larger: 2,259,800 ha. The forest land category includes around 90 per cent of all LULUCF sector emissions/removals.

The ratio of forest to total land in the country has increased steadily over the past 60 years, from around one-third in the 1950s. This increase has mainly taken place due to the abandonment of grasslands and the overgrowing of wetlands. A rising trend in forest area has been halted since the last decade due to agricultural subsidies from the EU.

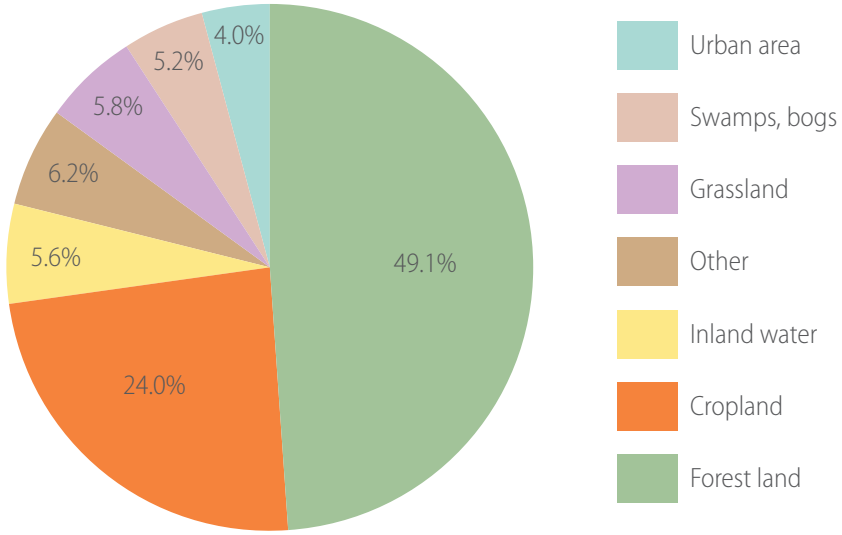


Figure 2.13. Total area of Estonia by land category (according to national definitions) 2011, per cent
Source: National Forest Inventory

According to the inventory of 2011, the supply of growing stock was 468 million m^3. Approximately 210 m^3 of timber grows on every hectare of forested land. Moreover, 8.0 million m^3 of timber grows in coppices and on grassland. The amount of deadwood has increased significantly in recent decades: there are 17 million m^3 of standing dead trees and 16 million m^3 of broken and fallen trees in forests, representing an average of 15 m^3 per hectare. The annual increment of forest stands is 12.2 million m^3. Approximately 22 per cent of forests are located on organic soils, of which 45 per cent are drained.

On average there are 1.72 hectares of forested land and 362 m^3 of growing stock per capita in Estonia. By quantity of timber per capita, Estonia ranks third behind Finland and Sweden.

Based on the geographical distribution of vegetation, Estonia is between the Boreal and Cold temperate climatic zones. The proportion of predominant deciduous tree and coniferous tree forests is more or less equal, comprising 51 per cent and 49 per cent of total forest area respectively. According to the total volume of growing stock, the proportions favour coniferous trees, which form 54 per cent of forest stock. Deciduous trees make up 46 per cent. The three most widespread tree species are Scots pine, Norway spruce and birch. As the predominant tree species they account for 81 per cent of forest land and 76 per cent of the stock of growing forest. The next three most common species are aspen, grey alder and black alder. These species form 17 per cent of the area of forest land and 20 per cent of the stock of growing forests. The proportion of other tree species is less than 2 per cent.

The average age of stands is 56 years. The proportion of mature stands of forest land accounts for as much as 28 per cent. Areas of forest that are more than 100 years old represent over 5 per cent of forest land. 10 per cent of forest land is under strict protection.

The forest and wood cluster forms an important part of the Estonian economy. Wood, paper and the furniture industry account for more than 20 per cent of the total production and value added of the manufacturing industry in the country. The cluster is one of the main stabilisers of foreign trade in Estonia: its exports, amounting to EUR1.5 billion, accounted for 12 per cent of all goods exported from Estonia in 2012. The added value created by the cluster amounted to 4 per cent of GDP in 2011. The strongest branch of this sector is sawmilling.

Felling volumes from year to year have been rather volatile over the last few decades, but in recent years they have again shown an upward trend (Figure 2.14). In 2011 the total harvest volume was 8.15 million m^3, 75 per cent of which was harvested through regeneration felling and 21 per cent through maintenance felling. Net annual increment of forests is slightly above 12 million m^3.

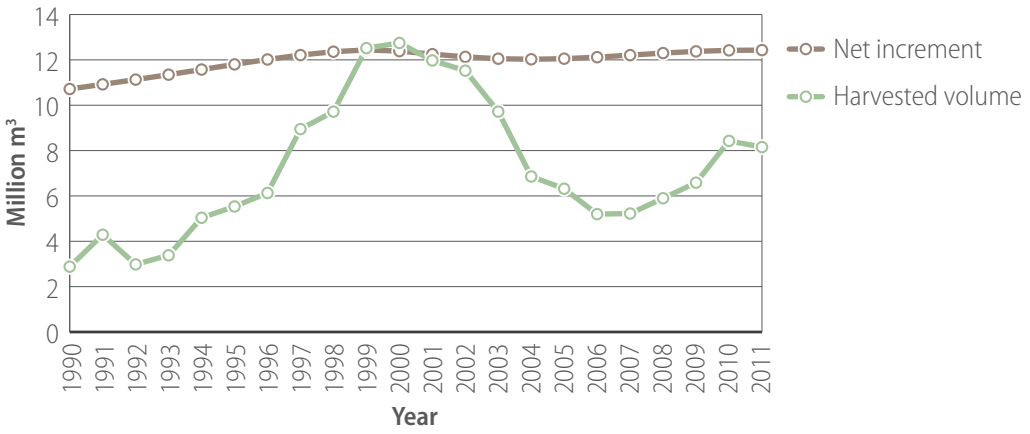


Figure 2.14. Felling volume and net annual increment of forests in Estonia 1990–2011, million cubic meters
Source: Statistics Estonia

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Ministry of Economic Affairs and Communications: www.mkm.ee

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Ministry of the Environment: www.envir.ee

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III

GREENHOUSE GAS INVENTORY INFORMATION, INCLUDING INFORMATION ON NATIONAL SYSTEMS AND NATIONAL REGISTRIES

3.1. Introduction and summary tables

This chapter sets out Estonia's greenhouse gas (GHG) emissions and their trends for the period 1990-2011. It also provides information on Estonia's national system for greenhouse gas inventory and the national registry. The greenhouse gas data presented in the chapter is consistent with Estonia's 2013 submission to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. Summary tables of GHG emissions in the common reporting format are presented in Annex I.

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

3.2. Descriptive summary of emission trends

3.2.1. Overall greenhouse gas emission trends

Estonia's total greenhouse gas emissions in 2011 were 20,955.58 Gg CO_2 equivalent, excluding net emissions from LULUCF (land use, land-use change and forestry). Emissions decreased by 48.31 per cent from 1990-2011 (see Table 3.1) but increased by around 5 per cent between 2010 and 2011. Estonia's Kyoto Protocol target was to reduce GHG emissions by 8 per cent during the period from 2008-2012 compared to the 1990 level. Emission trends by sector and the Kyoto Protocol target are given in Figure 3.1.

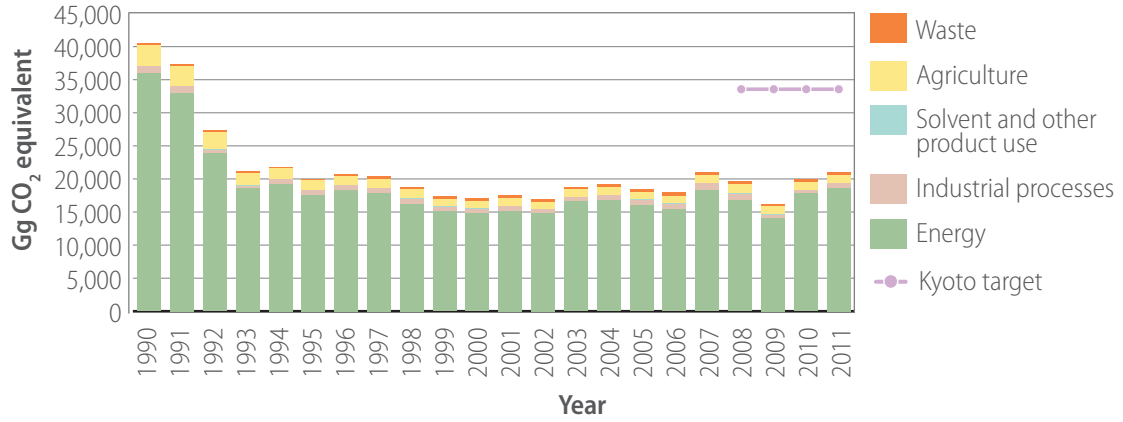

Figure 3.1. Estonia's greenhouse gas emissions by sector, 1990-2011, excluding LULUCF and Kyoto target, Gg CO_2 equivalent

The energy sector is by far the largest producer of GHG emissions in Estonia. In 2011 the sector accounted for 89.05 per cent of Estonia's total greenhouse gas emissions (Figure 3.2). The second largest sector is agriculture, which accounted for 6.06 per cent of total emissions in 2011. Emissions from the industrial processes, waste and solvent and other product use sectors accounted for 2.93 per cent, 1.87 per cent and 0.09 per cent of total emissions respectively.

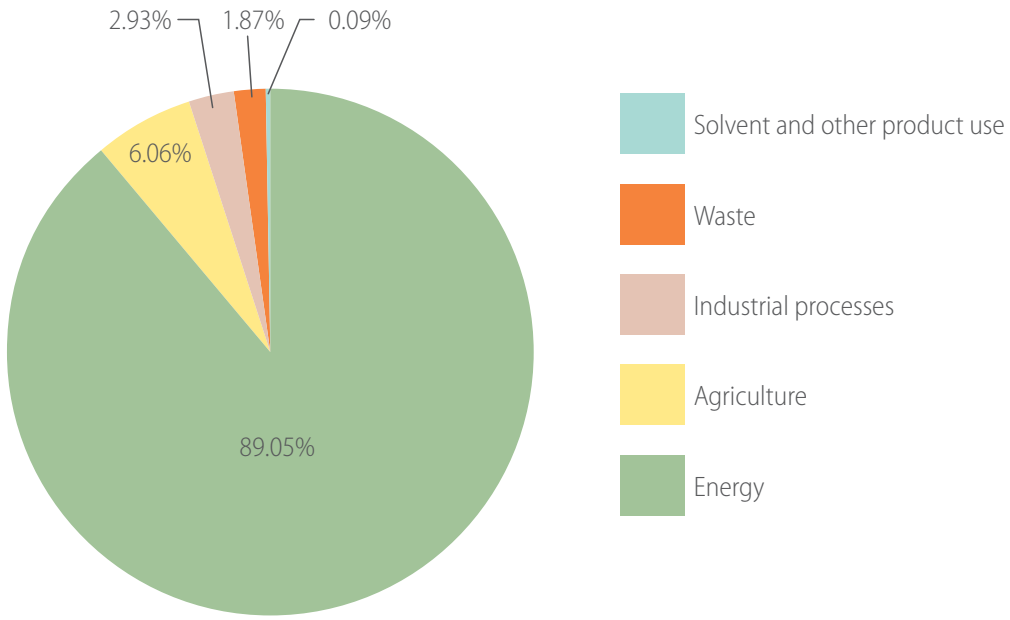

Figure 3.2. Greenhouse gas emissions by sector in 2011, per cent

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 2011 the LULUCF sector acted as a CO_2 sink, with total uptake of 4,262.81 Gg CO_2 equivalent (see Table 3.1). Uptake of CO_2 decreased by 51.83 per cent compared to the base year (1990) and by 28.26 per cent compared to the previous year (2010).

Table 3.1. Greenhouse gas emissions and removals by sector in 1990, 1995, 2000 and 2005-2011, Gg CO_2 equivalent

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	Change, per cent[1]
Energy	35,956.90	17,596.48	14,770.96	16,020.66	15,385.39	18,270.54	16,745.77	14,129.73	17,767.99	18,661.63	-48.10
Industrial processes	1,048.23	675.54	705.92	807.11	871.47	1,059.00	1,051.13	451.04	493.86	613.82	-41.44
Solvent and other product use	26.44	26.02	26.76	26.16	26.35	24.43	21.96	18.49	17.39	18.86	-28.69
Agriculture	3,166.84	1,483.71	1,203.70	1,170.78	1,166.40	1,209.27	1,329.85	1,230.60	1,256.59	1,270.52	-59.88
Waste	343.72	256.49	434.83	452.93	479.04	483.74	468.96	431.72	452.94	390.76	13.69
Total (excl. LULUCF)	40,542.14	20,038.23	17,142.17	18,477.64	17,928.66	21,046.97	19,617.67	16,261.58	19,988.77	20,955.58	-48.31
Land use, land-use change and forestry	-8,848.70	-10,596.46	1,099.71	-5,037.42	-6,989.58	-8,112.22	-8,125.30	-7,342.13	-5,941.64	-4,262.81	-51.83
Total (incl. LULUCF)	31,693.44	9,441.77	18,241.88	13,440.22	10,939.07	12,934.75	11,492.37	8,919.45	14,047.13	16,692.77	-47.33

In 2011, the main greenhouse gas in Estonia was carbon dioxide (CO_2), accounting for 89.87 per cent of all GHG emissions (excluding LULUCF), followed by nitrous oxide (N_2O) on 4.79 per cent and methane (CH_4) on 4.57 per cent. F-gases (HFCs, PFCs and SF_6) collectively accounted for 0.77 per cent of overall GHG emissions (see Figure 3.3).

[1] Change from base year (1990) to latest reported year (2011).

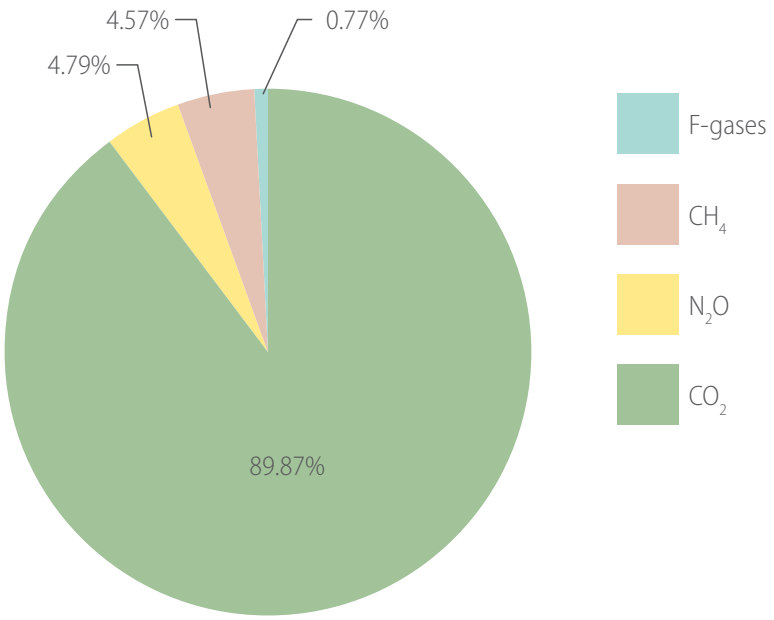

Figure 3.3. Greenhouse gas emissions by gas in 2011, per cent

Emissions of CO_2 decreased by 48.59 per cent from 1990-2011 (see Table 3.2), caused largely by CO_2emissions 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 55.06 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 42.78 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 161.19 Gg CO_2 equivalent in 2011, especially HFC emissions from refrigeration and air-conditioning equipment, which is the major source of halocarbons in Estonia. GHG emission trends from 1990-2011 by gas are shown in Figure 3.4.

Table 3.2. Greenhouse gas emissions by gas in 1990, 1995, 2000 and 2005-2011, excluding LULUCF, Gg CO_2 equivalent

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	Change, per cent[2]
CO_2 emissions (excl. net CO_2 from LULUCF)	36,635.00	17,981.46	15,143.30	16,419.49	15,842.60	18,873.36	17,357.71	14,157.89	17,801.49	18,832.99	-48.59
CH_4 emissions (excl. CH_4 from LULUCF)	1,673.18	981.63	1,024.95	1,043.93	1,054.57	1,062.77	1,053.77	984.50	1,016.84	957.42	-42.78
N_2O emissions (excl. N_2O from LULUCF)	2,233.95	1,046.55	901.65	894.98	894.95	960.83	1,073.49	979.61	1,016.05	1,003.97	-55.06
HFCs	NA,NE,NO	25.37	69.54	118.16	135.31	148.98	131.31	138.15	152.56	159.38	100.00
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.07	0.06	0.04	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
SF_6	NA,NE,NO	3.22	2.73	1.08	1.15	0.97	1.35	1.44	1.81	1.82	100.00
Total (excl. LULUCF)	40,542.14	20,038.23	17,142.17	18,477.64	17,928.66	21,046.97	19,617.67	16,261.58	19,988.77	20,955.58	-48.31

[2] Change from base year (1990) to latest reported year (2011).

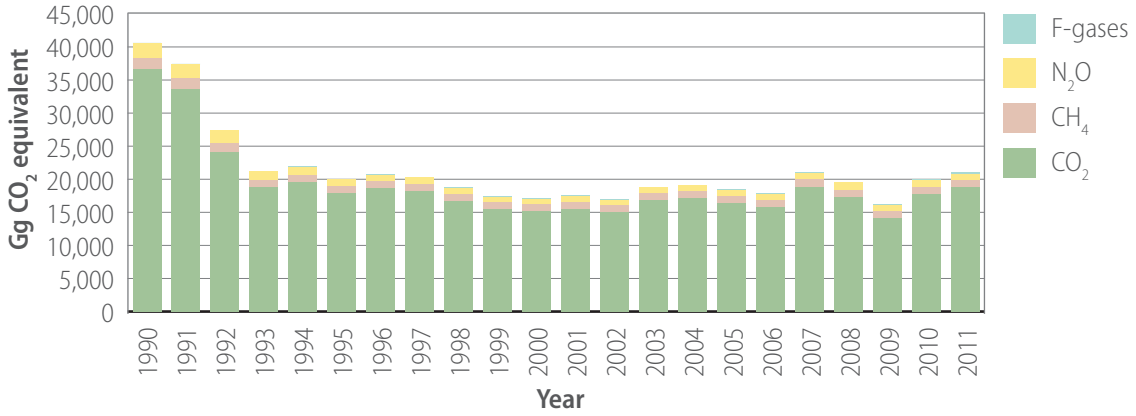

Figure 3.4. Estonia's greenhouse gas emissions by gas, 1990-2011, excluding LULUCF, Gg CO_2 equivalent

3.2.2. Greenhouse gas emissions by sector

3.2.2.1. 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 2011 the sector contributed 89.05 per cent of all emissions, totalling 18.66 Tg CO_2 equivalent. 99.6 per cent of emissions in the sector originated from fuel combustion – just 0.4 per cent were from fugitive emissions. The share of emissions by category in 2011 is presented in Figure 3.5.

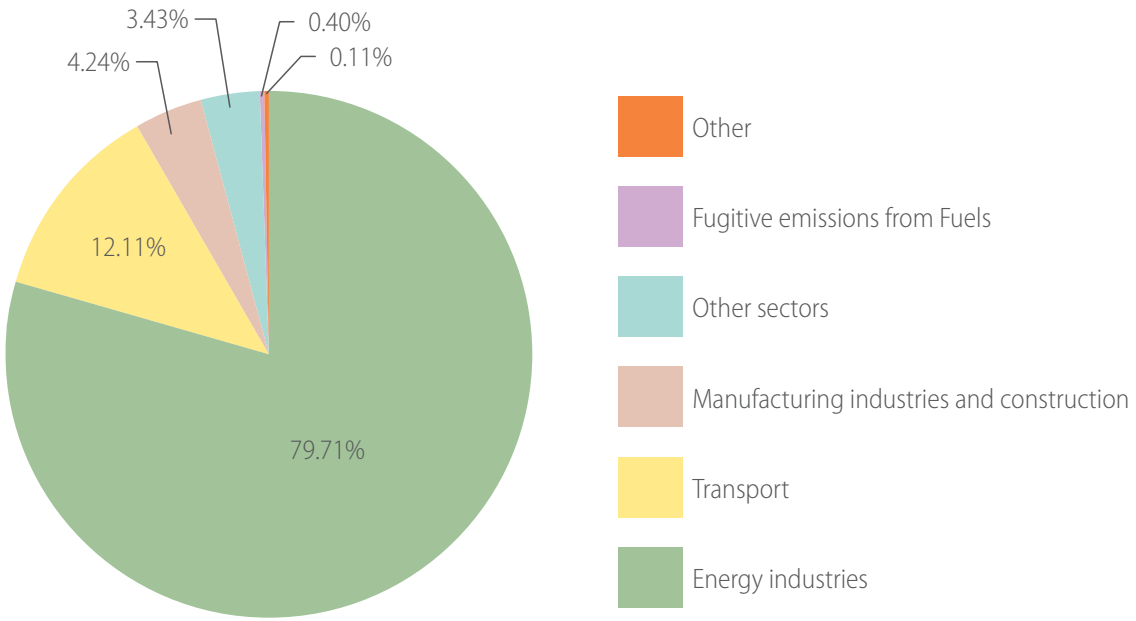

Figure 3.5. Share of emissions from energy sector by category, 2011

A substantial amount of energy-related emissions in Estonia are caused by extensive consumption of fossil fuels in power and heat production. 70.59 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 48.10 per cent compared to 1990 (incl. energy industries – 48.30 per cent; manufacturing industries and construction – 68.22 per cent; transport – 8.15 per cent; other sectors – 68.10 per cent; other – 54.51 per cent; and fugitive emissions from fuels – 58.51 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 3.6.

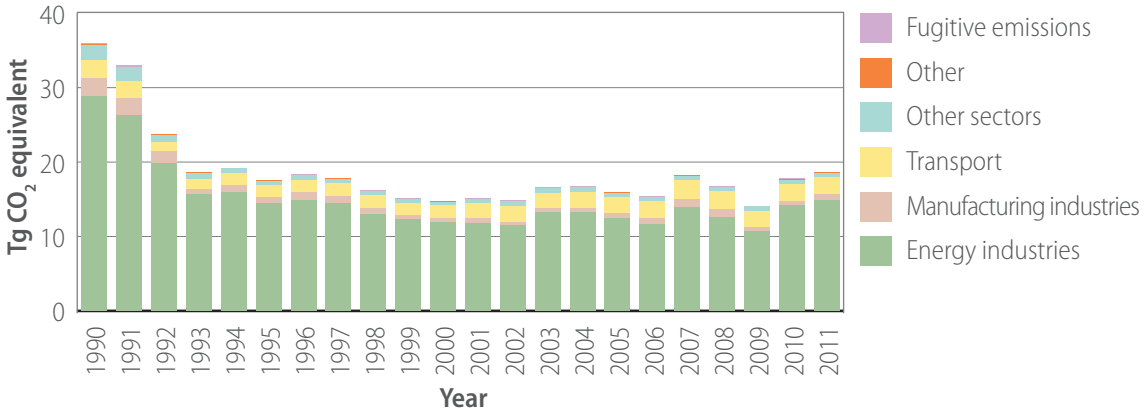

Figure 3.6. Greenhouse gas emissions from energy sector, 1990-2011, Tg CO_2 equivalent

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 2011, the supply of primary energy was 232.3 PJ, of which oil shale formed 66 per cent, and peat and wood together 14 per cent. The share of renewable energy sources amounted to approximately 13 per cent (see Figure 3.7), of which wood fuels comprised the main portion and other sources just 0.1 per cent. Around 50 per cent of primary fuel energy was used for electricity and 16 per cent for heat generation. The total primary energy supply remained at the same level in 2011 as during the previous year.

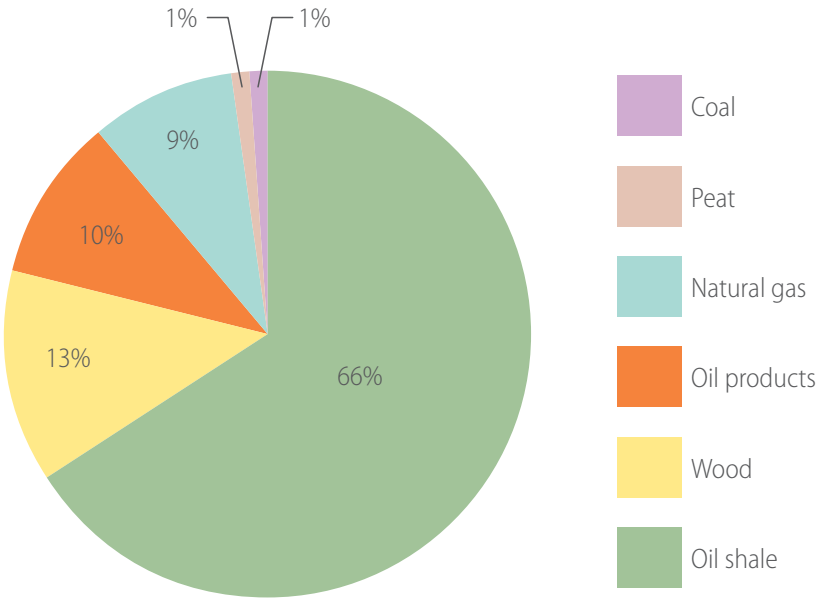

Figure 3.7. Structure of primary energy supply in Estonia, 2011

3.2.2.2. Industrial processes

Estonia's GHG emissions from the industrial processes sector are divided into the following emission categories: mineral products; chemical industry; and consumption of halocarbons and SF_6. Under mineral products, emissions from cement, lime, glass, bricks and tile production as well as those from lightweight gravel production and soda ash use are reported. Emissions from ammonia production are reported under chemical industry. Consumption of halocarbons and SF_6 covers emissions of F-gases from refrigeration and air-conditioning, foam blowing, aerosols and electrical equipment, as well as some smaller sources, such as fire extinguishers and other. The share of emissions by category in 2011 is presented in Figure 3.8.

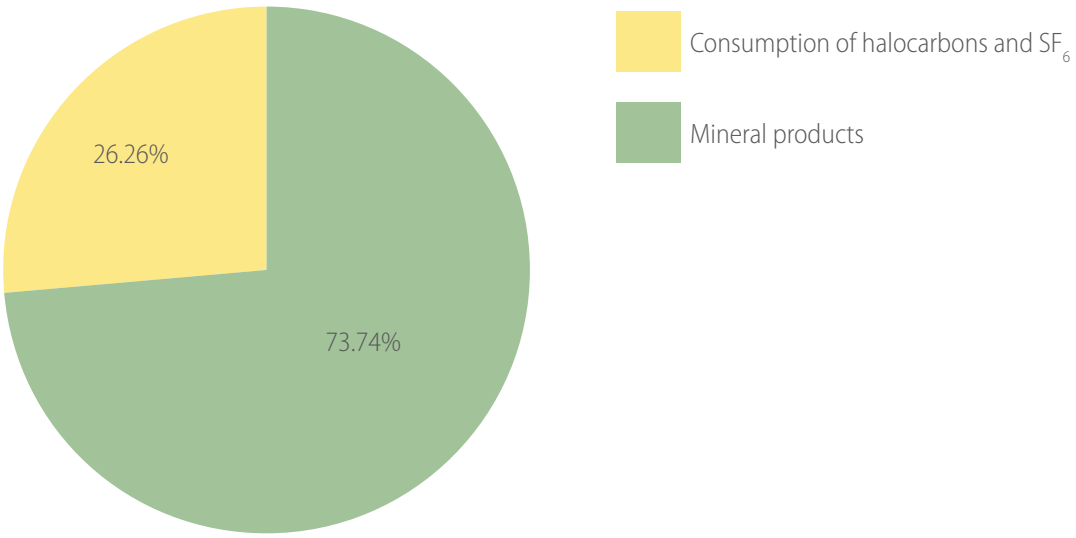

Figure 3.8. Share of emissions from industrial processes sector by category[3], 2011

[3] There was no ammonia production in 2011.

In 2011 the industrial processes sector contributed 2.93 per cent of all GHG emissions in Estonia, totalling 613.82 Gg CO_2 equivalent. The most significant emission sources were CO_2 from cement and lime production at 1.99 per cent and 0.11 per cent respectively, and HFC emissions from refrigeration and air conditioning equipment at 0.71 per cent of total GHG emissions. F-gas emissions as a whole comprised 0.77 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 3.9.

F-gas emissions have increased significantly from 0 Gg CO_2 equivalent in 1990 to 161.19 Gg CO_2 equivalent in 2011. A key driver behind the growing emissions trend in refrigeration and air conditioning, which is the major source of halocarbons in Estonia (see Figure 3.10), 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.

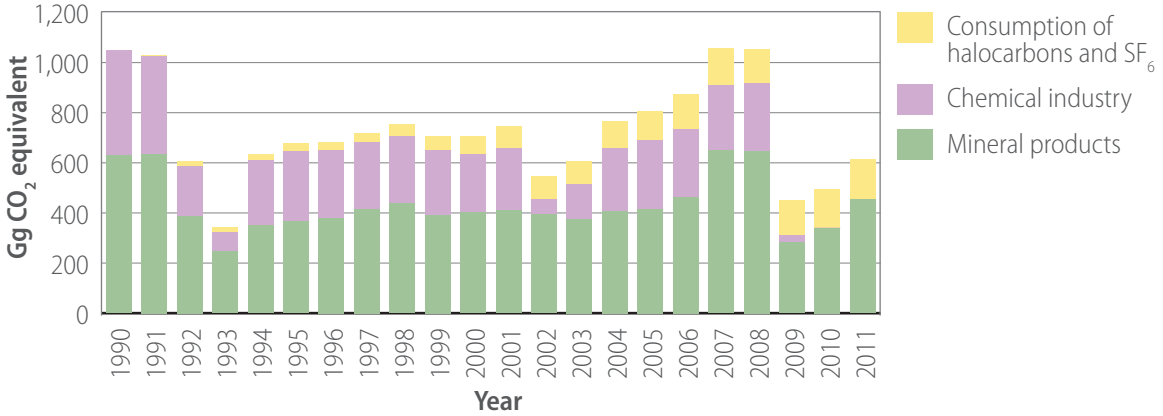

Figure 3.9. Greenhouse gas emissions from industrial processes sector, 1990-2011, Gg CO_2 equivalent

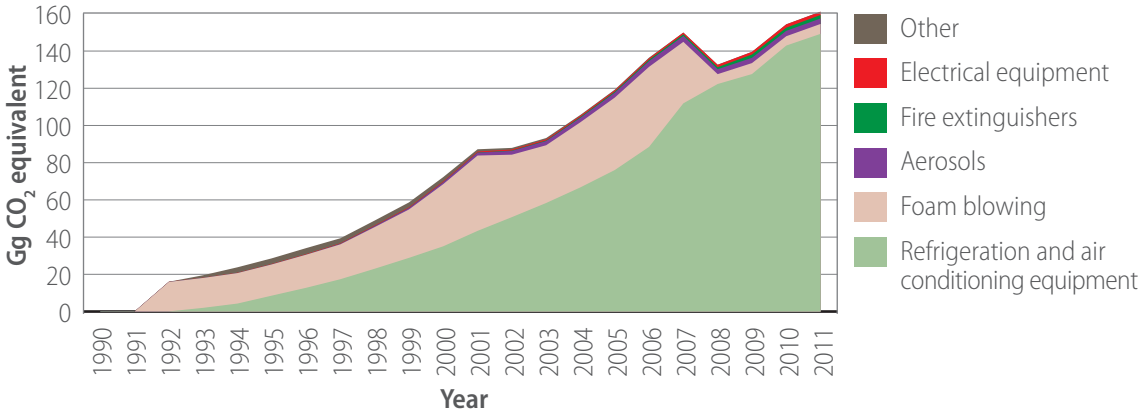

Figure 3.10. Actual emissions of F-gases by category, 1990-2011, Gg CO_2 equivalent

3.2.2.3. Solvent and other product use

Estonia's emissions from the solvent and other product use sector are divided into the following categories: paint application; degreasing and dry cleaning; chemical products, manufacture and processing; and other (CRF 3.D). Under these categories Estonia reports indirect greenhouse gas emissions (NMVOCs) and indirect CO_2 emissions from NMVOC emissions. Under CRF 3.D (other), Estonia also reports N_2O emissions from the sources N_2O use for anaesthesia and N_2O from aerosol cans.

In 2011, the solvent and other product use sector contributed 0.09 per cent of all greenhouse gas emissions in Estonia, totalling 18.86 Gg CO_2 eq. Indirect CO_2 emissions from paint application and other (CRF 3.D.5) contributed the main share of total emissions from the sector – 29.86 per cent and 28.19 per cent respectively. The share of emissions by category is presented in Figure 3.11.

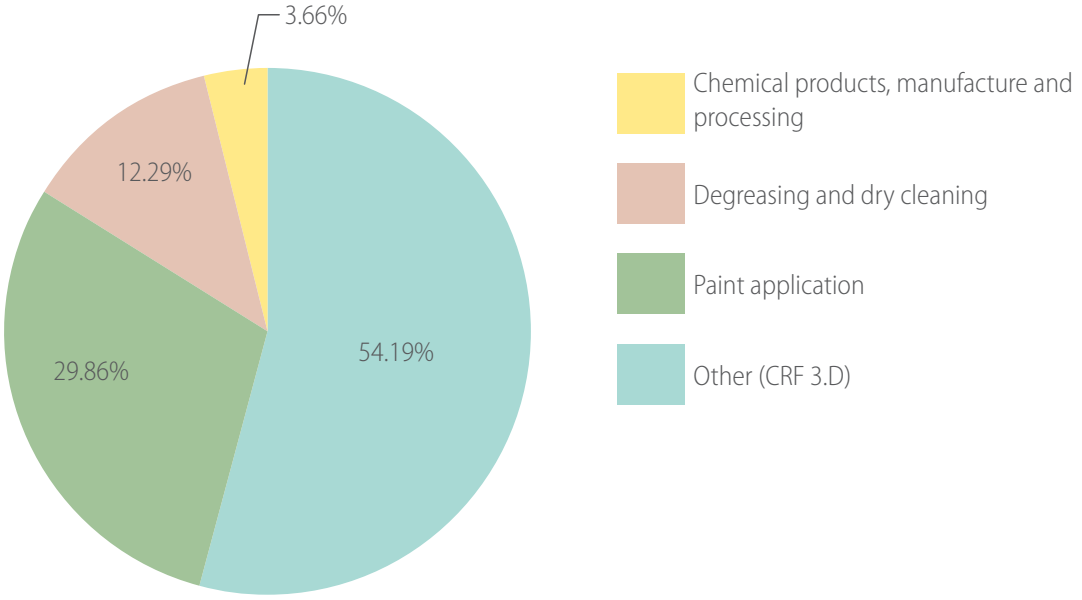

Figure 3.11. Share of emissions from solvent and other product use sector by category, 2011

Emissions from the solvent and other product use sector have decreased by 28.69 per cent compared to 1990. Two major categories where a decrease in NMVOC emissions and, consequently, a decrease

in indirect CO_2 emissions have occurred in more recent years are paint application and other product use. The fluctuation of NMVOC emissions in the period 1990-2011 has mostly occurred due to the welfare of the economic state of the country. The overall progression of GHG emissions in the solvent and other product use sector is presented in Figure 3.12.

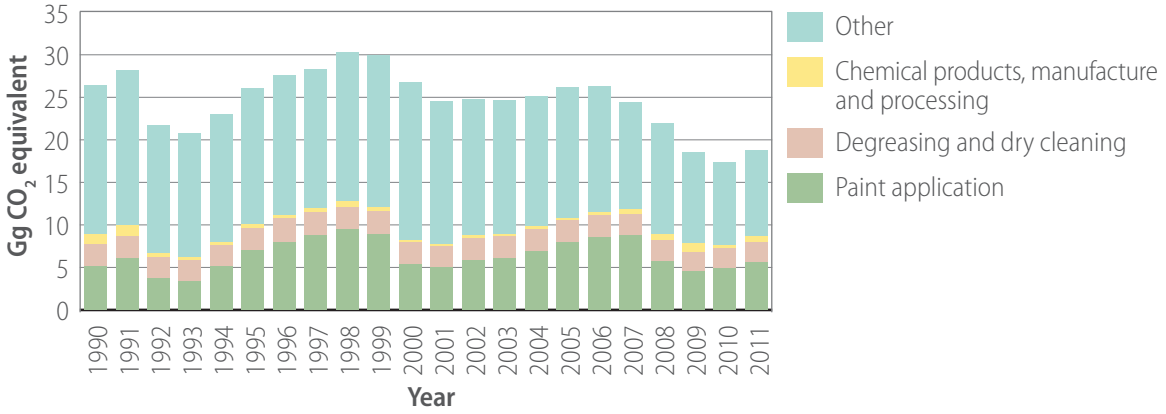

Figure 3.12. Greenhouse gas emissions from the solvent and other product use sector, 1990-2011, Gg CO_2 equivalent

3.2.2.4. Agriculture

Agricultural GHG emissions in Estonia consist of CH_4 emissions from enteric fermentation of domestic livestock, N_2O emissions from manure management systems and direct and indirect N_2O emissions from agricultural soils. Direct N_2O emissions include emissions from synthetic fertilizers, animal manure and sewage sludge applied to agricultural soils, emissions occurring from crop-growing (i.e. N-fixing crops and crop residue) and due to the cultivation of histosols. Indirect N_2O emissions include emissions due to atmospheric deposition and nitrogen leaching and run-off.

The total greenhouse gas emissions reported in the agriculture sector of Estonia were 1,270.52 Gg CO_2 equivalent in 2011. The sector contributed around 6.06 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 – 32.3 per cent and 31.5 per cent respectively. The share of emissions by category is presented in Figure 3.13.

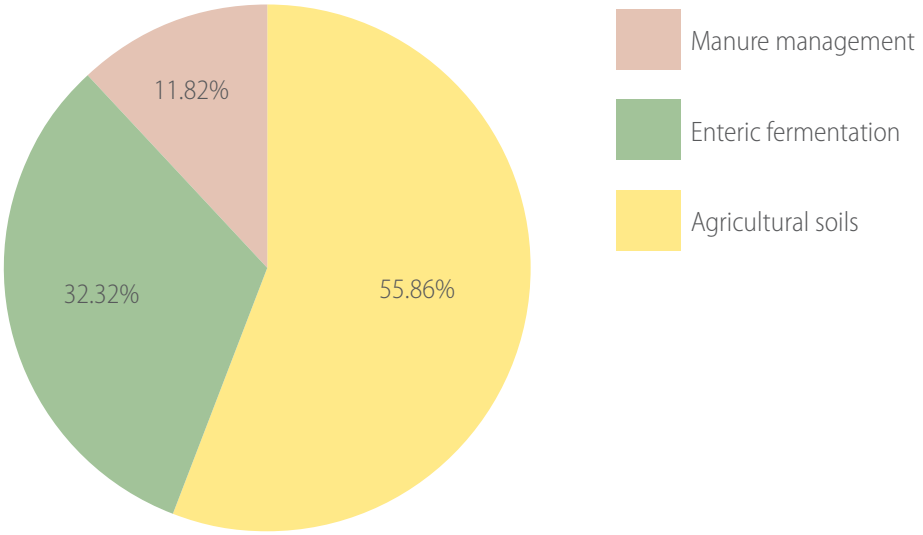

Figure 3.13. Share of emissions from agriculture sector by category, 2011

Emissions from the agricultural sector declined by 59.88 per cent by 2011 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 3.14.

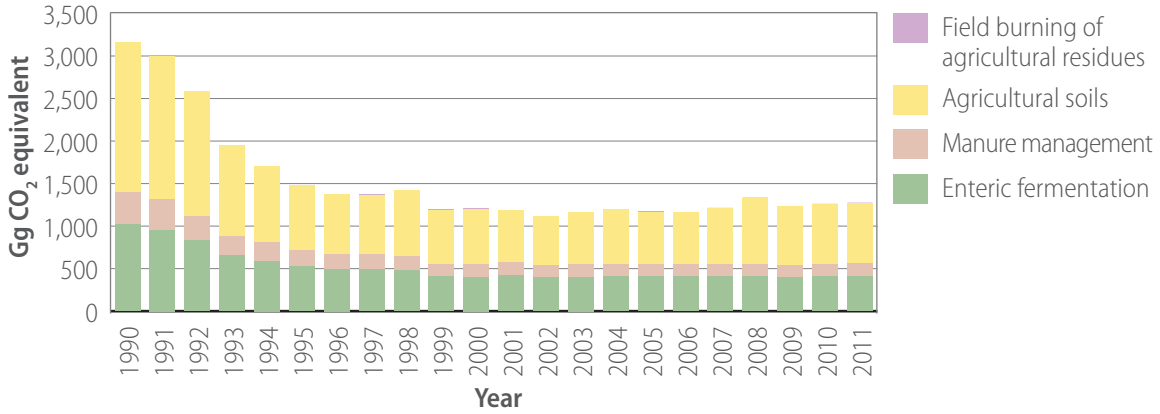

Figure 3.14. Greenhouse gas emissions from agriculture sector, 1990-2011, Gg CO_2 equivalent

3.2.2.5. 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; and other land. Each category is further divided between 'land remaining' and 'land converted to' sub-categories.

In 2011 the LULUCF sector acted as a CO_2 sink, totalling uptake of 4,262.81 Gg CO_2 equivalent. Compared to 1990, uptake of CO_2 has decreased by 51.83 per cent; compared to 2010, it has decreased by 28.26 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 3.15, 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 2011, forest land was 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), cropland liming and peat extraction.

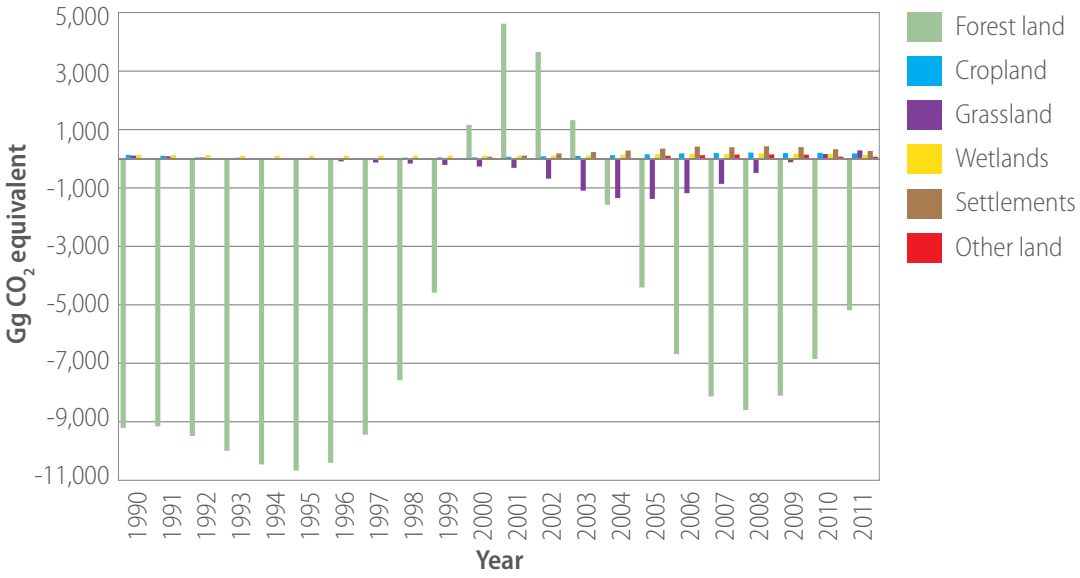

Figure 3.15. Greenhouse gas emissions and removals from land use, land-use change and forestry sector, 1990-2011, Gg CO_2 equivalent

3.2.2.6. 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 (incl. biogas burnt in a flare), biological treatment and wastewater handling including domestic, commercial and industrial wastewater.

In 2011, the waste sector contributed 1.87 per cent of all greenhouse gas emissions, totalling 390.76 Gg CO_2 eq. Solid waste disposal on land contributed the most to total emissions in the waste sector in Estonia. The share of emissions by category in 2011 is presented in Figure 3.16.

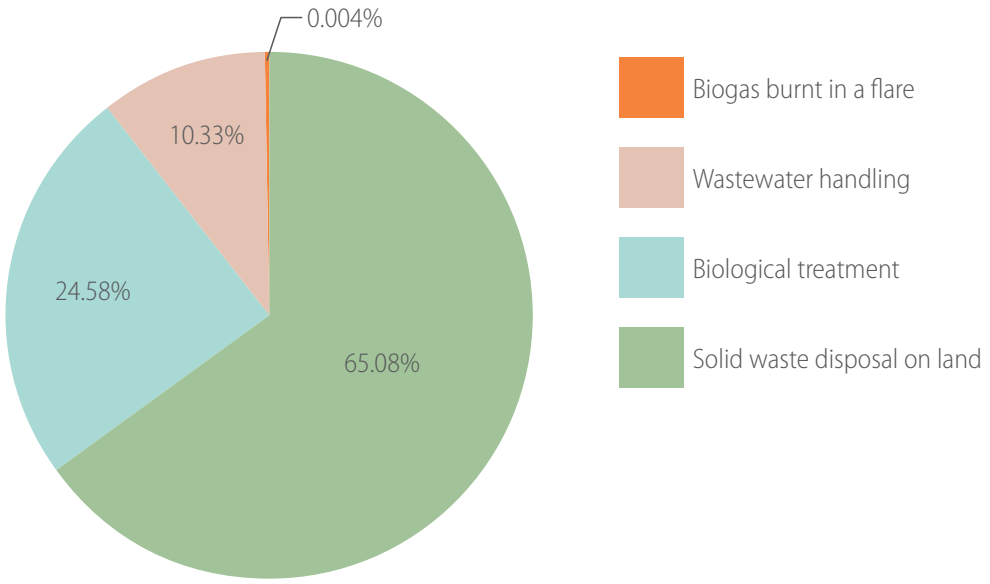

Figure 3.16. Share of emissions from waste sector by category, 2011

The total CO_2 equivalent emissions from the waste sector in 2011 increased by 13.69 per cent compared to the base year: emissions from solid waste landfilled increased by 41.5 per cent and emissions from waste composting processes increased almost a hundred-fold – from 1.26 Gg to 96.1 Gg – in 2011. 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 2007, mostly due to a steady increase in emissions from biological treatment, which is related to obligations stated in the Waste Act. The total CO_2 equivalent in 2011 decreased significantly compared to previous years (see Figure 3.17), mainly because of the change in the national currency, which raised prices in the country and therefore reduced consumption habits and waste generation.

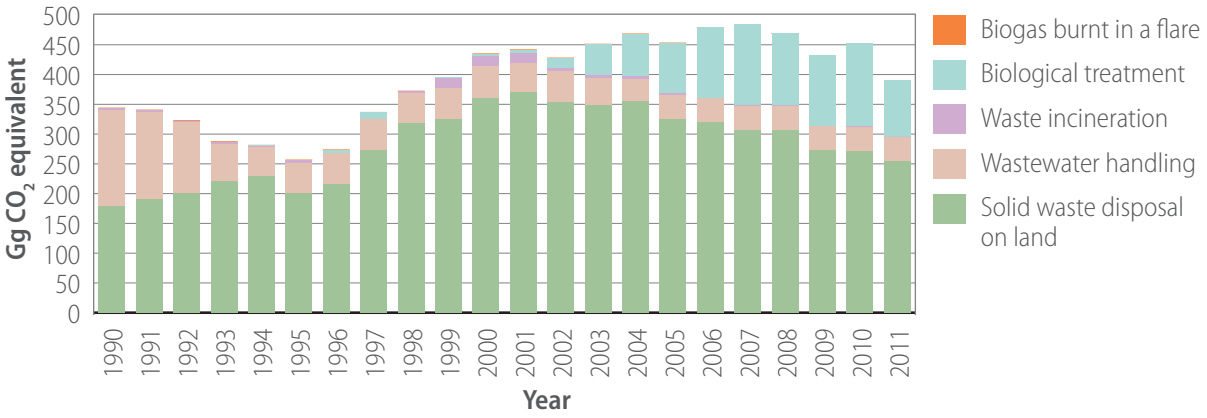

Figure 3.17. Greenhouse gas emissions from waste sector, 1990-2011, Gg CO_2 equivalent

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

Estonia reports activities under Article 3, paragraph 3, of the Kyoto Protocol and has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. 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). In 2011, net emissions from Article 3.3 activities were 232.11 Gg CO_2 equivalent. Uptake from afforestation and reforestation activities, including emissions from biomass burning, was estimated at -145.01 Gg CO_2 equivalent, whereas deforestation resulted in a net emission of 377.12 Gg CO_2 equivalent. Areas subject to AR and D were 27,295 and 19,135 ha respectively by the end of 2011. Annual rates of afforestation and deforestation declined continuously from 0.6 kha to 0.4 kha per year for AR and from 2.2 kha to 0.8 kha per year for D during the period 2008-2011.

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

3.3.1. 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 Anne Mändmets
Adviser, Climate and Radiation Department
Tel. +372 626 2817
Fax +372 626 2801
Anne.Mandmets@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.

Estonia's 2013 GHG inventory submission was compiled in collaboration between the MoE, the Estonian Environmental Research Centre (EERC), the Estonian Environment Information Centre (EEIC) and Tallinn University of Technology (TUT).

The MoE contracted EERC to prepare the estimates for the energy, industrial processes, solvent and other product use, agriculture and waste sectors and to coordinate inventory. The EERC signed a contract agreement with the Department of Chemistry at TUT to prepare the estimates for the agriculture sector.

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;
- preparing the UNFCCC inventory reviews and coordinating communication with the expert review team, including responses to the review findings; and
- the overall archiving system.

The Department of National Forest Inventory at the EEIC was responsible for the LULUCF and KP LULUCF sectors.

An overview of the division of responsibilities in 2013 inventory submission is shown in Figure 3.18.

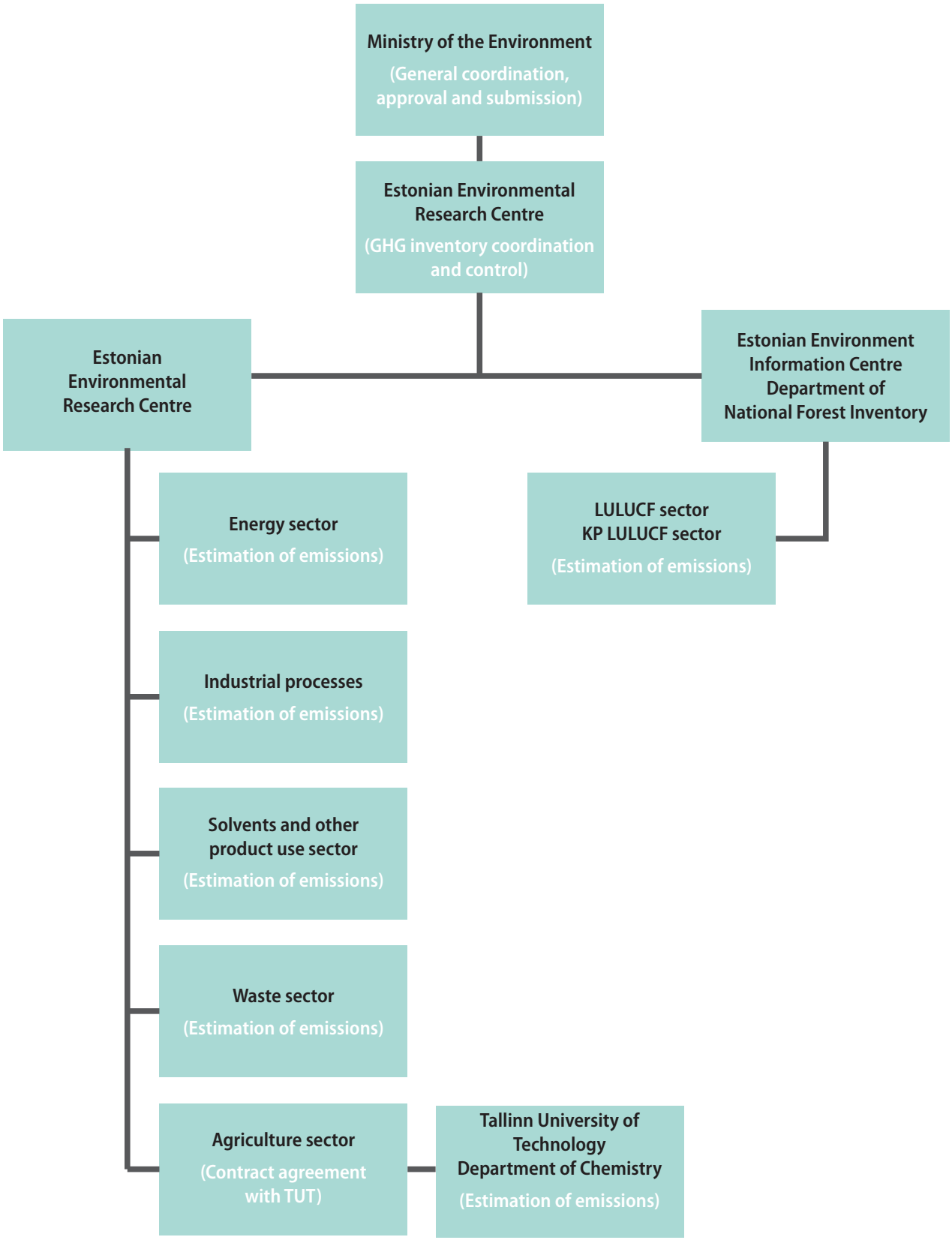

Figure 3.18. Overview of institutional arrangements for compilation of Estonia's 2013 GHG inventory

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.

In accordance with §6 section 3 and 4 of the Statutes of the Estonian Environment Information Centre, the EEIC performed[4] the following tasks: forest and forest sector data collection, analysis and assessments; and National Forest Inventory compilation.

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, solvent and other 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.

The Forest Monitoring Department of the Estonian Environment Agency is responsible for LULUCF and KP LULUCF estimates in the 2014 inventory submission.

3.3.2. 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.

[4] The Estonian Environment Agency was formed in 2013 as a result of the merger of the Estonian Meteorological and Hydrological Institute and the Estonian Environment Information Centre and is the legal successor to both.

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 Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1996) and IPCC Good Practice Guidance (IPCC 2000), IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (IPCC 2003) and 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 2000. 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 the Tier 2 method to identify key categories, and emission categories are sorted according to their contribution to emission levels or trends. The key categories are those that together represent 90 per cent of the inventory level or trend.

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

Recalculations are made if errors, overlaps or inconsistencies in the time series are identified, when a new source or sink is considered or if more accurate knowledge becomes available. The driving forces in applying recalculations to Estonia's GHG inventory are the implementation of the guidance given in IPCC 2000 and IPCC 2003 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.

Estonia has undertaken several projects to improve the quality of the country-specific emission factors and other parameters used in the greenhouse gas inventory (see Chapter VIII).

3.3.3. 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 four 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 Good Practice Guidance. General inventory QC checks (IPCC GPG 2000, Table 8.1 and IPCC GPG LULUCF 2003, Table 5.5.1) 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, 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 2013 submission the inventory was reviewed in parts by the EERC, TUT 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.

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

3.4. National registry

Before June 2012 Estonia was using Greenhouse Gas Registry for Emission Trading Arrangements (GRETA) software from Defra for ETS registry. The GRETA registry system was implemented using a Microsoft SQL Server relational database management system with a dedicated data model for supporting registry operations. Estonia's national registry was linked to the other operational EU Member States' National Registries through the European Commission CITL (Community Independent Transaction Log).

Directive 2009/29/EC, adopted in 2009, provides for the centralization of the EU ETS operations into a single European Union registry operated by the European Commission as well as for the inclusion of the aviation sector. At the same time, and with a view to increasing efficiency in the operations of their respective national registries, EU Member States who are also Parties to the Kyoto Protocol plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries – in particular Decision 13/CMP.1 and decision 24/CP.8.

With a view to complying with the new requirements of Commission Regulation 920/2010 and Commission Regulation 1193/2011, in addition to implementing the platform shared by the consolidating Parties, the registry of the EU has undergone a major re-development. The consolidated platform, which implements the national registries in a consolidated manner (including the registry of the EU), is called the Consolidated System of EU registries (CSEUR) and was developed together with the new EU registry on the basis of the following modalities:

(1) Each Party retains its organization designated as its registry administrator to maintain the national registry of that Party and remains responsible for all of the obligations of Parties that are to be fulfilled through registries;

(2) Each Kyoto unit issued by the Parties in such a consolidated system is issued by one of the constituent Parties and continues to carry the Party of the origin identifier in its unique serial number;

(3) Each Party retains its own set of national accounts as required by paragraph 21 of the Annex to Decision 15/CMP.1. Each account within a national registry keeps a unique account number comprising the identifier of the Party and a unique number within the Party where the account is maintained;

(4) Kyoto transactions continue to be forwarded to and checked by the UNFCCC Independent Transaction Log (ITL), which remains responsible for verifying the accuracy and validity of those transactions;

(5) The transaction log and registries continue to reconcile their data with each other in order to ensure data consistency and facilitate the automated checks of the ITL.

(6) The requirements of paragraphs 44 to 48 of the Annex to Decision 13/CMP.1 concerning making non-confidential information accessible to the public would be fulfilled by each Party individually.

(7) All registries reside on a consolidated IT platform sharing the same infrastructure technologies. The chosen architecture implements modalities to ensure that the consolidated national registries are uniquely identifiable, protected and distinguishable from each other, notably:

(a) with regards to the data exchange, each national registry connects to the ITL directly and establishes a distinct and secure communication link through a consolidated communication channel (VPN tunnel);

(b) the ITL remains responsible for authenticating the national registries and takes the full and final record of all transactions involving Kyoto units and other administrative processes such that those actions cannot be disputed or repudiated;

(c) with regards to the data storage, the consolidated platform continues to guarantee that data is kept confidential and protected against unauthorized manipulation;

(d) the data storage architecture also ensures that the data pertaining to a national registry are distinguishable and uniquely identifiable from the data pertaining to other consolidated national registries; and

(e) in addition, each consolidated national registry keeps a distinct user access entry point (URL) and a distinct set of authorisation and configuration rules.

Following the successful implementation of the CSEUR platform, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on 20 June 2012. During the go-live process, all relevant transaction and holdings data were migrated to the CSEUR platform and the individual connections to and from the ITL were re-established for each Party.

Information on registry administrator	Ministry of the Environment Mr Mihkel Visnapuu khgregister@envir.ee Tel. +372 6262 829
Cooperation with other countries concerning operation of registry	EU Member States who are also Parties to the Kyoto Protocol plus Iceland, Liechtenstein and Norway have decided to operate their registries in a consolidated manner. The Consolidated System of EU registries was certified on 1 June 2012 and went to production on 20 June 2012. A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries. This description includes: • **Readiness questionnaire** • **Application logging** • **Change management procedure** • **Disaster recovery** • **Manual Intervention** • **Operational Plan** • **Roles and responsibilities** • **Security Plan** • **Time Validation Plan** • **Version change Management** A new central service desk was also set up to support the registry administrators of the consolidated system. The new service desk acts as 2nd level of support to the local support provided by the Parties. It also plays a key communication role with the ITL Service Desk with regards notably to connectivity or reconciliation issues.
Database structure and capacity of national registry	In 2012 the EU registry has undergone a major redevelopment with a view to comply with the new requirements of Commission Regulation 920/2010 and Commission Regulation 1193/2011 in addition to implementing the Consolidated System of EU registries (CSEUR). A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries.

	During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the Data Exchange Standard (DES). All tests were executed successfully and lead to **successful certification on 1 June 2012.**
Conformity with DES	The overall change to a Consolidated System of EU Registries triggered changes the registry software and required new conformance testing. A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries. During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the DES. All tests were executed successfully and lead to successful certification on 1 June 2012. The October 2012 release (version 4.0) was only a minor iteration and changes were limited to EU ETS functionality and had no impact on the Kyoto Protocol functions in the registry. However, each major release of the registry is subject to both regression testing and tests related to new functionality. These tests include thorough testing against the DES and were successfully carried out prior to the relevant major release of the version to Production.
Procedures employed to minimize discrepancies in issuance, transfer, acquisition, cancellation and retirement of registry units	The overall change to a Consolidated System of EU Registries also triggered changes to discrepancies procedures, as reflected in the updated **manual intervention** document and **the operational plan**. A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries.
Overview of security measures to prevent unauthorized manipulations and operator error	The overall change to a Consolidated System of EU Registries also triggered changes to security, as reflected in the updated **security plan**. A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries.

Information available to public	Due to the updates on the publicly available information web page in year 2011, information referred in Decision 13/CMP.1; II Registry requirements; E. Publicly accessible information in paragraphs 45-48 are as following via the user interface of the MoE (http://www.envir.ee/ 1170489): • account information (information on paragraph 45 of annex to decision 13/CMP.1); • JI projects in Estonia (information on paragraph 46 of annex to decision 13/CMP.1); • information about unit holdings and transactions (information on paragraph 47 of annex to decision 13/CMP.1); and • information about Entities Authorized to Hold Units (information on paragraph 48 of annex to decision 13/CMP.1). Information regarding the NR is publicly available to users via the MoE website http://www.envir.ee/register. This information is currently available at: 1) paragraph 45 of annex to decision 13/CMP.1 (account information). This information is available to users via the user interface of the MoE http://www.envir.ee/1170489 and via CITL http://ec.europa.eu/environment/ets/. Selecting from left hand menu 'Accounts' - 'Search' - selecting Estonia; 2) paragraph 46 of annex to decision 13/CMP.1 (information of JI projects in Estonia). This information is available to users via the user interface of the website of the MoE http://www.envir.ee/1155464; 3) paragraph 47 of annex to decision 13/CMP.1 (information about unit holdings and transactions). The following information is publicly accessible via the user interface of CITL http://ec.europa.eu/environment/ets. Selecting from left hand menu 'Transactions' - 'Search' - selecting Estonia and other relevant parameters displayed in the search field. In accordance with the annex XVI of the EC regulation (No 2216/2004 of 21 Dec. 2004) 'the information for each completed transaction relevant for the registries system for year X shall be displayed from 15 January onwards of year X+5'; and

4) paragraph 48 of annex to decision 13/CMP.1 (information about Entities Authorized to hold units under its responsibility). Decision 280/2004/EC of the European Parliament and of the Council requires EU Member States to provide information on the legal entities authorized to participate in the mechanism under Articles 6, 12 and 17 of the Kyoto Protocol in the NIR. According to Estonia's national legislation (The Ambient Air Protection Act) §117) the Ministry of the Environment as the competent authority is authorized to trade with AAUs, RMUs, ERUs and CERs. This information is available online at http://www.envir.ee/1170489. Installations falling under the scope of the Directive 2003/87/EC are authorized to use ERUs and CERs for compliance according to the percentage set out in the National Allocation Plan for 2008-2012. This information is available to users via the user interface of the website of the MoE http://www.envir.ee/1173994.

Public information required by Commission regulation (EC) No 920/2010 (in addition to the above-mentioned public information):

1) installation and permit details - information about installations and permit details is available to users via the user interface of the MoE

http://www.envir.ee/orb.aw/class=file/action=preview/id=1172349/KP+2008-2012+ja+aastad_alloc+ja+VE.pdf and CITL http://ec.europa.eu/environment/ets/ selecting from left hand menu 'Operator Holding Accounts' – 'Search' – selecting Estonia;

2) information on verified emissions, surrenders and the compliance status of installations - information about verified emissions, surrenders and compliance status of installations is available to users via the user interface of the MoE website at http://www.envir.ee/cp1 (selecting 'Ülevaade kauplemisperioodil 2008-2012 eraldatud LHÜ-de, tõendatud KHG heitkoguste ja tagastatatud LHÜ-de kohta on leitav siit') and from the interface of CITL http://ec.europa.eu/environment/ets/ selecting from left hand menu 'Allocation/Compliance' – 'Search' – selecting Estonia;

3) National allocation plan for Estonia - information on the national allocation plan for Estonia is available via the user interface of the MoE website at http://www.envir.ee/cp1 (selecting from headline

	'Eesti riiklik kasvuhoonegaaside lubatud heitkoguse jaotuskava aastatel 2008-2012' last three headings in English and via the CITL website http://ec.europa.eu/environment/ets/ selecting from left hand menu 'NAP-info' – 'Search' – selecting Estonia.– 'Estonia' from the left-hand menu. The NIMs list is available at http://www.envir.ee/orb.aw/class=file/action=preview/id=1181767/NIMs List+EE_v3_avalikustamine.pdf.
Internet address for the national registry	https://ets-registry.webgate.ec.europa.eu/euregistry/EE/index.xhtml
Measures taken to safeguard, maintain and recover data to ensure integrity of data storage and recovery of registry services in event of disaster	The overall change to a Consolidated System of EU Registries also triggered changes to data integrity measures, as reflected in the updated disaster recovery plan. A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of the EU and all consolidating national registries.
Results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of national registry	On 2 October 2012 a new software release (called V4) including functionalities enabling the auctioning of phase 3 and aviation allowances, a new EU ETS account type (trading account) and a trusted account list went into production. The trusted account list adds to the set of security measures available in the CSEUR. This measure prevents any transfer from a holding account to an account that is not trusted. Prior to each release, security tests are carried out by the registry developer, the hosting organization (DIGIT) and by an independent security expert. Test reports for these tests are confidential, in line with standard security protocol, and cannot be disclosed. The scope of the security tests includes source code analysis, vulnerability tests (OWASP) and penetration tests. Prior to specific release, load and stress tests are carried out by the DIGIT. The version following iteration 4 was tested with the following conclusions: - average response times are correct and a lot of them have decreased since the previous version; - the CPU used by the application is good; and - the CPU used on the Database is correct.

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IV
POLICIES AND MEASURES

4.1. Policy-making process

The major documents on environment-related issues are either passed by the **Parliament** (Riigikogu) or adopted by the **Government**. The relevant measures can be taken at the national and/or local level. The **Parliament** is the highest legislative body in Estonia. The **Government** of Estonia is the supreme executive body and the **Ministry of the Environment** (MoE) is the highest executive body responsible for carrying out national environmental policy.

The main mission of the **Government Office** is to support the **Government** and the Prime Minister in policy drafting and implementation. The Strategy Unit supports the planning of the work of the **Government** and coordinates the drawing up and carrying out of the **Government's** action plan, as well as strategic development plans to increase the country's competitiveness and for sustainable development. The Legal Department makes sure that the draft legislation of the **Government** complies with the Constitution and laws. The function of the EU Secretariat is to coordinate the development of Estonia's positions on issues relating to the European Union and the transposition of European Union legislation, as well as to advise and support the Prime Minister on issues relating to the European Union and in the preparation of European Council summits.

The Constitution of the Republic of Estonia states that the natural wealth and resources of Estonia are national riches which shall be used economically. The function of the **Ministry of the Environment** is to establish prerequisites and conditions which ensure a natural environment rich in species and a clean living environment as well as guarantee the economical use of natural resources. Hence, the activities of the **Ministry of the Environment** focus on the utilisation of natural resources and environmental protection, balanced development of economic and social spheres, ensuring a well-functioning system necessary for the achievement thereof and the purposeful and well-considered use of resources allocated to environmental protection.

The **Ministry of the Environment** comprises sixteen departments, including the Climate and Radiation Department, the Forest Department, the Environmental Management Department, the Waste Department, the Mineral Resources Department and the Ambient Air Department. The jurisdictional structure of the **Ministry of the Environment** includes several subordinated entities:

- four state authorities (incl. the Estonian Environment Agency);
- six state-owned commercial enterprises and companies (incl. the **Estonian Environmental Research Centre**, the **State Forest Management Centre** and the **Private Forest Centre**.); and
- three governmental authorities: the **Land Board**, the **Environmental Inspectorate** and the **Environmental Board**.

The **Environmental Board** was formed on 1 February 2009. It was established by merging the functions of three previous bodies: the State Nature Conservation Centre, the Radiation Centre and the departments of environmental services. Similarly, the Estonian Environment Agency was formed on 1 June 2013, by merging the functions of Estonian Environmental Information Centre and Estonian Meteorological and Hydrological Institute.

Some aspects having an impact on the environment and climate are in the scope of responsibilities of other ministries. The **Ministry of Economic Affairs and Communications** is responsible for energy-related issues, including energy efficiency and conservation, transport and the use of renewable sources in the energy sector. The **Ministry of Agriculture** advises the **Government** in the field of agriculture and rural life. Some responsibilities of the **Ministry of Finance** include matters important to environmental management – taxation, use of state budget funds etc. All ministries are in charge of national development plans and programmes.

As a rule, new national environmental legislation is initiated by the **Government** or by the **Ministry of the Environment**. In some respects, the initiative can also come from the **Ministry of Economic Affairs and Communications** or the **Ministry of Agriculture**.

The responsibilities of the **Ministry of the Interior** include environment- and energy-related tasks concerning the handling and solving of crises. The functions of the Crisis Management Department include developing and organizing the implementation of a state crisis management policy based on the Emergency Preparedness Act; organizing the work of the Crisis Management Committee of the **Government**; coordinating nationwide training in the area of crisis management; and coordinating the crisis management-related activities of institutions in the **Ministry of the Interior**'s area of government.

Coordination Council of EU issues ensures effective inter-ministerial cooperation. It is chaired by the director of EU affaires (in case of his/her absence by the head of EUS) and is comprised of representatives of all ministries and the Bank of Estonia.

In September 2009 the decision was taken to establish an energy and climate agency subordinated to the **Ministry of Economic Affairs and Communications**. The main tasks of this institution were analysing and surveying energy- and climate-related activities and promoting sustainable development with relevant supporting investments. In summer 2011 the responsibilities of the agency were transferred to the financing institution **KredEx**, which belongs to the administrative area of the **Ministry of Economic Affairs and Communications**.

The monitoring and regular evaluation of policies and measures adopted is usually performed by the institution that is implementing the relevant strategy document or action plan. For GHG emission estimates PAMs are updated and evaluated every two years under Regulation No 525/2013 of the European **Parliament** (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). The last report was submitted in March 2013.

There has been an increase in the number of NGOs dealing with environmental problems and raising public awareness of matters related to the environment and sustainable development. Several NGOs have taken an active part in the preparation of environment-related development plans (e.g. **Estonian Renewable Energy Association**, **Estonian Biogas Association**).

During the period that has elapsed since Estonia regained its independence, great progress has been made in developing legislation. Estonian legal acts were amended in the process of integration with the EU, and today the country's legislation (including that on environmental management) is harmonized with the *acquis communautaire* of the EU.

According to §5 of the Constitution of the Republic of Estonia the natural wealth and resources of Estonia must be used economically, and §53 prescribes that everyone has a duty to preserve the human and natural environment and to compensate damage inflicted on the environment.

It is important to emphasize that §123 of the Constitution stipulates that if the laws or other legislation of Estonia are in conflict with international treaties ratified by the Riigikogu, the provisions of the international treaty shall prevail.

4.1.1. National GHG targets

According to the Kyoto Protocol, Estonia had to reduce its GHG emissions by 8 per cent in comparison with the 1990 level during the period 2008-2012. The obligation to reduce GHG emissions according to the Kyoto Protocol has been achieved in Estonia as a result of the significant reorganization of economic sectors (particularly energy production, but also industry and agriculture) mainly in the early 1990s.

At the EU level, there are two main key policies implemented at achieving its climate policy objectives: The European Union Emissions Trading Scheme (EU ETS) that is established by Directive 2003/87/EC (see Chapter 4.2.5) and The Effort Sharing Decision (ESD) that is established by Decision 406/2009/EC (see Chapter 4.2.6). According to the Effort Sharing Decision, the GHG emissions in Estonia from non-ETS sectors can increase 11 per cent by 2020, compared to 2005 level.

4.2. Legislation, strategy documents and programmes

4.2.1. International agreements and conventions, EU legislation

Since regaining its independence in 1991, Estonia has entered into a number of bilateral or trilateral environmental agreements and has become a party to many environmental conventions and protocols. The conventions to which Estonia has acceded include New York (1992), Arhus (1998), Espoo (1991), Helsinki (1992), Geneva (1979), Rio de Janeiro (1992) and Vienna (1985).

The UNFCCC was opened for signature on 9 May 1992, after an Intergovernmental Negotiating Committee produced the text of the Framework Convention as a report following its meeting in New York from 30 April to 9 May 1992. It entered into force on 21 March 1994. As of May 2011, UNFCCC has 195 parties. Estonia ratified the Convention on July 27, 1994.

Estonia signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) on 3 December 1998. The Protocol was ratified by the Estonian parliament in September 2002.

In December 2008 the European Parliament adopted a set of legislative documents (the so-called EU climate and energy package) to gradually transform Europe into a low-carbon economy and to increase energy security. An agreement has been reached on legally binding targets which, by 2020, will:

- cut GHG emissions by 20 per cent;
- establish a 20 per cent share for renewable energy in final consumption; and
- improve energy efficiency by 20 per cent.

Directive 2009/28/EC (amending and subsequently repealing Directives 2001/77/EC and 2003/30EC) on the promotion of the use of energy from renewable sources sets for Estonia a target (25 per cent) for the share of energy from renewable sources in gross final consumption of energy by 2020.

Directive 2010/31/EC lays down requirements as regards:

- the common general framework for a methodology to calculate the integrated energy performance of buildings and building units;
- the application of minimum requirements for the energy performance of new buildings and new building units;
- national plans to increase the number of nearly zero-energy buildings;
- energy certification of buildings or building units;
- regular inspection of heating and air-conditioning systems in buildings; and
- independent control systems for energy performance certificates and inspection reports.

In 2011, the European Commission published 'A Roadmap for moving to a competitive low-carbon economy in 2050.' Estonia finalized its report on 'Opportunities for a Low-Carbon Economy in Estonia' in 2013.

4.2.2. Strategy documents

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

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

The national strategy is based on the *Sustainable Development Act*[1], adopted by the Parliament in 1995, which establishes, first and foremost, principles for the sustainable use of the natural environment and natural resources. No separate plan has been compiled to implement the National Strategy on Sustainable Development. The strategy is being implemented through different sectoral strategies and development plans.

More concrete long-term environmental development objectives are formulated in the *National Environmental Strategy until 2030* endorsed by the Parliament in 2007. Also in 2007 the Government approved the *Environmental Action Plan for 2007-2013* prepared by the 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 environmentally 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 EU funds, as well as from the state, local government budgets and companies.

In the *Action Plan for 2011-2015* of the Government (approved in March 2011), high priority to environmental issues is given. For example, in terms of the environment there are two major goals set for 2015:

1. to increase the share of renewables in final energy consumption up to 23.6 per cent; and
2. to stabilize total GHG emissions at the level of 2010 (20 Mt CO_2 eq).

It should be emphasized that according to Regulation No 302 of the Government (13 December 2005) *Types of strategic development plans and procedure for drafting, amending, evaluating and reporting on their implementation*, all strategic development plans to increase the country's competitiveness and for sustainable development should be taken as a basis when compiling sectoral development plans.

Concerning the estimates of adverse effects of PAMs, no estimates are available, since no significant adverse effects of PAMs are expected.

[1] Texts of all Estonian legal acts (in Estonian) are available on the website of the State Gazette (Official Journal): www.riigiteataja.ee

4.2.3. Legislation

The *Sustainable Development Act* prescribes the principles of sustainable development, thus serving as a basis for all environment-related legislation and relevant national programmes. Therefore, the legal acts regulating the energy, industrial and transport sectors (i.e. the sectors that are the largest emitters of greenhouse gases) usually take into account major environmental issues.

The *Ambient Air Protection Act* regulates activities which emit pollutants into the ambient air, damage the ozone layer, and lead to factors causing climate change. The Act provides the main principles for the control of ambient air quality, sets the basis for emission standards, foresees measures for a reduction in air pollution etc. The main objective of the Act is to maintain the quality of the ambient air in areas where the air is good and to improve the quality of the ambient air in areas where the air does not conform to requirements. The Act stipulates that activities for a reduction in climate change must be organised by the MoE. The Act also provides that the possessors of pollution sources must take additional measures to reduce the emission levels of carbon dioxide and other GHG. The Act has been amended in numerous cases. For example, the latest amendment (in force since 15 July 2012) sets out F-gases related requirements. A great number of secondary level legal acts have been issued on the basis of this Act.

The *Environmental Monitoring Act* provides requirements for the organisation of environmental monitoring, the procedure for processing and storing data obtained and relations between persons carrying out environmental monitoring and owners or possessors of immovables. Environmental monitoring is defined as the continuous observation of the state of the environment and the factors affecting it, with the main purpose being to predict changes in the state of the environment and to obtain data for programmes and plans, as well as for the preparation of development plans.

The *Environmental Register Act* provides the basis for data entry regarding natural resources, natural heritage, the state of the environment and environmental factors in the environmental register, for the retention of data in the register and for the processing and release of the data.

The *Environmental Impact Assessment and Environmental Management System Act* provides a legal basis and procedure for the assessment of possible environmental impact and the organisation of eco-management and an audit scheme. The Act also forms legal bases for awarding eco-labels in order to prevent environmental damage and establishes liability upon violation of the requirements of the Act. The Act specifies the procedure and principles of environmental impact assessment, with strategic assessment being regulated in detail. Strategic environmental assessment is made mandatory in the case of national, county and local plans and programmes.

The *Environmental Supervision Act* defines the nature of environmental supervision, establishes the rights and obligations of persons and agencies that exercise environmental supervision, the rights and obligations of persons and agencies which are subject to environmental supervision and the procedures for supervisory operations.

The *Environmental Liability Act* is targeted at the more effective implementation of the 'polluter pays' principle and more efficient reaction to environmental damage. The act specifies the procedures for the prevention and rectification of environmental damage, which ensures the restoration of the environment by those who cause the damage.

The *Integrated Pollution Prevention and Control Act* determines environmentally hazardous activities and lays down the bases for the integrated prevention and control of pollution arising from such activities, in order to prevent or reduce the harmful effect of human activities on the environment.

Some of the acts described above will be repealed and replaced with new acts in the near future as the process of environment-related legislation reforms has commenced. In February 2011 a new framework law was approved by the Parliament – the *Environment Code – General Provisions*.

The *Electricity Market Act* regulates the generation, transmission, sale, export, import and transit of electricity and the economic and technical management of the power system. Regarding planning for the development of the electricity sector, it is stipulated in the Act that every three years the Ministry of Economic Affairs and Communications (MoEAC) must prepare a development plan for the electricity sector and submit it to the Government for approval. This plan must also include environmental protection aspects.

The *Liquid Fuel Act* prescribes liquid fuel quality requirements and procedures for controlling fuel enterprises. The environmental requirements of fuel quality stipulated by regulations of the MoEAC have gradually become more stringent.

The *District Heating Act* regulates activities related to heat production, distribution and sales in district heating networks and terms for connection to the network. The Act also provides that in order to increase energy efficiency, preserve the quality of the environment and use natural resources rationally, the Government must approve an energy conservation programme combined with the related action plan.

The *Product Conformity Act*, which entered force on 1 October 2010, repealed the *Energy Efficiency of Equipment Act*. The new act sets out the competence of authorities participating in market surveillance and stipulates that the Technical Surveillance Authority must exercise state surveillance over compliance of household appliances, heating appliances and devices with energy efficiency, energy performance labels and ecological design requirements.

Due to the large share of buildings in total energy use the improvement of energy efficiency in the residential and tertiary sectors also has an important role from the emissions reduction aspect. Here the impact of EU Directive 2002/91/EC and its recast 2010/31/EU on the energy performance of buildings (EPBD) should be highlighted. In Estonia, the implementation of the EPBD is the responsibility of the MoEAC. The provisions of the EPBD have been transposed into the *Building Act*. Several detailed requirements were enforced using secondary legislation. The most important secondary level act is the regulation (No 258 of 20 December 2007) of the Government on the Minimum Requirements for Energy Performance of Buildings. The regulation applies to new buildings

as well as existing ones undergoing major renovations. Since 1 January 2009 the regulation (No 107 of 17 December 2008) providing the format and issuance procedures for the energy performance certificate of buildings has been in force. On 19 January 2009 another regulation (No 194 of 30 December 2008) related to energy performance certificates entered into force.

As to impact on the environment, the *Organic Farming Act* is important among legislation regulating the agricultural sector. A number of secondary legislative acts have been issued on the basis of this act to regulate aspects of organic farming.

The *Forest Act* regulates the sustainable management of forests as a renewable natural resource. The Act provides the legal basis for surveys, planning and management of forests. The Act prescribes the obligation to prepare a national forestry development plan at least every ten years.

The *Waste Act* provides the general requirements for preventing waste generation and the health and environmental hazards arising there from. It also prescribes the organisation of waste management with the objective of reducing the harmfulness and quantity of waste.

4.2.4. Joint implementation and international emissions trading

Estonia is using two of the three Kyoto flexible mechanisms – Joint Implementation (JI) and International Emissions Trading. According to the National GHG Inventories, Estonia's emissions decreased significantly between 1990 and 1993 due to the restructuration of the economy after the collapse of the Soviet Union (almost 50 per cent). Since then, annual emissions have remained approximately 50 per cent below the 1990 level. This is a clear indication that Estonia does not have problems meeting its Kyoto target. As a consequence, Estonia is acting as a seller within both mechanisms. The Clean Development Mechanism (CDM) is not used, as Estonia is not a developing country.

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 (http://ji.unfccc.int/JI_Parties/DB/ZY0IK6ZF2CQKOTBPPY1MKN130ITMM7/viewDFP).

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 JI 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.

JI and CDM, as Kyoto flexible mechanisms, and their relation to the EU Emission Trading Scheme 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 (see Table 4.1).

Table 4.1. Emission reductions from JI projects in Estonia (2002-2012)

Project	Emission reductions, t CO_2-eq.
Tamsalu District Heating Project	52,115
Kadrina District Heating Project	37,217
Paide Bioenergy Project	139,043
Saaremaa Animal Waste Management Project	57,155
Virtsu III Wind Power Project	48,994
Esivere and Virtsu II Wind Farm	214,223
Viru-Nigula Wind Farm	231,703
Pakri Wind Farm Project	379,139
Jägala-Joa Hydropower Joint Implementation Project	31,978
Paldiski Wind Farm	0
Vanaküla Wind Power Project	52,656
Tooma Wind Power Project	99,469
Total	1,343,692

International Emissions Trading

Estonia ratified the Kyoto Protocol in 2002, taking an obligation to reduce its GHG emissions by 8 per cent during 2008 to 2012 compared to 1990. Mainly due to the collapse of the Soviet Union in 1991,

followed by a complete restructuration of the economy together with the implementation of energy efficiency measures, increase in the use of renewable energy and modern technologies, a significant emission reduction (about 50 per cent) has taken place since 1990. Therefore only 103,000,000 AAUs out of the total 196,000,000 AAUs distributed to Estonia are used for the first commitment period reserve. The surplus of AAUs can be used for trading (Article 17 of the Kyoto Protocol).

In 2010 the Ambient Air Act was amended with provisions on AAU trading and procedures for the use of revenue from sales of 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 surplus AAUs, a government regulation is issued to approve each AAU SPA. The use of surplus 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 (e.g. electromobility programme);
- development of wind energy farms; and
- use of renewable energy (e.g. wind parks);

Since 2010 Estonia has concluded 21 SPAs with Austria, Spain, Luxembourg and Japan. By 2013 Estoina has sold AAUs worth of more than 388 million euros[2].

4.2.5. Emissions trading under the EU Emission Trading Scheme

The European Union Emissions Trading Scheme (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 Emissions Trading Scheme (EU ETS) for 2005-2007 included 43 installations. The first NAP for greenhouse gas emission allowances provided the right to emit 56.7 million tons of carbon dioxide from 2005-2007.

[2] More detailed information of the GIS is given in the overview on sectors.

On 30 June 2006, Estonia submitted its second NAP for the EU ETS for 2008-2012 to the European Commission 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 provides the right to emit 66.51 Mt of CO_2 eq. (13.3 Mt/a). This quantity includes 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.

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 18 Mt of emission allowances free of charge to electricity producers included in the EU emission credit trading system.

4.2.6. 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. For Estonia, the GHG emissions from non-ETS sectors can increase 11 per cent by 2020, compared to 2005 (see Chapter 4.1.1 and Table 4.4).

4.2.7. Information on activities under Kyoto Protocol Articles 3.3 and 3.4

Estonia has elected to account for the activities under article 3.3 (afforestation, reforestation and deforestation) for the first commitment period stated in the '*Report to facilitate the estimation of Estonia's assigned amount under the Kyoto Protocol, 2007*'.

Estonia has estimated greenhouse gas emissions and removals from forestry activities under Article 3.3 for 2008-2011 as part of the 2013 greenhouse gas inventory submission. An extract from the inventory (April 2013 submission) is presented in Table 4.2.

Table 4.2. Information on accounting for activities under article 3.3 of Kyoto Protocol

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	BY	Net emissions/removals					Accounting parameters	Accounting quantity
		2008	2009	2010	2011	Total		
	(Gg CO_2 equivalent)							
A. Article 3.3 activities								
A.1. Afforestation and Reforestation								-495.23
A.1.1. Units of land not harvested since beginning of commitment period		-97.88	-121.26	-131.07	-145.01	-495.23		-495.23
A.1.2. Units of land harvested since beginning of commitment period								NA, NO
Total Estonia		NA, NO	NA, NO	NA, NO	NA, NO	NA, NO		NA, NO
A.2. Deforestation		721.53	638.44	475.74	377.12	2,212.82		2,212.82
B. Article 3.4 activities								
B.1. Forest Management (if elected)		NA	NA	NA		NA		NA
3.3 offset							1,717.59	NA
FM cap							1,833.33	NA
B.2. Cropland Management (if elected)	0.00	NA	NA	NA		NA	0.00	0.00
B.3. Grazing Land Management (if elected)	0.00	NA	NA	NA		NA	0.00	0.00
B.4. Revegetation (if elected)	0.00	NA	NA	NA		NA	0.00	0.00

From 2008-2011 the activities under Article 3.3 were net source in total. At present, no special measures regarding afforestation, reforestation and deforestation are foreseen. Therefore current trends are expected to continue and activities under Article 3.3 are expected to be net source during the first commitment period.

Estonia has not elected to account for the activities under article 3.4 for the first commitment period.

The Estonian Forestry Development Plan up to 2020 was approved by the Parliament on 15 February 2011. The main aim of the plan is to ensure sustainable forest management.

4.2.8. Procedures for making legislative arrangements publicly accessible

The web-based outlet for publication of laws and official announcements can be accessed at: https://www.riigiteataja.ee/ (Electronic State Journal). Under Estonian law, Electronic State Journal is since 1 June 2002 considered the authoritative reference source for laws of Estonia.

Most of the action plans are available at the websites of the Ministries, that have compiled the action plan.

EUR-Lex (eur-lex.europa.eu/en/index.htm) is a service providing legal texts of the European Union on its official website europa.eu. Replacing the earlier service CELEX, EUR-Lex provides direct free access to EU law. The system makes it possible to consult the Official Journal of the European Union and it includes inter alia the treaties, legislation, case-law and legislative proposals.

4.3. Policies and measures and their effects

Policies and measures reported in current NC are adopted and implemented under Kyoto Protocol Article 4, paragraphs 2 (a), (b) and (e)(ii).

4.3.1. Cross-cutting measures

4.3.1.1. National programmes and EU assistance

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

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

In the Programme, the Government has set an ambitious goal for making final energy consumption more efficient in Estonia – to keep final energy consumption in 2020 at the same level as 2010, i.e. reducing final consumption of energy by approx. 11 per cent compared to the forecast for 2020 (see Table 4.3). Accordingly, final energy consumption in 2015 should not significantly exceed current consumption and it should remain between 123 and 125 PJ (approx. 4 per cent lower than the projected level for 2015). Keeping final consumption of energy at the 2010 level will require decreased energy use combined with an increase in energy efficiency.

Table 4.3. Final consumption of energy, PJ

Actual (preliminary)	Targets	
2010	**2015**	**2020**
120	123 – 125	120

Regarding GHG emissions, the National Reform Programme 'Estonia 2020' provides that according to EU goals, Estonia's emissions from non-ETS sectors should not increase by more than 11 per cent by 2020 compared to the 2005 level. This situation is illustrated in Table 4.4.

Table 4.4. GHG emissions from non-ETS sectors, Gg CO_2 eq.

Actual	Targets	
2005	**2015**	**2020**
5,627	6,183	6,246

The level of GHG emissions is related to the plans set in the Programme for the wider utilization of renewable energy sources (RES) developing relevant solutions in all sectors (see Table 4.5).

Table 4.5. Share of renewable resources in final energy consumption, per cent

Actual	Targets	
2009	**2015**	**2020**
19.5	23.6	25.0

The total target is in accordance with Directive 2009/28/EC – Estonia must ensure that the share of energy from renewable sources amounts to 25 per cent of the gross final consumption of energy by 2020. The same directive also provides that each member state shall adopt a national renewable energy action plan. In Estonia, the *National Renewable Energy Action Plan up to 2020* (NREAP) was approved by the Government in November 2010 (Order No 452, 26.11.2010). The national goals for Estonia in the EU 20-20-20 package require a 25 per cent share of energy from renewable sources in gross final energy consumption by 2020 and allow for an 11 per cent increase in greenhouse gas emissions outside the emissions trading directive scope by 2020, compared to the 2005 level. The 10 per cent share of renewable energy sources in road transport fuels by 2020 is an EU-wide goal. The *National Renewable Energy Action Plan* presents estimations and planned policies and measures to achieve the national targets. The *Implementation plan for 2010-2013 of the 'National Renewable Energy Action Plan up to 2020'* has also been adopted. It should be noted that the Plan predicted the share of renewable energy in final consumption to be 20.9 per cent in 2010, but it actually reached 24.0 per cent.

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

In September 2011, the MoEAC presented a mid-term overview of the implementation of the Energy Efficiency Plan 2007-2013 and the further implementation plan that was presented to the EC as the *Second energy efficiency action plan of Estonia* (NEEAP2). The action plan focuses on the following aspects of energy efficiency:

- continued support programmes for energy conservation activities in apartment buildings;
- a new measure for energy conservation in small houses;
- implementation of the programme for renovation of public sector buildings;
- improving energy efficiency to increase the competitiveness of industry and small enterprises;
- energy conservation in the transport sector;
- energy efficiency in the service sector; and
- improving the quality of implementation of energy conservation policy.

NEEAP2 includes 99 measures to increase energy efficiency in all sectors. In the current document, the key measures are described in sector overviews.

Both NEEAP2 and NREAP present a long-term forecast of the final energy consumption in Estonia by 2020 (see Table 4.6). The forecast was compiled by the MoEAC when drawing up the NREAP until 2020. According to this forecast, Estonia's final energy consumption would be 137 PJ in the case of the basic (reference) scenario and 131 PJ in the case of the additional energy efficiency scenario in 2020.

Table 4.6. Final consumption of energy by sector, PJ

Sector	2009	2020	
		Reference scenario	Efficiency scenario
Industry	20.9	36.5	35.6
Agriculture	3.7	4.7	4.6
Transport	20.3	26.8	26.2
Services	16.7	16.9	16.4
Households	51.3	52.1	48.1
Total	**112.9**	**137.0**	**130.9**

In Estonia, oil shale is the main domestic fuel, therefore to ensure the long-term balanced use of it, the *National Development Plan for the Use of Oil Shale 2008-2015* was prepared to specify the plans for use of oil shale as a nationally strategic indigenous energy resource. These plans include an assessment of the use of shale fuel oil and oil shale gas taking into account economic, social, security and environmental issues. In the Plan, the upper limit on the amount of annual mining of oil shale has been set at 20 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.

During the EU financial period of 2007-2013, the EU funds for supporting agriculture and fisheries are no longer regarded as structural assistance as was the case from 1999-2006. Therefore, planning for the use of respective funds is undertaken separately from structural assistance planning – although in the same general framework of the *State Budget Strategy 2007-2010* preparations. The *Rural Strategy 2007-2013* as a strategic document and the *Rural Development Plan 2007-2013* (RDP) as its implementation document are bases for using the resources of the European Agricultural Fund for Rural Development. Environmental issues are mainly included in the following priority axes of the RDP:

1. improving the competitiveness of the agricultural and forestry sector; and
2. improving the environment and countryside.

To promote the use of biomass and bio-energy, in January 2007 the Government approved the *Development Plan 2007-2013 for Enhancing the Use of Biomass and Bio-energy*. The objective of the plan is to create favourable conditions for the development of domestic biomass and bio-energy production to reduce Estonia's dependence on imported resources and fossil fuels and decrease pressure on the natural environment. The measures of the development plan are directed at supporting the research and development of biomass and bio-energy and raising the awareness of consumers, operators and market regulators. After carrying out appropriate analyses, the employment of a range of market-based instruments will be considered to promote the use of biomass and bio-energy. Investment in bio-energy production will be supported using the measures of the *Estonian Rural Development Plan 2007-2013*.

To administer environment-related financial support measures, the Environmental Fund was established in 1993. In 2000 the Fund was reorganized as the Environmental Investments Centre (EIC). The main goals of the EIC are to channel the proceeds from the exploitation of the environment into environmental projects; to act as the implementing agency for the environmental projects funded by the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund (CF); and to lend money for the implementation of environmental projects. Since 2010 the EIC has also acted as the implementing agency for the Green Investment Scheme, i.e. selling the surplus AAUs and supervising the relevant investments. In 2011, the EIC distributed foreign aid (ERDF and CF and other smaller EU grant funds), including co-financing, to a total value of EUR 149,000,000, which was twice as much as in 2010, when foreign aid and co-financing amounted to EUR 74,000,000.

4.3.1.2. 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 was 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 4.7.

Table 4.7. Excise tax on fuels and energy (as of 1 March 2013)

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	23.45
Oil shale	GJ	0.30
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*, 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* (enforced in 2006) 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.

4.3.2. Energy supply

4.3.2.1. General development programmes

Regarding the energy sector, Estonia's second *National Long-term Development Plan for the Fuel and Energy Sector until 2015 (*approved by the Parliament in 2004) was replaced in 2009 with the *National Development Plan of the Energy Sector until 2020*. The present structure of strategy documents for the development of the energy sector is presented in Figure 4.1. One plan – Development Plan for Heat supply (in italics in the figure) – has yet to be prepared.

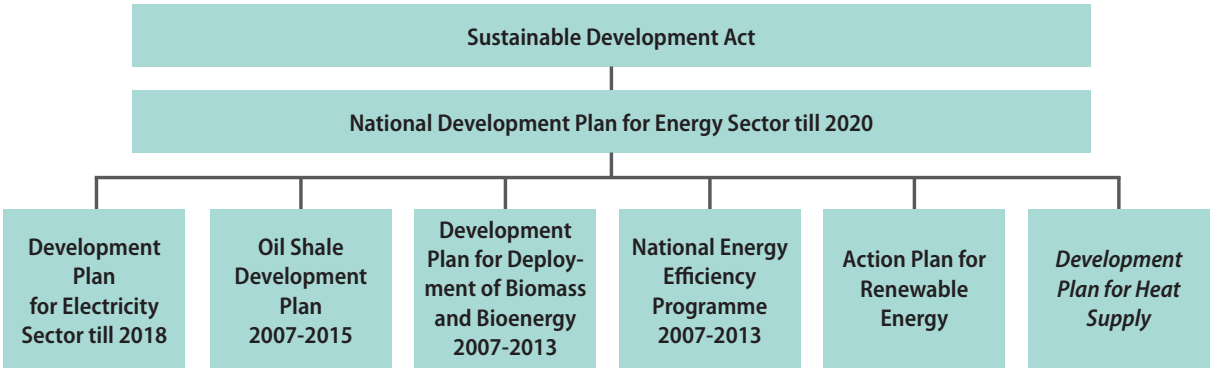

Figure 4.1. The current structure of strategy documents for energy sector

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

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

The major measures (or sub-measures) to be taken that have an impact on the emission of GHGs include:

- developing and applying support schemes for the use of renewable energy;
- preparing and implementing measures that foster the cogeneration of heat and electricity;
- improving the energy efficiency of oil shale use;
- developing and introducing up-to-date energy technologies;
- developing and implementing an action plan for the deployment of renewable energy;
- developing and implementing an action plan for heat supply (district heating) systems;
- transposing and implementing EU regulations on sustainable energy use; and
- analysing taxation alternatives for the energy sector.

For several measures, target level indicators have been set. Some quantitative indicators related to the emission of GHG are presented in Table 4.8.

Table 4.8. Key indicators for energy sector development

Indicator	Current level[1]	Target level
Share of oil shale in meeting domestic energy	45% (2007)	<30% (2020)
Shares of other energy sources in energy balance	Every source <20% (2007)	Every source <20% (2020)
Share of renewables in energy end-use	17.5% (2006)	25% (2020)
Share of CHP electricity in gross electricity use	10.2% (2007)	20% (2020)
Energy saving (annually)	5 TJ (2007)	9,800 TJ (2016)
Share of renewables in fuel use of transport	0.06% (2007)	10% (2020)
CO_2 emissions from energy sector	15.7 Mt (2007)	7.85 Mt (2020)

[1] indicator level presented as current in Plan

Activities provided in the development plan are to be financed from the state budget and from the budgets of energy companies. The amount of state expenditure on the activities planned will be approximately EUR 2,045,000,000 until 2020. Together with the involvement of private capital and loan capital, the full implementation of the *Development Plan for the Energy Sector* will cost more than EUR 6,000,000,000. The final actual amount of investments will depend on administrative and political decisions.

Currently, a new *Development Plan for the Energy Sector 2030+* is under development.

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

4.3.3. Electricity production

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

proportion of other sources of energy. The construction of an Estonian nuclear power plant is being considered as a potential development option.

The plan emphasizes that Estonia's electricity sector requires fundamental changes as the impact of electricity generation on the environment must be reduced. This process is also affected by the need to use the resources of oil shale in a more sustainable way. Therefore, the plan provides scenarios for the restructuring of electricity production in Estonia within the next 10-15 years. For this purpose, combined heat and power production should be expanded from the existing level of 200 MW to 300 MW by 2014 and two more units in the Narva power plants should be reconstructed with a total capacity of 600 MW. Also, the capacity of wind turbines (mainly wind farms) could be increased significantly (up to 900 MW) together with the required capacity reserves.

Estonia has exported a large share of its generated electricity, e.g. *ca* 20 per cent in 2007, while in 2011 net export made up 27.6 per cent of gross production. The plan stipulates the construction of a second submarine cable (EstLink 2) to Finland.

Regarding options for electricity generation, the plan considers four main development scenarios. The projected annual increase rate of the peak load is 1.6-3.8 per cent, the average taken as 2.3 per cent per annum. As for consumption, the target is set to keep the domestic final consumption of electricity at the current level or lower (7,180 GWh in 2007). The main precondition is that total electricity demand (with a peak load of 1,800 MW in 2016) must be covered by domestic generation. All scenarios include the following common elements for generation:

1) the currently used oil shale-based units with fluidized bed boilers are still in operation;
2) at least 200 MW of cogeneration units firing various fuels; and
3) some old units of oil shale pulverized combustion with desulphurization equipment.

Some quantitative indicators related to the GHG emissions are presented in Table 4.9.

Table 4.9. National Development Plan for Electricity sector until 2018

Indicator	Current level[1]	Target level
Share of renewable electricity in gross electricity use	1.5% (2007)	5.1% (2010) 15% (2015)
Share of oil shale-based electricity in gross electricity production	93.6% (2007)	<70% (2018)
Share of CHP electricity in gross electricity use	10.2% (2007)	20% (2020)
Electricity end-use	7,180 GWh (2007)	max 7,180 GWh (until 2015)
Household electricity use (per capita)	1,320 kWh (2007)	EU27 average (2018)
Losses in electricity transmission networks	3.0% (2007)	<3% (2015)
Losses in electricity distribution networks	7.8% (2007)	<6% (2015)
CO_2 emissions from electricity sector	15.7 Mt (2007)	5 Mt (2018)

[1] indicator level presented as current in Plan

Latest actual developments

The development of oil shale-based power production using environmentally sound technologies is an issue of growing importance in Estonia. In order to comply with the requirements of Directive 2001/80/EC the owner of the largest power plants, Eesti Energia AS, must reconstruct several units in the power plants of Narva Elektrijaamad AS (Narva Power Plants, including the Eesti and Balti plants). Until 2004 only the pulverized combustion technology of oil shale had been used in these power plants. Electricity generation based on such oil shale is characterized by low net average efficiency (27-29 per cent). This, together with the peculiarities of oil shale as a fuel, resulted in an extremely high specific emission of carbon dioxide per amount of electricity generated – approximately 1.2 t CO_2/MWh_e.

Therefore, the gradual replacement of oil shale pulverized combustion with circulating fluidized bed combustion (CFBC) method commenced. The higher combustion efficiency reduces fuel consumption, which in turn means substantially lower CO_2 emissions – approximately 0.9 t CO_2/MWh_e. The first two new units (both 215 MW) in Narva Elektrijaamad AS, one at the Eesti and the other at the Balti Power Plant, equipped with new CFBC boilers, were commissioned in 2004. The NDPES 2018 foresees the construction of two more CFBC units. In May 2012, the construction of a new 300 MW_e CFBC-based power plant began in Auvere. The owner – the state-owned Eesti Energia AS – plans to commission a new plant by the end of 2015.

Special attention has been paid to the promotion of renewable energy in producing electricity. In 2010 the Government approved a new *National Renewable Energy Action Plan until 2020* and its implementation plan for 2010-2013. According to RES Directive 2009/28/EC Estonia must increase the share of renewable energy sources in total energy consumption up to 25 per cent by 2020. The plan includes implemented and planned policies and measures to meet the target by 2020.

The primary measures to support energy generation from renewable resources are feed-in tariffs and investment support. Feed-in tariffs are also provided for efficient heat and power cogeneration (CHP) plants. The major sources of investment support are:

- the funds of EU structural assistance combined with Estonia's own budgetary sources; and
- GIS based on revenue from sales of surplus AAUs.

Electricity producers are eligible to receive operational support in the cases indicated in Table 4.10.

Table 4.10. Support for renewable or efficient CHP-based electricity production (2012)

Support rate	Electricity source
53.7 EUR/MWh	Renewable sources, except biomass
	Biomass, in cogeneration regime
32.0 EUR/MWh	Waste (as defined in Waste Act), peat or oil-shale processing retort gas, all only if in efficient cogeneration regime
	Generation capacity not exceeding 10 MW_e in efficient cogeneration regime

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 2012, the total sum of paid operational support was EUR 67,000,000, including EUR 62,800,000 for renewable-based electricity.

A rapid increase has taken place as a result of the wider deployment of wind energy, and during the last two to three years also due to firing biomass in new CHP plants and co-firing wood chips with oil shale in large power plants. In 2010, the installed capacity of wind generators reached 108 MW; by the end of 2011 it was already 184 MW, with electricity generation having increased by 32.5 per cent compared to 2010. In 2012, three new wind farms have been commissioned: two in Paldiski (both 25 MW) and one (39 MW) on the former ash field of Narva Power Plant.

As for biomass firing, three new privately owned efficient cogeneration plants have launched operations in recent years:

1) Tallinna Elektrijaam in Väo – 21 MW_e/49 MW_{th}, 2009;
2) Tartu Elektrijaam (AS Fortum Tartu) – 25 MW_e/50 MW_{th}, 2009; and
3) Pärnu Fortum Eesti AS plant – 24 MW_e/48 MW_{th}, 2010.

All three plants primarily use wood chips (but also wood waste and peat) as fuel. Also, several smaller cogeneration plants are planned or under construction. In addition to planned plants firing wood chips, there are four new CHP plants firing biogas under construction (see the section on heat production).

Regarding the use of oil shale in electricity production, it is proposed in the National Electricity Sector Development Plan until 2018 to increase the net efficiency of oil shale-based electricity generation up to 35 per cent, but at the same time to gradually reduce the share of oil shale electricity in the gross consumption of electricity. Also, it should be emphasized that Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) set out stricter limit emission values for SO_2, NO_x, CO and dust emitted by combustion plants. The Directive provides an exception for cases where the units will not be operated for more than 17,500 hours, starting from 1 January 2016 and ending on 31 December 2023 at the latest.

The opening up of the electricity market in Estonia may affect the development of generation capacities significantly – since 2009 the market has opened up by 35 per cent, and at the start of 2013 full opening was completed. Therefore, new possibilities to export and import electricity must be taken into account when analysing the impact of the energy sector on the environment.

In 2007, a direct current submarine cable line (EstLink) with an interconnection capacity of 350 MW between Estonia and Finland was commissioned. Significant changes in the electricity market in the Baltic States (e.g. the shut down of the Ignalina nuclear power plant in Lithuania) and the gradual opening of the market in Estonia have caused electricity export from Estonia to increase.

At present, the construction of the second direct current undersea cable (650 MW; EstLink 2) from Estonia to Finland is on-going and planned to be completed by 2014. This will triple the capacity of the connection between the electricity systems of Estonia and the Nordic countries.

Policies and measures in the electricity generation sector are presented in Table 4.11.

Table 4.11. Policies and measures in electricity generation sector

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)*			
							2015	2020	2025	2030
1	Improvement of efficiency of use of oil shale	To comply with the requirements of Directives 2001/80/EC and 88/609/EEC. Reduction of use of oil shale and atmospheric emissions. Reconstruction of two units in Narva Power Plants (2x215MW)	CO_2	Regulatory	expired	Eesti Energia AS	752.664	752.664	752.664	752.664
1	Improvement of efficiency of use of oil shale	To comply with the requirements of Directives 2001/80/EC and 88/609/EEC. Reduction of use of oil shale and atmospheric emissions. Reconstruction of two units in Narva Power Plants (2x215MW)	N_2O	Regulatory	expired	Eesti Energia AS	-8.052	-8.052	-8.052	-8.052
2	Improvement of efficiency of use of oil shale	To comply with the requirements of Directives 2001/80/EC and 88/609/EEC. Reduction of use of oil shale and atmospheric emissions. Reconstruction of one unit in Narva Power Plants (300MW)	CO_2	Regulatory	implemented	Eesti Energia AS	513.216	513.216	513.216	513.216
2	Improvement of efficiency of use of oil shale	To comply with the requirements of Directives 2001/80/EC and 88/609/EEC. Reduction of use of oil shale and atmospheric emissions. Reconstruction of one unit in Narva Power Plants (300MW)	N_2O	Regulatory	implemented	Eesti Energia AS	-5.491	-5.491	-5.491	-5.491
3	Transform energy supply structure towards renewable energy. 1. Feed-in tariff for renewable electricity production; 2. Investment support for inland wind parks	Increased electricity production from renewable resources	CO_2	Economic, Fiscal, Regulatory	implemented	Elering AS	815.572	815.572	815.572	815.572
4	Support for efficient cogeneration of heat and electricity	Increased energy production from renewable resources and promotion of cogeneration	CO_2	Economic, Fiscal, Regulatory	implemented	Elering AS	293.583	293.583	293.583	293.583
4	Support for efficient cogeneration of heat and electricity	Increased energy production from renewable resources and promotion of cogeneration	CH_4	Economic, Fiscal, Regulatory	implemented	Elering AS	-0.384	-0.384	-0.384	-0.384

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)*			
							2015	2020	2025	2030
4	Support for efficient cogeneration of heat and electricity	Increased energy production from renewable resources and promotion of cogeneration	N_2O	Economic, Fiscal, Regulatory	implemented	Elering AS	-0.751	-0.751	-0.751	-0.751

* Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.3.1. Heat production

Heat supply, particularly district heating, is the next important sector with significant potential for increasing energy efficiency, which in turn will result in lower GHG emissions. Combined with the deployment of renewable energy sources, biomass in particular, it should have an increasing role in mitigating the impact of heat supply on the environment in Estonia.

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

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

Energy efficiency and the use of renewable energy in small boiler plants and improvements to district heating networks are supported from the European Regional Development Fund (ERDF) as well as through the GIS. The support scheme was started in the framework of the *National Strategic Reference Framework 2007-2013* that combines EU structural assistance with Estonia's own budgetary funds (24.03.2009 Regulation No 14 of the Minister of Environment). The measures supporting wider use of renewables for energy production are targeted at the following activities:

- construction of small-scale combined heat and power plants; establishment or reconstruction of CHP plants with a total installed power capacity of more than 2 MW located outside the Estonian islands is not supported;

- fuel switching from fossil to renewable energy sources in existing boiler plants; establishment or reconstruction of DH boiler plants with a total installed capacity of more than 4 MW is not supported; and
- energy conservation through the improvement and reconstruction of DH networks, including expansion of DH networks.

Later, similar targets were set for support measures financed from the surplus AAUs sales in the framework of the GIS (30.08.2010 Regulation No 42 of the Minister of Environment).

21 projects have received EUR 9,560,000 in investment support from the ERDF, with an estimated reduction of 60,000 t of CO_2 annually. The supported projects include:

- construction of biogas-based CHP plants – 4 projects;
- switching boiler plants to renewable sources (wood chips) – 2 projects; and
- renovation of DH systems – 15 projects.

Since 2010 an additional financing source has been made available: in the framework of the GIS, financed from sales of AAUs, 41 projects in the field of heat (and partially also electricity) supply have received investment grants. The projects include the construction of six biomass-based CHP plants, the rest being renovations of DH networks.

An indirect measure of economic regulation targeted at the higher efficiency of DH systems also results in smaller emissions. In Estonia, the price of the heat sold to customers in DH systems must be approved by the Competition Authority (CA). The CA sets heat price ceilings (caps) for all companies rendering DH services, including boiler houses and CHP plants. The method of setting the ceiling includes the minimum technical requirements for the efficiency coefficient of boiler houses. Efficiency by fuel type must not be less than:

- 90 per cent (or 92 per cent for new plants[3]) in the case of natural gas;
- 85 per cent (90 per cent) in the case of liquid fuels; and
- 80 per cent (85 per cent) in the case of solid fuels.

Also, there is a ceiling for the level of heat losses in DH pipelines that can be included in the heat price as a cost item. The maximum level of losses accepted by the CA in the cost calculation is being reduced annually:

2012 – max. 20 per cent
2013 – max. 19 per cent
2014 – max. 18 per cent
2015 – max. 17 per cent
2016 – max. 16 per cent
2017 – max. 15 per cent

[3] New plants are those that are less than 10 years old.

In the framework of the RDP, investment support is provided for the production of bioenergy, including biogas collection equipment and biogas plants. In addition to the collection of methane, cogeneration plants running on bioenergy are being developed and therefore the use of fossil fuels as well as emission of GHG will decrease. Several biogas production plants are currently under construction.

Policies and measures in the heat generation sector are presented in Table 4.12.

Table 4.12. Policies and measures in heat generation sector

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)**			
							2015	2020	2025	2030
1	Energy efficiency and use of renewable energy in small boiler houses and improvement of district heating networks	Decrease in fossil fuel use, use of local fuels (biomass) and reduction in heat price	CO_2, CH_4, N_2O*	economic	implemented	Government, Owners	156.556	156.556	156.556	156.556

* Effect of the measure is not evaluated by GHGs. Only the total effect is available

** Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.3.2. Shale oil production

Shale oil production can be highlighted as a rapidly growing branch of industry. The quantities of oil shale used to produce other fuels have been growing year by year: in 2012, 4.71 Mt (50.0 PJ) of oil shale was processed and the production of shale oil was 599,000 t. There are three companies processing oil shale into oil, mainly fuel oil. Two technologies are used for the thermal processing of oil shale:

- gaseous heat carrier (Kiviter-type) technology; and
- solid heat carrier technology.

Due to the growing crude oil prices on the world market, the economic feasibility of shale oil production is improving and new facilities for thermal processing of oil shale will be commissioned in the near future. Eesti Energia AS is commissioning a new shale oil plant (solid heat carrier) known as Enefit-280 in Auvere. The plant will produce approximately 2,000,000 bbl (310,000 tons) of oil and 75,000,000 m^3 of retort gas per year. The oil plant is combined with an integrated 37.5 MW steam-driven turbine that uses residual heat to generate electricity to run the plant. The company has longer-term plans to establish two more Enefit280 shale oil plants and a post-processing plant to upgrade the oil produced. In 2014, VKG Oil AS plans to commission a new shale oil solid heat carrier plant (Petroter II) in Kohtla-Järve producing approximately 140,000 tons of shale oil per year. The company has planned to launch construction of Petroter III in 2013. The Kiviõli Oil Shale Processing & Chemical Plant is currently commissioning new Galoter-type technology (TSK-500). The Kiviõli Oil Shale & Chemical Plant additionally plans to build one more TSK-500 plant (with a production capacity of 500 tons of shale oil per day) and a TSK-3000 plant (with a production capacity of 3,000 tons of shale oil per day) by 2020.

4.3.4. Energy consumption – industry and industrial processes

The latest national-level document setting policy targets for energy performance in industry is the second Energy Efficiency Action Plan (NEEAP2) presented to the EC in September 2011. The Plan declares 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 electricity market was opened from 2009 to consumers of more than 2 GWh electricity per year), the renewable energy charge, fuel and electricity excise duties and reduced differences in excise duty rates. Therefore, NEEAP2 concludes that energy efficiency measures for industry must focus primarily on improving the skills and awareness of specialists. It is stated that these energy conservation measures must be implemented at the same time as other activities to improve the competitiveness of companies, and energy conservation policy must be based on the following principles:

- encouragement of the performance of energy audits in industrial plants and small enterprises;
- contribution to improving energy auditors' qualifications with respect to industrial energy conservation issues and fostering energy consultants' participation in EU projects related to energy conservation in industries;
- better financing opportunities for energy conservation measures in industries and small enterprises; and
- development of databases and methods of benchmarking companies' energy performance.

As for direct emissions of GHG from technological processes, in Estonian industry carbon dioxide is formed mainly in the processes of cement and lime manufacturing. Limestone decomposes when heated and carbon dioxide is emitted. There are two main companies operating in this sub-sector: Kunda Nordic Cement AS (Heidelberg Cement Northen Europe) and Rakke Plant (Nordkalk), both of which form part of large international industrial groups. These companies have been awarded the environmental standard ISO 14001 as well as the quality management standard ISO 9001 and publish environmental reports annually.

As early as 2008, both of these manufacturing branches had almost reached their maximum output levels. Further growth is now impossible, except by means of plant renovation and/or expansion. Some reduction in GHG emissions can be achieved, but only through the introduction of more up-to-date production technologies. For example, in Kunda Nordic Cement there is a preliminary projection plan to convert from a wet to a dry kiln system. This conversion would enable specific CO_2 emissions from the current 1,162 kg CO_2/t of clinker to be reduced to 760-770 kg CO_2/t. However, the plan is not feasible for the foreseeable future.

Since 2007 an amendment to the Integrated Pollution Prevention and Control Act has been in force with stricter requirements of integrated environmental permits for the use of the best available technique (BAT).

Also, specialized training for energy specialists in companies has been arranged. An *Intelligent Energy – Europe* project entitled *Training and Network of European Energy Managers (EUREM.NET)* was carried out from 2007-2009 in 12 EU Member States, including Estonia. The project extended the

successful experience of the previous EUREM project (2003-2005) in old Member States (Austria, Germany, Portugal and the United Kingdom) to several new EU members, adding country-specific features. Energy managers in industry are the main target group of the project.

Policies and measures in the industrial sector are presented in Table 4.13.

Table 4.13. Policies and measures in industrial sector

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)*			
							2015	2020	2025	2030
1	Energy efficiency in manufacturing industries and construction	Improve energy efficiency in the manufacturing industries and construction. Expected annual savings: 0.6 PJ of heat, 0.7 PJ of electricity and 0.9 PJ of fuels by 2016	CO_2	Economic, Education, Research	planned	Ministry of Economic Affairs and Communications	276.3	331.85	331.85	295.33
2	Energy efficiency in manufacturing industries and construction	Improve energy efficiency in the manufacturing industries and construction. Expected annual savings: 0.6 PJ of heat, 0.7 PJ of electricity and 0.9 PJ of fuels by 2016	CH_4	Economic, Education, Research	planned	Ministry of Economic Affairs and Communications	0.04	0.05	0.05	0.05
3	Energy efficiency in manufacturing industries and construction	Improve energy efficiency in the manufacturing industries and construction. Expected annual savings: 0.6 PJ of heat, 0.7 PJ of electricity and 0.9 PJ of fuels by 2016	N_2O	Economic, Education, Research	planned	Ministry of Economic Affairs and Communications	0.18	0.22	0.22	0.71

* Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.5. Energy consumption – residential, commercial and other sectors

The *Second National Energy Efficiency Action Plan* points out that according to Directive 2006/32/EC, the 2016 target for Estonia is to achieve 9.9 PJ savings as a result of the energy conservation measures implemented in the period from 2008-2016.

Residential sector

Regarding the residential sector, the key document of policy and measures is the *National Development Plan for Housing Sector 2008-2013*, approved by the Government. One of the main objectives of the Plan is targeted at improving the quality and sustainability of housing stock in Estonia.

The energy-saving effect of this Plan has not been ex-ante estimated. Nevertheless, target values (to be reached by 2013) are foreseen in the Plan for certain measures. The following are relevant to the energy performance of buildings:

- number of apartment buildings refurbished with support – 8,000;
- share of apartment building types with energy performance mapped – 95 per cent;
- energy audits carried out (of total number of buildings in target group) – 30 per cent; and
- share of apartment buildings with indicators of highest energy performance category – 10 per cent.

In May 2009 the Minister of Economic Affairs and Communications issued an order (No 137, 07.05.2009) adopting a new programme on loans for the renovation of apartment buildings. The programme is implemented by the state-owned foundation KredEx. The scheme and relevant procedures for long-term loans were developed in cooperation with the German development bank KfW Bankengruppe. The scheme allows banks to combine finances from the structural funds of the EU (financed from the European Regional Development Fund) and additional loans from the CEB (Council of Europe Development Bank) to issue more advantageous loans with a longer repayment period (of up to 20 years) to apartment buildings constructed before 1993. The aim of the renovation loan is to improve the energy efficiency of apartment buildings by at least 20 per cent in buildings with an area of up to 2000 m^2 and by at least 30 per cent in buildings with an area of more than 2000 m^2. Estonia was the first country to launch this type of reuse of EU structural funds. The KredEx support scheme is able to cover approximately 6-7 per cent of all apartment buildings. For example, in the framework of the scheme 167 loan contracts were entered into in 2011 in the sum of EUR 16,700,000, the total investment being EUR 23,200,000 (including own financing). The resulting average energy saving is estimated at 39.3 per cent. It was estimated that if this scheme continues, 15 per cent of apartment buildings will have been refurbished by 2020.

In 2010 a new financial opportunity arose with the successful sale of surplus AAUs (Kyoto Protocol, Article 17). In August 2010 the Minister of Economic Affairs and Communications issued Regulation No 52 (17.08.2010) 'Terms and Procedures of Using Green Investment Scheme *'Apartment Building Renovation Grants*". In September 2010 KredEx started issuing renovation grants in the amount of 15-35 per cent of the total cost of renovation projects. The total budget for renovation grants is EUR 28,000,000. The grant is first of all meant to accompany the renovation loan of KredEx to decrease the required share of self-financing, but the grant may also be combined with own funds of the applicant. The grant is financed from the sale of surplus AAUs to Luxembourg in the framework of the GIS. The grant limits are 15 per cent, 25 per cent and 35 per cent of the total project cost depending on the level of integration in the reconstruction of apartment buildings. To obtain a grant of 15 per cent, an apartment building must achieve an energy saving of at least 20 per cent in a building with a closed net area of 2,000 m^2 and at least 30 per cent in a building with a closed net area of over 2,000 m^2. By performing reconstruction work, the accordance of indoor climate to requirements must be ensured, and the apartment building must achieve energy label class E (i.e. annual specific energy consumption in the range of 201-250 kWh/m^2) as a minimum. To obtain a grant of 25 per cent, in addition to the fulfilment of the above terms, an apartment building must reconstruct its heating system so that it is locally adjustable, and mount devices that make it possible to divide and measure heating costs individually by apartment, partly or fully insulate and reconstruct the façade, replace all windows with energy-saving ones and insulate or/and reconstruct the roof, achieving an energy saving of at least 40 per cent, resulting in being eligible to be issued with energy label class D (151-

200 kWh/(m^2·a)). To obtain a grant of 35 per cent, in addition to the fulfilment of all of the above terms, the applicant must install a ventilation system with heat return, achieving an energy saving of at least 50 per cent on consumption of heating energy, and energy label class C (121-150 kWh/(m^2·a)) for the building.

By the end of 2011, 243 apartment buildings had received a positive decision from KredEx regarding the renovation grant in the framework of the GIS. The total amount of grants was EUR 6,710,000, while the estimated average energy savings were up to 40 per cent.

In 2012, a similar grant was made available for small private (single- or two-family) homes. The measure has a budget of EUR 4,000,000, including EUR 3,000,000 for thermal refurbishment and EUR 1,000,000 for the use of renewable energy sources (solar and wind) locally. The popularity of the grant demonstrated the demand for such measures – there were 254 applications (to a total of EUR 3,220,000) for refurbishment grants, 111 of which were awarded.

Public sector

The Government has gradually concentrated the development and management of state assets into one company: Riigi Kinnisvara AS (RKAS; State Real Estate Ltd), which was established in 2001 with the objective of guaranteeing the saving and effective provision of real estate services to the executors of state authority. RKAS creates preconditions for the state to operate on the real estate market as one entity and with a single objective – to guarantee the prudent and effective management of state assets. RKAS was issued with the ISO quality management certificate (9001) in 2007 and the environmental certificate (14001) in 2009.

In the framework of the GIS financed from the sale of surplus AAUs, the renovation of public buildings is also supported to increase energy efficiency. The renovation process is arranged by RKAS under the supervision of the Ministry of Finance. Applications were received from 201 of 226 municipalities for the renovation of 862 buildings:

- 63 per cent – schools and kindergartens;
- 26 per cent – cultural institutions;
- 7 per cent – social and health care establishments; and
- 4 per cent – other buildings.

The actual number of state- and municipally owned buildings currently being renovated is 490, with a total floor area of more than 1,100,000 m^2. The total renovation budget is approximately EUR 146,500,000, while the resulting CO_2 reduction is estimated to be *ca* 680 Gg over a 30-year period.

Regarding the possible exemplary role of the public sector in the use of energy in buildings, NEEAP2 sets a target to construct at least 10 publicly accessible nearly zero-energy buildings of various types with a total usable area of not less than 5,000 m^2 in Estonia by 2015. In early 2013, the guidelines for constructing nearly zero-energy buildings were developed by Tallinn University of Technology and RKAS.

Legal acts

In terms of improving the energy efficiency of buildings, EU Directive 2002/91/EC and its recast Directive 2010/31/EU on the energy performance of buildings have played important roles. The main provisions were and will be introduced in the *Building Act*. The objectives of the amendments already made were to introduce the energy auditing and labelling of buildings, to improve the energy performance of new and existing buildings and to provide users of buildings with easier access to information about the building's energy consumption and energy-saving measures.

Several detailed requirements have been enforced using acts of secondary legislation. The major secondary-level act is the Regulation of the Government on *Minimum Requirements for Energy Performance of Buildings* (No 258 of 20 December 2007). The Regulation provides detailed requirements for energy performance of buildings. In 2009 another regulation (No 194 of 30 December 2008) related to energy performance certificates entered into force providing a list of the types of buildings where the certificate must be placed in a prominent place that is clearly visible to the public.

Directive 2010/31/EU on energy performance of buildings requires Member States to develop and implement measures to reconstruct public buildings to become nearly zero-energy buildings. Minimum requirements for nearly zero-energy buildings are enforced with Regulation No 68 of the Government (30 August 2012).

Auditing of energy performance of buildings

The legal institution of the energy auditor plays an important role in the monitoring of the results of the thermal refurbishment of buildings. Regarding experts performing energy audits and/or issuing relevant certificates, the Building Act provides that only registered legal entities may issue an energy certificate or perform an energy audit on a building. The legal entities providing services of energy certification or energy auditing must fulfil following requirements:

- they should be in the register of economic activities;
- they should have a legal relationship (i.e. a contract) with a competent person, who is a specialist in charge; and
- they should keep records of issued energy audits and/or energy certificates and linked documents.

The Estonian Technical Surveillance Authority has the authority to carry out the quality control of energy audits and building energy certificates.

As for the training of experts, the MoEAC initiated a project entitled 'Development of energy audit practices' in 2007. The professional standards for energy auditors and energy certification specialists were established and a training programme developed as the standardized training course for energy auditors. Three professional levels of energy auditors were established:

- level IV – auditor for residential buildings;
- level V (diploma) – auditor for residential and public buildings; and
- level V (chartered) – auditor for all types of buildings (incl. industrial).

Public procurement

According to Directive 2006/32/EC, Member States must implement at least two measures to ensure energy efficiency and conservation via public procurements. Of these, Estonia has decided to implement the following measures:

1. requirements to purchase equipment and vehicles based on lists of energy-efficient product specifications of different categories of equipment and vehicles; and
2. requirements to use energy audits and implement the resulting cost-effective recommendations.

Dissemination of information

The programme for informing residents of the energy performance of buildings was approved by the Minister of Economic Affairs and Communications in Directive No 146 of 28 April 2008. The aim of the programme is to improve people's awareness of energy conservation and promote, through KredEx, intelligent energy conservation measures that ensure a good indoor climate in buildings, reduce pollution of the ambient air and increase energy savings in apartment buildings.

In particular, the residential sector has been the focus of several studies commissioned by the MoEAC. For example, in-depth studies were carried out by Tallinn University of Technology into the condition of the stock of residential houses. The main types of houses – concrete panel, brick and wooden – have been studied separately and options for their renovation analysed.

Energy efficiency information is disseminated by KredEx and a number of energy companies. The only institution especially targeted at energy efficiency is the Tartu Regional Energy Agency (*Tartu Regiooni Energiaagentuur*), which was established in 2009 as a regional energy agency to promote sustainable energy and energy management in the region.

Electrical appliances

In the *National Energy Efficiency Programme for 2007-2013* the target level for the share of A-label electric appliances sold on the Estonian market by 2013 was set at 75 per cent, the level in 2006 being approximately 50 per cent (estimate). The projected saving as a result of the increased effectiveness of electrical appliances will increase 10 per cent by 2020, which is estimated to lead to a potential saving of 0.5 PJ of electricity annually.

The wider use of heat pumps is gaining popularity in the country. The Heat Pump Association of Estonia has estimated that in the period from 1993-2010 around 47,500 heat pumps, including *ca* 41,500 air-sourced (air-to-air) heat pumps and *ca* 6,000 geothermal (ground-to-water) heat

pumps, have been installed in Estonia. The total installed capacity of heat pumps is approximately 275 MW (estimation of Heat Pump Association of Estonia).

Street lighting

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 total cost of the programme is estimated to be tens of millions of euros. Its goal is to provide high-quality, efficient street lighting. The expected energy saving is around 5 GWh per year.

Policies and measures in the residential, commercial and other sectors are presented in Table 4.14.

Table 4.14. Policies and measures in residential, commercial and other sectors

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)**			
							2015	2020	2025	2030
1	Energy efficiency in residential sector. Investment support and grants for energy-efficient renovation of residential buildings (apartment buildings and private homes)	Improve energy efficiency in residential sector	CO_2, CH_4, N_2O*	Economic	Implemented	KredEx	28.000	28.000	28.000	28.000
2	Promotion of use of energy-efficient electrical appliances	The increased efficiency of electrical appliances is expected to lead to annual savings of 0.5 PJ of electricity by 2020	CO_2	Regulatory, Information	Implemented	Government	102.500	152.736	151.929	151.120
2	Promotion of use of energy-efficient electrical appliances	The increased efficiency of electrical appliances is expected to lead to annual savings of 0.5 PJ of electricity by 2020	N_2O	Regulatory, Information	Implemented	Government	0.269	0.401	0.399	0.397
3	Grants for energy audits in residential buildings	Estimation and further improving of energy efficiency in private buildings	CO_2, CH_4, N_2O*	Economic, information	Implemented	Government	Included elsewhere	Included elsewhere	Included elsewhere	Included elsewhere
4	Energy efficiency improvement in public buildings. Investment support for energy-efficient renovation of public buildings	Improve energy efficiency in public buildings	CO_2, CH_4, N_2O*	Economic, Information	Implemented	Government	27.287	27.287	27.287	27.287

* Effect of the measure is not evaluated by GHGs. Only the total effect is available

** Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.6. Energy consumption – transport

The latest policy document setting targets for energy consumption in transport is the second Energy Efficiency Action Plan (NEEAP2) presented to the EC in September 2011. It states that in Estonia

the main energy conservation measure in the transport sector is the excise duty on motor fuel. Nevertheless, NEEAP2 presents 17 specific energy efficiency measures for implementation in the transport sector, as set out below.

- Sectoral legislative acts
  - Energy conservation criteria in public procurements, i.e. procurements for motor vehicles that take the entire service life of a vehicle into account: its energy efficiency, CO_2 and other emissions (since 2010)
  - Introduction of larger (60 m^3 instead of 40 m^3) trucks (planned)
  - Development of standard energy performance certificates for cars (planned)
- Financing and other support
  - GIS-based projects for the development of public transport (since 2009)
  - Pilot project for widespread introduction of electric cars (in the framework of GIS; since 2011)
- Tax policy
  - To offer EU support for the devising and introduction of technical solutions that contribute to the efficient use of infrastructure and to a reduction in CO_2 emissions (new pricing and taxation systems for the road network, intelligent transport systems and programmes to increase capacity) (planned)
  - Free parking for electric and sustainable cars (current measure)
- Provision of know-how
  - New study programme at Tallinn University of Technology: integrated transport management (current measure)
  - Eco-driving courses in driving schools (current measure)
- Research and development
  - To launch national programmes supporting the devising of sustainable transport technologies and development of new environmentally friendly technologies (e.g. engines and alternative fuels) where possible (planned)
  - Introduction of transport based on electricity, hydrogen and hybrid technology and increasing their share (planned)
- Awareness
  - Information campaigns to increase awareness of cars' impact on the environment and to promote public transport and non-motorised vehicles (current measure)
- Other measures
  - More efficient spatial planning: promotion and development of non-motorised vehicle traffic (development/construction of bike lanes/lanes in larger cities); development of sustainable transport, incl. priority development of public transport (planned)
  - Improvement of the railway network and development of a rail connection to Europe (Rail Baltica) in compliance with EU standards, allowing travel from Estonia to Western Europe by express train (planned)
  - Renewal of public transport rolling stock and transition to electricity-powered transport (the new residential districts of Tallinn must have an environmentally friendly connection with the city centre, by electric transport) (planned)

➢ To start using intelligent mobility systems, such as the European Intelligent Transport System (ITS), new-generation systems to arrange multimodal transport and information exchange (planned)

Taxation

The rates of excise taxes on fuels have been raised in several cases during the past few years. This has been done, among other reasons, with the objective of affecting the fuel demand of transport and making it more environmentally sustainable. The current rates are presented in section 4.3.1.2. The Government has increased fuel excise duties faster than stipulated in EU directives. According to Directive 2003/96/ EC, the minimum rates of fuel excise duty were to be reached by the beginning of 2010 in Estonia, but the Government decided to raise the excise duties to the EU minimum level at the start of 2008.

The *Heavy Goods Vehicles Tax Act* establishes tax rates for heavy goods vehicles. The rates are differentiated according to the number of axles, maximum weight and type of suspension of driving axle. At present, the quarterly paid rates for trucks (lorries) range from EUR 7.90 to EUR 134.40 and for road trains (a truck with a trailer) from EUR 3.50 to EUR 133.80.

Biofuels in transport

Regarding the use of biofuels in transport, the EU has set common objectives for the share of biofuels in the consumption of all motor fuels: 5.75 per cent by 2010 and 10 per cent by 2020. In Estonia, the corresponding share was 0.2 per cent in 2010. To promote the growth of biofuel use in transport, the amendment (made in 2005) to the *Alcohol, Tobacco, Fuel and Electricity Excise Duty Act* provides that if biofuel has been added to motor fuel, the portion of biofuel contained in the motor fuel is exempt from excise duty. This provision, considered as state aid, needed approval from the EC. In July 2005, the EC authorized Estonia to exempt from excise duty non-synthetic biodiesel, vegetable oils made from biomass and bioethanol made of agriculture products or plant products. The exemption remained in force until June 2011 and was not extended. This measure had no effect on the use of biofuels in transport.

The new *National Energy Sector Development Plan until 2020* declares that Estonia considers targets concerning biofuels binding only if the use of second generation biofuels is economically feasible and fully sustainable. Some specific measures are foreseen in the *National Renewable Energy Action Plan* to reach the 10 per cent renewables target in the transport sector:

- stipulating a 5-7 per cent mixed fuel requirement for liquid fuels. Relevant amendments to legal acts are planned for proposal. The estimated increase of the share of biofuels in transport is up to 5 per cent by 2015;
- the transfer of public transport to renewable energy. A financing plan and conditions for implementation will be prepared by 2013. The expected increase of the share of biofuels is 2 per cent by 2020; and

- as a result of technology development, the share of vehicles using alternative fuels (other than biodiesel and bioethanol) is also estimated to increase. The estimated share by 2020 is 1 per cent of total use of fuels in transport.

National transport development programme

In January 2007, the Parliament approved the *Transport Development Plan for 2006-2013*, which includes at least three measures aimed at making transport more environmentally friendly:

- developing the traffic management and coordination system;
- enhancing the competitiveness of public transport; and
- promoting light traffic.

There are certain differences between the goals set in the EU sustainable development strategy and the target set in the *Transport Development Plan 2006-2013*. While the EU strategy establishes a goal for the average CO_2 emission level of passenger cars (120 g/km by 2012), the Estonian plan sets a similar goal for a 30 per cent share of new cars.

The new *Transport Development Plan 2014-2020* is under development.

Public transport

Currently, public transport subsidies are used to compensate up to 60 per cent of the costs connected with providing public transport services on local bus lines. Compensation payments are paid in accordance with Regulation No 1370/2007 of the European Parliament and of the Council. However, the compensation mechanism has not motivated public transport service providers to make sufficient investments in rolling stock. Therefore a measure through the GIS (financed from the sale of surplus AAUs) was introduced which is based on the principle that new buses are rented to a public transport service provider. In 2010 EUR 21,000,000 was invested in energy-efficient and environmentally friendly buses (approximately 100 buses) for the public transport system – the Estonian Road Administration purchased new environmentally friendly buses that were provided for the use of public transport service providers only for the duration of the public service contract. The new buses can use gas (including biogas) as their fuel. In the City of Tartu, the first five buses using natural gas were introduced in 2012. All of the new buses exceed the requirements of the European emission standard for motor vehicles EURO5.

In May 2011, a considerable investment in the framework of the GIS in public transport was made. The sum of EUR 45,000,000 (from surplus AAU sales revenue) was used for energy-efficient and environmentally benign trams for the City of Tallinn. The trams must use electricity generated from renewable energy sources. Currently, the average age of the trams in Tallinn is 25 years. AAU-based investment enables the purchasing of 15-16 modern trams that will be used on a 16 km route from 2014.

Since 1 January 2013, the use of public transport of the capital city Tallinn is free of charge for persons who are registered in Tallinn. There has been a couple of studies made on how the free public transport has influenced the number of its users. However, since these studies are based on the data of few months and the results differ significantly, then no fundamental conclusions cannot be made.

Electric mobility programme

Estonia has set itself the goal of achieving a 10 per cent share of renewable energy use in the transport sector by 2020. To reach this target the wider introduction of biofuels is needed, but there is another development option that supports reaching this target as well – the use of electricity in transport if the electricity is generated using renewable sources. This option is possible as the generation of renewable electricity in Estonia has increased rapidly in recent years: from 110.8 GWh in 2005 to 1,046 GWh in 2010.

In March 2011 the Government decided to launch the *Electric Mobility Programme* (EMP) for Estonia combining the extensive introduction of electric vehicles with financing available from the sales of surplus AAUs via the GiS in the amount of 10 million AAUs. The EMP includes three parts:

- the Ministry of Social Affairs adopting 507 electric cars (Mitsubishi model i-MiEV) as a pilot project;
- the MoEAC developing a grant scheme to support the acquisition of electric cars by individuals (up to 500 cars); and
- recharging infrastructure for electric cars covering the entry country is built.

Both the grant scheme and the building of infrastructure are administered by KredEx. The support measure for the acquisition of electric cars is available to accelerate the introduction of electric cars in Estonia. Acquisition and the financial/operational leasing of electrical vehicles by individuals are supported within the framework of the support measure. The grant scheme will enable up to 500 Estonians to acquire an electric car. Their choice must be made from among those electric cars that have obtained EU type approval. Grants are awarded to new cars that are fully electric vehicles or plug-in hybrids. The maximum grant rate for electric vehicles is EUR 18,000, although the grant will not exceed 50 per cent of the acquisition price of the car or EUR 1,000 per 1 kWh of battery capacity, whichever is the lower of the two.

In order to guarantee the full environmental effect of the programme, including the reduction of GHG emissions related to conventional fossil energy sources, all owners of electric vehicles must only consume electricity generated from renewable energy sources through a 'guarantee of origin' scheme. It is estimated that owners of electric cars will each use 1-2 MWh of electricity per year.

International bunkers

There are currently no emission limits on international bunkers (aviation and shipping). Such limits have regularly been on the agenda of the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO), but no decisions have been made.

A global agreement reached by the 37th Session of the ICAO Assembly in October 2010 established a new benchmark for ICAO's objective relative on aviation and climate change. It provided a roadmap for action through 2050 for the 190 Member States of the Organization and invited them to voluntarily submit their/national action plans to reduce CO2 emissions from international civil aviation to ICAO by June 2012. Estonia did not submit their action plan.

The EU decided to include aviation in the EU ETS from 2012. All aircraft taking off and/or landing in the EU are included in the trading.

IMO's Marine Environment Protection Committee (MEPC) has given extensive consideration to control of GHG emissions from ships and finalized in July 2009 a package of specific technical and operational reduction measures. In March 2010 MEPC started the consideration of making the technical and operational measures mandatory for all ships irrespective of flag and ownership. This work was completed in July 2011 with the breakthrough adoption of technical measures for new ships and operational reduction measures for all ships, which are, consequently, the first ever mandatory global GHG reduction regime for an entire industry sector. The adopted measures add to MARPOL Annex VI a new Chapter 4 entitled 'Regulations on energy efficiency for ships' , making mandatory the Energy Efficiency Design Index (EEDI) for new ships and the Ship Energy Efficiency Plan (SEEMP) for all ships. The regulations apply to all ships over 400 gross tonnage and above and were entered into force through the tacit acceptance procedure on 1 January 2013.

In June 2013, the European Commission set out a strategy to progressively integrate maritime emissions into the EU's policy for reducing its domestic greenhouse gas emissions. This has yet to be approved by the European Parliament and Council.

Policies and measures in the transport sector are presented in Table 4.15.

Table 4.15. Policies and measures in transport sector

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)**			
							2015	2020	2025	2030
1	Introduction of regulation regarding use of biofuels	To achieve 10 per cent of transport fuels from renewable resources by 2020	CO_2	Regulatory	Planned	Government	110.429	235.42	251.132	267.854
2	Promotion of public transport: 1) Subsidies for public transport; 2) Investments in rolling stock	Promotion of use of public transport	CO_2, CH_4, N_2O*	Economic	Implemented	Government	21.370	21.370	18.310	18.310

* Effect of the measure is not evaluated by GHGs. Only the total effect is available

** Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.7. Fluorinated gases

In Estonia, the use of F-gases has been growing in recent years. The main reason for that is the increasing use of F-gases (mainly HFC) as substitutes for ozone-depleting substances. In terms of international multilateral agreements on ozone-depleting substances, Estonia ratified the *Vienna Convention for the Protection of the Ozone Layer* and *Montreal Protocol on the Substances that Deplete the Ozone Layer* in 1996. The *National Programme for Phasing out Ozone-Depleting Substances* was approved by the Government in 1999. From 2000 the programme was co-financed from the Global Environmental Facility (GEF) and it was successfully completed in 2005.

There has been some delay in the full harmonisation of national legislation with EU provisions related to F-gases in Estonia. Nevertheless, in July 2012, a voluminous set of amendments to the *Ambient Air Act* related to F-gases was approved by the Parliament. In addition to tens of detailed amendments in many articles, a completely new section (section 4 in Chapter 7 of the Act) regulating issues relevant to F-gases was added. These amendments, together with the relevant secondary-level acts, formed the basis and infrastructure for the full implementation of the major requirements of all related EU acts covering:

- training, certification and attestation systems;
- containment provisions;
- proper recovery of F-gases;
- labelling requirements;
- reporting obligations; and
- bans and penalties.

With regard to information dissemination, there have been international projects in which Estonia has been involved. For example, there was a project entitled *REAL Skills Europe* in the framework of the European Commission's Lifelong Learning Programme in which the achievements of a UK programme developed in 2009 to achieve reductions in refrigerant leakage through improved awareness, education and training were introduced in several countries. The Ozone/F-gases Unit (*Osoonibüroo*) of the Estonian Environmental Research Centre *(Eesti Keskkonnauuringute Keskus OÜ*; EERC) was the participant institution from Estonia.

No quantitative assessments have been made on measures regarding F-gases.

4.3.8. Agriculture

The use of environmentally friendly methods in agriculture is encouraged in the *Rural Development Plan 2007-2013* (RDP), which is the implementation document of the *Rural Strategy 2007-2013*. The RDP was prepared in order to support the regionally balanced development of rural areas through EU Common Agricultural Policy (CAP) measures.

In September 2011, a special commission was established to launch preparations for the drafting of the rural development plan for the period 2014-2020 (Order of Minister of Agriculture No 117, 13.09.2011).

In terms of impact on the environment, organic farming can play an essential role. In Estonia, the development of organic farming began in 1989 when the Estonian Biodynamic Association was founded. The Association adopted the standards of IFOAM (the International Federation of Organic Agriculture Movements) to develop the first Estonian organic agriculture standards, started using the 'ÖKO' trademark and also introduced a control system over producers. In 1997, the *Organic Farming Act* came into force and the Centre for Ecological Engineering started actively organising educational events, published informational brochures and launched several development projects. Information about organic farming was made available from many sources.

Officially, organic farming as an environmentally friendly form of agricultural production has been supported since 2000. It was during that year that the Estonian Organic Farming Foundation was created, and it has been very active in developing organic farming ever since. The Agro-Environment Bureau was founded by the Ministry of Agriculture in 2000. In 2007, the *Organic Farming Development Action Plan 2007-2013* and the relevant action plan were approved by the Minister of Agriculture.

Operational support for organic farming has been paid out yearly since 2000. When Estonia joined the EU in 2004, the basis for the distribution of support money became the agro-environment support provided in the RDP. 80 per cent of the support money is covered by EU funds and 20 per cent by the Estonian Government. By applying for support the applicant assumes the duty of pursuing organic farming for at least five years. In 2011, the rates of support payments for organic production were as follows:

- cereals, legumes, oil and fibre crops, potatoes and fodder roots; black fallow; grassland used as cover crop for up to two years; grass seed field – 119.20 EUR/ha annually;
- open area vegetables, medicinal herbs and aromatic herbs, fruit crops and berries – 349.60 EUR/ha annually; and
- in the case of grasslands (except where the grassland is used for up to two years as cover crop and grass seed field) if at least 0.2 livestock units are kept per hectare of organically kept animals – 76.69 EUR/ha annually.

The *Organic Farming Development Plan 2007-2013* sets the objective of increasing the organically farmed area from 72,800 ha to 120,000 ha; the number of organic producers from 1,173 to 2,000; the number of enterprises processing organic products from 14 to 75; and the share of Estonian organic products on the market of foodstuffs from 0.15 per cent to 3 per cent by the end of 2013. In fact, the area of land used for organic production has grown rapidly since 2000. In 2011, a total of 134,100 hectares of agricultural land was in organic use by 1,431 farms, equating to 14 per cent of total agricultural land. Organic production has increased rapidly, one of the reasons being the financial support provided per organic hectare since 2000. However, developments in organic processing and marketing have been modest. In 2011, the organic farming register had a total of 127 organic food processors and traders.

Regarding organic animal husbandry, nearly two-thirds of organic farmers (899) in Estonia raise animals. Foremost are organically raised sheep (46,496 in 2011) and cattle (28,701 in 2011).

Organic products are labelled with the EU organic logo, which has been compulsory on pre-packaged products since 1 July 2011. In addition, the Estonian organic logo can be used. Labelled products must originate from organic land or organic animals. In processed products at least 95 per cent of ingredients of agricultural origin by weight must be organic and the only non-organic ingredients used must be listed in Regulation (EC) No 889/2008 Annex IX.

Policies and measures in the agriculture sector are presented in Table 4.16.

Table 4.16. Policies and measures in Agriculture sector

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)*			
							2015	2020	2025	2030
1	Modernisation of agricultural holdings. Investments in production of bioenergy	Maintenance of the environment; maintenance of landscapes; supply certainty of raw materials for energy production; diversity of energy sources; distributed energy production	CH_4	Economic	Implemented	Government	127.985	127.985	127.985	127.985
2	Support for organic farming	Maintaining and increasing biological and landscape diversity and to maintain and improve soil fertility and water quality	N_2O	Economic	Implemented	Government	100.900	128.766	57.33	57.33

* Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.9. Waste

In 2008, a strategy document entitled *National Waste Management Plan 2008-2013* was endorsed by the Government. According to the plan, the closure of non-conforming landfills is supported. In addition, the establishment of regional landfills and other regional waste handling facilities, including incineration plants and facilities for the treatment of biological waste (e.g. for use in composting fields) that comply with the designated requirements, is promoted by the Government. Among other things, it plans to set up a waste handling system for biodegradable waste and to improve the options for sorting waste in its place of generation. According to the *Waste Act*, all landfills had to meet EU requirements by 16 July 2009. Landfills closed for waste deposit by this date had to be conditioned in accordance with the requirements by 16 July 2013.

In May 2012, the Minister of the Environment initiated the preparation of the *National Waste Management Plan* for the period 2014-2020.

General waste-related requirements and rules are provided by the Waste Act. Rules on municipal waste planning, producer responsibility and tax on landfilling of waste and prohibition of mixed waste are expected to lead to a reduction in waste generation and recycling. The objective regarding the share of waste recycled by 2020 is 50 per cent so as to meet the requirements of Directive 2009/98/EC.

In 2004 and 2005, research was carried out to investigate the amount of landfilled biodegradable waste and to increase the share of biodegradable waste recycling. In 2007, the *Action Plan for Biodegradable Waste 2008-2013* was compiled for the handling of such waste, offering opportunities to attain the objectives of sustainable waste management in handling biodegradable waste, and also providing suitable solutions for each county.

Prohibition concerning the percentage of biodegradable waste deposited is stipulated in the Waste Act. 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 16 July 2020.

In 2010, 11.7 million tonnes of waste was deposited in 15 landfills (with 59.6 per cent of all waste being landfilled). To initiate the process of using waste as a source of energy, the development of incineration technologies and combined heat and power production from landfill gas emitted from closed landfills has begun. General requirements for the construction, operation and closing down of waste management facilities design for waste disposal are provided by a Regulation of the Minister of the Environment (No 38, 29.04.2004). This includes requirements with regard to establishing methane collection, recycling and disposal systems. The provisions for waste incineration plants are stipulated in a Regulation of the Minister of the Environment (No 66, 04.06.2004).

Regarding energy use of waste in Estonia, there are some small-scale CHP plants utilizing landfill gas in Tallinn (two plants), Jõelähtme (Harju County), Väätsa (Järva County) and Rääma (Pärnu County). Feasibility studies for the construction of more plants have been carried out.

In 2008, the first mechanical biological treatment (MBT) plant processing waste in the Baltic States was commissioned at the Sillamäe landfill combining sorting with biological treatment (composting). As a result, waste which is not suitable for recycling is separated, recyclable materials are extracted and the rest is utilized to produce fuel (solid recovered fuel – SRF; also refuse-derived fuel – RDF). At present, there are two more plants that use MBT technology for waste-processing to produce SRF, but mixed municipal waste has not yet been used for direct energy production. In Tallinn a new energy unit burning municipal waste is under construction combined with the existing Iru CHP plant (owned by Eesti Energia AS) supplying heat to the DH system of the City of Tallinn. The new energy unit (17 MW_e / 50 MW_{th}) in Iru was put in work in 2013. The unit can incinerate up to 220,000 tons of mixed municipal waste per year, converting around 85 per cent of the energy in

waste into electricity and heat. It is estimated that the biodegradable content of the mixed municipal waste to be used at the Iru Power Plant is around 60 per cent by weight.

As to the promotion of sustainable waste management, over the last few years numerous projects have received investment support from national and international sources. As a rule, the support that has been granted has been administered by the Environment Investment Centre (EIC). For example, in 2011 a total of EUR 27,150,000 in grants was paid out to 42 waste-related projects (see Table 4.17).

Table 4.17. Payments for waste management projects in 2011

Subprogram	Number of projects	Payments, MEUR
Closure and redevelopment of non-conforming oil-shale industry landfills (CF*)	2	12.71
Closure of non-conforming non-hazardous waste landfills (CF)	15	8.74
Management and development of waste collection, sorting and recycling (CF)	18	4.42
Extension of landfill areas of waste treatment centres with landfill areas (CF)	1	0.85
Non-hazardous waste management (CF)	10	0.30
Non-hazardous waste management (CF)	6	0.14
Total	42	27.15

* CF – projects financed from EU Cohesion Fund

In 2011, four landfill closure projects were completed with the help of the EU Cohesion Fund measure, the most relevant and extensive being the Rääma landfill in Pärnu. At the end of 2011 there were still three landfill closure projects in the processing phase in EIC.

The adaptation or closure of landfill sites that contain waste from the oil shale industry and oil shale-fired power plants that did not comply with environmental requirements helps reduce the load on the environment caused by energy production. Such landfills include the oil shale semi-coke landfills of Kiviõli and Kohtla-Järve and the ash landfills near Narva.

Policies and measures in the waste sector are presented in Table 4.18.

Table 4.18. Policies and measures in waste sector

No	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact by gas (Gg CO_2 eq)*			
							2015	2020	2025	2030
1	Prohibition concerning percentage of biodegradable waste deposited	The percentage of biodegradable waste in the total amount by weight of municipal waste deposited in a landfill shall not exceed: 1) 45 per cent by 16 July 2010; 2) 30 per cent by 16 July 2013; and 3) 20 per cent by 16 July 2020	CH_4	Regulatory	Implemented	Government	85.092	144.975	140.07	134.396

* Estimate of mitigation impact by gas (Gg CO2 equivalent)" - Effects of PaMS for the years 1990, 1995, 2000 and 2005 are not estimated and therefore not presented in table

4.3.10. Land use, land use change and forestry (LULUCF)

In light of climate change mitigation, it is important to preserve and protect areas that have high carbon sequestration capacity: forests, wetlands, peatland and grasslands. It is also important to promote carbon sequestration through sustainable forest management, reforestation and afforestation and the improvement of cropland management practices and to resume supportive activities like mowing and grazing in order to preserve the natural state of meadows and semi-natural grasslands.

In Estonia, there are currently no policies targeted directly at reducing greenhouse gases in the LULUCF sector, but there are cross-cutting strategies as well as land use-specific acts that comprise different issues under the LULUCF sector, e.g. promoting the use of wood as a renewable material and energy source to other materials and non-renewable sources with higher greenhouse gas emissions in the framework of Development Plan 2007-2013 for Enhancing the Use of Biomass and Bioenergy. Since half of Estonian's territory is covered with forest, of which 10 per cent is strictly protected, forestry is of great importance to the Estonian economy and environment. Therefore, forest policies have a major effect on the development of the LULUCF sector as a whole.

Policies and measures implemented

The Forest Act[4] provides the legal framework for the management of forests in Estonia. The main objective of this is to ensure the protection and sustainable management of forests as an ecosystem. The Act provides legal basis for forest surveys, planning and management. Among other sustainable forest management practices, the Forest Act regulates the implementation of forest regeneration and requires forest owners to apply the reforestation methods specified in the Act in order to ensure the regeneration of forests no later than five years after the occurrence of final felling or natural disturbances.

According to the Forest Act and the Sustainable Development Act, a forestry development plan is to be drafted every ten years. The Estonian Forestry Development Programme until 2020[5], 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 to achieve them for the period 2011-2020. The main objective of the development plan is to ensure productivity and viability and 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, cleaning and thinning. In Table 4.19 the main indicators and target levels are presented for the current situation and for 2020.

[4] https://www.riigiteataja.ee/akt/MS
[5] https://www.riigiteataja.ee/.../Eesti_ per cent20metsanduse_arengukava.pdf

Table 4.19. Indicators and target levels of forest management

Indicator	Baseline level	Target level
Growing stock	442 Mm^3 (2008)	450 Mm^3
Annual increment	12.1 Mm^3 (2008)	12.5 Mm^3
Annual volume and area of regeneration felling	22,400 ha/y (2000-2008)	34,500 ha
Annual area of cleaning	22,200 ha (2009)	32,400 ha
Annual area of thinning	14,200 ha (2007)	34,500 ha
Woody biomass used in energy production	22 PJ (2009)	30 PJ/yr

National timber production is dependent on the existence of mature stands, the forest market situation, demand for renewable sources in energy production, taxes, subsidies and other factors that all have a complex impact on harvesting intensity. Taking into account these factors, primarily the availability of wood resources in mature stands, several scenarios were constructed for possible harvest rates until 2040. Optimal and maximum sustainable harvest rates under a moderate scenario are highlighted in the current forestry development programme as the two most likely estimates used in future forestry development plans. The optimal and maximum sustainable harvest rates are 12.670 million m^3 and 15.826 million m^3 per year respectively. The general goal is to promote and increase the use of wood as a renewable material and energy source instead of non-renewable materials and resources with higher GHG emissions.

The Estonian Forestry Development Programme is supported by the Estonian Rural Development Plan 2007-2013[6] (ERDP), which funds measures designed for private forest owners, who hold a share of 45 per cent of all forests in Estonia (NFI 2010). The ERDP was prepared in order to support regionally balanced development of rural areas through the European Union Common Agricultural Policy measures. The overall objective of the ERDP is to improve the competitiveness of the agricultural and forestry sector as well as to improve the environment and countryside. Under measure 1.5 'Improving the economic value of forests and adding value to forestry products' there are activities directed at the improvement of the economic value of forest, at the restoration of forests damaged in natural disasters or forest fires and at the prevention of fires to ensure the sustainable and efficient management of private forest and to protect the function of forests. The target of the measure is to restore 3,500 ha of forest damaged by natural disturbances or fires and the additional creation of 7,000 ha of forest area with measures for the prevention of forest fires.

Analysis of the additional CO_2 sequestered through the implementation of these measures under the Rural Development Plan has not been carried out.

The Estonian Earth's Crust Act[7] entered into force in 2005 and stipulates that the owner of an extraction permit is obliged to restore the land disturbed by mining.

Planned policies and measures

The **Estonian Rural Development Plan 2014-2020**[8] is currently under development. Under priority No 5: Resource-saving and environmental-friendly economy, one of the objectives

[6] http://www.agri.ee/public/juurkataloog/MAK/RDP_2007-2013.pdf
[7] https://www.riigiteataja.ee/akt/1011618

is promoting CO_2 uptake in agriculture and forest sectors. Detailed targets and activities to achieve the targets have not yet been determined.

4.3.11. Effect of policies and measures on the modification of long-term GHG trends

As stated in Chapter 4.1.1, Estonia reached its Kyoto target already in the beginnings of 1990, after major restructuration of economy. In the National Inventory Report 2013 of Estonia, the GHG emissions had decreased about 48 per cent by 2011, compared to 1990. Therefore Estonia had no specific need for policies and measures reducing GHG emissions to reach its Kyoto target. However, after joining EU in 2004, significant efforts have been made GHG mitigation policies and measures.

The share of renewable energy resources in final consumption of energy has increased from 18.4 per cent in 2004 to 25.9 per cent in 2012. The CO_2 intensity of GDP has decreased from 2.30 t CO_2/MEUR in 1998 to 1.56 tCO_2/MEUR in 2013. This indicates, that policies and measures have had a sizeable impact on GHG trends.

The Measures that have the most significant impact on affecting GHG emissions are mainly in energy sector (i.e. improvement of the efficiency of the use of oil shale and transform energy supply structure towards renewable energy).

4.4. Policies and measures no longer in place

During the reporting period most of the policies and measures from the previous period were continued without major changes. Nevertheless, some documents and measures expired due to the arrival of target dates. As a rule, these policy documents were replaced with the new versions, which generally carry on the same policy and apply similar measures. A brief overview of some major documents expired and replaced during the reporting period is given below.

The *National Programme of Greenhouse Gas Emission Reduction for 2003-2012* (approved by the Government in April 2004) has been expired. This programme was the only programme where reaching the Kyoto target was set as a main objective.

In June 2011, *The second energy efficiency action plan of Estonia* was drawn up on the basis of European Parliament and Council Directive 2006/32/EC. The first one was submitted in November 2007.

The Estonian Forestry Development Plan until 2010 (approved by Parliament in 2002) has been replaced with *The Estonian Forestry Development Plan until 2020* that was endorsed by the Parliament in February 2011.

[8] http://www.agri.ee/public/juurkataloog/MAAELU/MAK_20142020/prioriteedid/Prioriteet_5_ressursisaast_01.05.2012.pdf

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V

PROJECTIONS AND TOTAL EFFECT OF POLICIES AND MEASURES, AND SUPPLEMENTARITY RELATING TO KYOTO PROTOCOL MECHANISMS

5.1. Introduction

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; solvent and other product use; agriculture; waste; and LULUCF. Projections of GHG emissions have been calculated for the period from 2010-2030. 2010 has been used as a reference year (historical data).

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 projections in current National Communication are updated, compared to the previous National Communication (NC5). 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 in assumptions between the current NC and the previous NC are presented in Chapter 5.2.1.

Since the latest projections were compiled at the beginning of 2013, then no official data existed for 2011. Therefore the starting point of projections in current NC for all scenarios is 2010, not 2011.

5.2. Methodology

Projections in the energy sector are calculated using LEAP (the Long-range Energy Alternatives Planning system), which was developed at the Stockholm Environment Institute. LEAP is an integrated modelling tool that 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.

The modelling with LEAP enables to create a whole energy system. Therefore some of the measures, that are implemented in one sector, but actually affect the GHG emissions in another sector are correctly taken into account. (e.g. energy savings in residential sector, that are using district heating).

The projections in NC5 were compiled using NEEDS model. This energy development model is elaborated in the framework of the Sixth Framework Program within the project 'New Energy Externalities Development for Sustainability (NEEDS)'.

The estimated final consumption of fuels in future years is based on the projections of the Ministry of Economic Affairs and Communications presented in the National Renewable Energy Action Plan (NREAP) of Estonia (corrected with updated GDP assumptions and updated historical data). Consumption of electricity (including losses) is projected according to the report compiled by the transmission network operator of Estonia AS Elering (*Varustuskindluse aruanne 2012*). Consumption of heat (including losses) is projected according to the report compiled by the Estonian Renewable Energy Association and the Estonian Council of Environmental NGOs (*Renewable Energy 100*).

Consumption of fuels for electricity, heat and shale oil production is calculated by LEAP. The calculations take current legislation and future investment plans for this sector into account.

Projections in the industrial processes sector are based on data received from companies that are included in the industrial processes sector. Emission projections from the consumption of halocarbons and SF_6 are based on expert judgement.

Projections in the solvent and other product use sector are calculated based on historical data (2005-2010) and are also based on the projection of the population.

Projections in the agriculture sector are based on information received from the Ministry of Agriculture and also expert judgements.

Projections in LULUCF are calculated using land use data from 1990-2010 and emissions reported in the *National Inventory Report 2012* and CRF tables. Projections of CO_2 are calculated as an average of linear forecasts over the time series 1990-2010 and 2004-2010. The main reason for using the second forecast in calculations is 2004 was the starting point for the current trend of all relevant factors - both the intensive felling period and the afforestation of agricultural areas stopped at this time. Projections of CH_4 and N_2O are calculated as a linear forecast over the entire time series 1990-2010.

Projections in the waste sector are based on the National Waste Management Plan for 2008-2013 and on expert judgements.

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

Table 5.1. Main assumptions used in the projections

	Historic	Projected			
	2010	2015	2020	2025	2030
GDP growth, %	2.3	3.5	2.3	2.1	2.3
Population, thousand people	1,340.1	1,332.4	1,328.3	1,315.9	1,296.4
International coal import prices, €(2010)/boe		22	22.6	23.7	24
International oil import prices, €(2010)/boe		86	88.5	89.2	93.1

	Historic	Projected			
	2010	2015	2020	2025	2030
International gas import prices, €(2010)/boe		53.8	61.5	58.9	64.5
Oil shale mining limit, Mt	20	20	20	20	20
Net electricity import, GWh	-3,570	-871	1,485	3,300	5,358
Number of total cattle, thousand heads	236.3	236.9	273.7	241	241
Number of sheep, thousand heads	78.6	80	82	84	86
Number of swine, thousand heads	371.7	360.4	351.9	360	365
Number of poultry, thousand heads	2,046.4	2046	2,046	2,046	2,046
Municipal solid waste generation, kt	304.6	334.9	354.3	373.3	395.2
Area of managed forest, 1000 hectares	2,253.5	2,252.3	2,251.1	2,249.9	2,248.8

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 the 'Quality assurance procedure for the reporting of policies and measures by Member States under Decision 280/2004/EC').

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 5.3.4.

The total effect of PaMs is calculated as the sum of all PaMs (See Chapter 5.4).

5.2.1. Comparison of projections between previous and current NC

In NC5, the projections on the GHG emissions of Estonia were compiled by Tallinn University of Technology using the energy supply development model NEEDS (or NEEDS/TIMES). These projections had 2006 as a base year and were made up to 2020. Some of the main assumptions and results of the previous and current NC projections are presented in Table 5.2.

Table 5.2. Comparison of projections between previous and current NC

	2010	2015	2020	2025	2030
NC5 Population growth rates, %	-0.20	-0.10	-0.20	-0.30	-0.10
NC6 Population growth rates, %	-0.14	-0.10	-0.06	-0.19	-0.30
NC5 Annual GDP growth rates, %	3.00	2.70	2.70	2.50	2.30
NC6 Annual GDP growth rates, %	2.30	3.50	2.30	2.10	2.30
NC5 WM total consumption of electricity (incl. losses), GWh	10,307	11,216	11,857		
NC6 WM total consumption of electricity (incl. losses), GWh	7,943	9,283	10,442	11,743	13,044
NC5 Net import of electricity, GWh	-750	0	0		

	2010	2015	2020	2025	2030
NC6 Net import of electricity, GWh	-3,571	-871	1,270	3,300	5,108
NC5 Production of electricity from wind, GWh	278	789	1,900		
NC6 Production of electricity from wind, GWh	997	3,294	3,294	3,294	3,294
NC5 WM total emissions, Gg CO_2 equivalent	15,960		15,615		
NC6 WM total emissions, Gg CO_2 equivalent	19,962	18,089	17,060	16,535	16,165
NC5 WAM total emissions, Gg CO_2 equivalent	15,974		13,012		
NC6 WAM total emissions, Gg CO_2 equivalent	19,962	17,671	16,550	15,951	15,797

As seen in Table 5.2 the assumptions and the results of the two projections are quite different. The total GHG emissions in the WM and WAM scenarios in 2020 of the previous NC are lower than in the current NC (*ca* 1,445 Gg CO_2 equivalent in the WM scenario and 3,538 Gg CO_2 equivalent in the WAM scenario).

5.3. Projections

5.3.1. With Measures (WM) scenario for 2010-2030

'With Measures' projections encompass currently implemented and adopted policies and measures.

5.3.1.1. Demographic assumptions and macroeconomic outlook

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 'Recommendations for reporting on projections in 2013' provided by the European Commission (see Table 5.3).

Table 5.3. Population and GDP growth rates 2010-2030

	2010	2015	2020	2025	2030
Population (thousand people)	1,340.1	1,332.4	1,328.3	1,315.9	1,296.4
Annual GDP growth rates	2.3%	3.5%	2.3%	2.1%	2.3%

5.3.1.2. Energy

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 (including public electricity and heat production and shale oil production); manufacturing industries; and construction, transport and other sectors (including commercial/institutional, residential and agriculture/forestry/fisheries).

Final consumption of energy in Estonia's energy sector according to Statistics Estonia in 2010 was 119 PJ, including 64 PJ fuels and 55 PJ electricity and heat. Total GHG emissions in 2010 in the energy sector were 17,867.34[1] Gg CO_2 equivalent (15 January 2013 submission to the European Commission, Estonia's National Inventory Report).

5.3.1.2.1. Energy industries

The main electricity producer 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 2010 there were a total of 10 pulverized combustion (PC) blocks and two circulating fluidised bed (CFB) blocks in Narva Power Plants. The process of building one more CFB block in Narva is currently underway. Construction of the new CFB block should be completed in 2015 (with a capacity of 300MW).

In recent years the share of electricity produced from renewable energy sources has grown rapidly, achieving over 9 per cent from gross electricity production in 2010. The main reason for this growth has been the support paid by Elering AS to electricity produced from renewable energy sources, as shown in the Policies and Measures chapter.

Historically, Estonia has been an exporter of electricity. In 2010, for example, Estonia exported over 30 per cent of its gross produced electricity. In the WM scenario it is projected that export of electricity will start declining linearly from 2012 and that by 2025 there will be no more exports of electricity. This will lead to a decrease in GHG emissions due to the fact that Estonia has been exporting oil shale-based electricity. Projected export and import of electricity is presented in Figure 5.1.

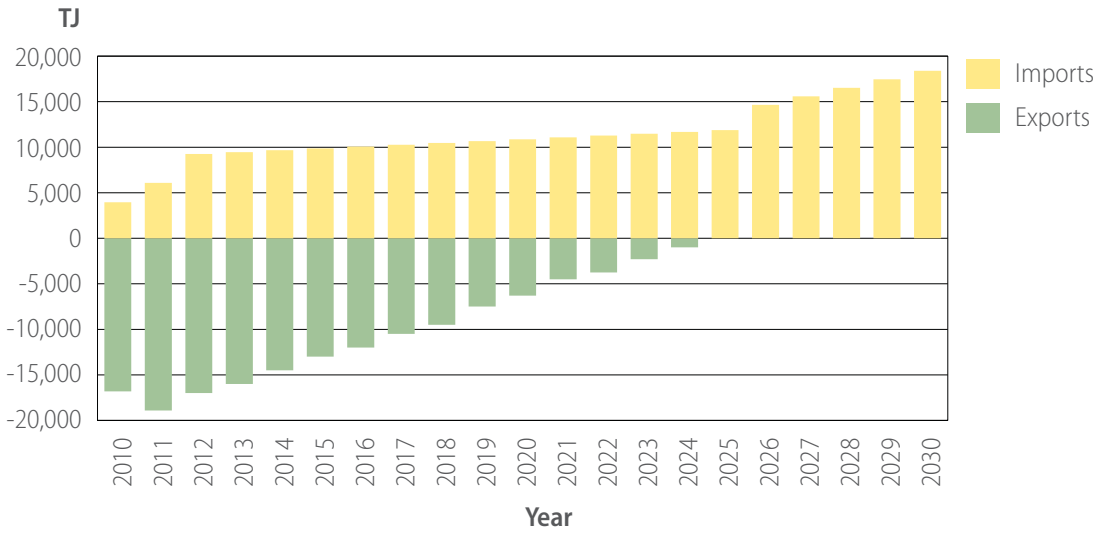

Figure 5.1. Projected export and import of electricity in WM scenario, TJ

[1] The GHG emissions from Energy sector are from the Estonia's National Inventory Report, 15 January 2013 submission to the European Commission, because the projections were compiled at the beginning of 2013, and no official data for 2011 existed.

Table 5.4. Production and consumption of electricity and heat in WM scenario, TJ

	2010	2015	2020	2025	2030
Production of electricity	41,447	36,553	32,011	30,393	27,433
... including wind	997	3,294	3,294	3,294	3,294
... including hydro	97	115	115	115	115
... including CHP	4,806	6,094	6,769	6,769	6,769
... including condensing PPs	35,547	27,050	22,842	20,217	18,390
Production of heat	33,467	32,290	31,115	29,509	27,899
... including CHP	12,323	15,954	17,730	17,730	17,730
Losses of electricity	3,769	4,177	4,511	4,862	5,165
Losses of heat	3,730	3,358	2,975	2,718	2,458
Net import of electricity	-12,854	-3,135	4,572	11,880	18,390
Final consumption of electricity	24,825	29,241	33,081	37,413	41,793
Final consumption of heat	29,540	28,932	28,141	26,791	25,441

In the WM scenario it is expected that two of the PC blocks using oil shale will be closed down by 2016. For four of the PC blocks there are plans to install SO_2 and NO_x emissions abatement technology; as such, they are expected to continue operating until 2025. For the remaining four PC blocks, an exception under the Industrial Emissions Directive (IED) is granted so that each block can operate for 17,500 hours between 2016 and 2023 – after which they will be shut down. The limit on oil shale mining is set at 20 Mt (approximately 178,000 TJ). The priority in oil shale use is to produce shale oil; what remains of the 20 Mt will be available to power plants. (The amount of oil shale used for shale oil production in different technologies is presented in Table 5.6).

Table 5.5. Total GHG emissions from public electricity and heat production in WM scenario, Gg

		2010	2015	2020	2025	2030
Public electricity and heat production	**CO_2**	13,741.7	10,493.9	7,730.1	6,937.3	6,258.9
	CH_4	0.5	0.5	0.5	0.5	0.4
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	13,781.3	10,530.8	7,771.3	6,977.0	6,296.8

Emissions from public electricity and heat production are expected to decrease by around 54 per cent by 2030 compared to 2010 (see Table 5.5 and Figure 5.2). The main reason for this decrease is the increase in wind electricity production and also the projection that Estonia will change from an exporting to an importing country of electricity.

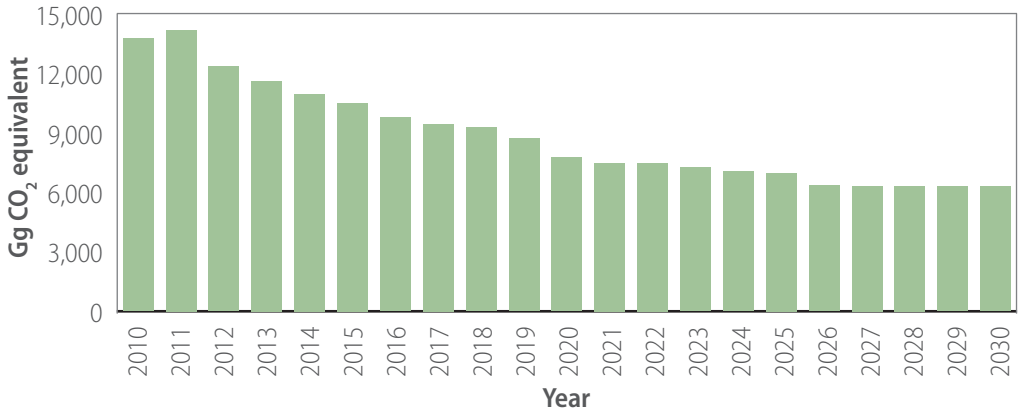

Figure 5.2. Total GHG emissions from public electricity and heat production in WM scenario, Gg CO_2 equivalent

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 a gaseous heat carrier (GHC); and technology for the processing of fine-grained oil shale with a solid heat carrier (SHC). GHC technology is 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. GHG emissions only occur only in SHC technology. The data on both technologies is presented in Table 5.6.

Table 5.6. Oil shale consumption and shale oil production in WM scenario, TJ

	2010	2015	2020	2025	2030
Oil shale for shale oil production using SHC technology	17,170	52,170	107,259	107,259	107,259
Oil shale for shale oil production using GHC technology	25,252	25,377	25,377	25,377	25,377
Oil shale for shale oil production total	42,422	77,547	132,636	132,636	132,636
Shale oil production using SHC technology	8,818	29,331	60,623	60,623	60,623
Shale oil production using GHC technology	13,275	14,130	14,130	14,130	14,130
Shale oil production total	22,093	43,461	74,753	74,753	74,753

As can be seen from Table 5.6, the production of shale oil is expected to increase *ca* three-fold by 2030 compared to 2010.

Table 5.7. Total GHG emissions from shale oil production in WM scenario, Gg

		2010	2015	2020	2025	2030
Shale oil production	**CO_2**	418.7	1,292.4	2,737.9	2,737.9	2,737.9
	CH_4	0.0	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	419.6	1,295.2	2,743.5	2,743.5	2,743.5

Due to the significant increase in the use of oil shale in shale oil production, GHG emissions from such production are also expected to increase rapidly (see Table 5.7 and Figure 5.3).

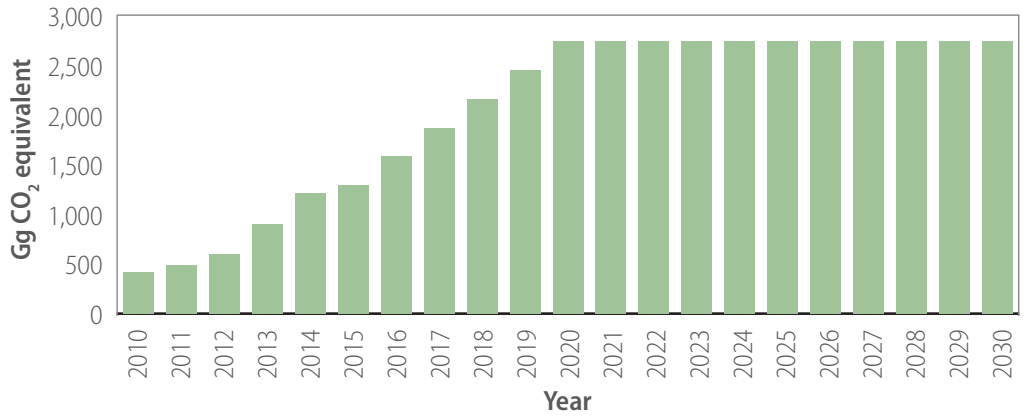

Figure 5.3. Total GHG emissions from shale oil production in WM scenario, Gg CO_2 equivalent

GHG emissions from shale oil production are expected to increase from 464 Gg of CO_2 equivalent in 2010 to 2,743 Gg of CO_2 equivalent by 2030.

5.3.1.2.2. Manufacturing industries and construction

The manufacturing industries and construction sector is divided into the following sub-sectors: iron and steel; non-ferrous metals; chemicals; pulp, paper and print; food beverages and tobacco; and other industries. Under 'other industries' the majority of fuel (mainly oil shale and coal) is used in cement production. Also diesel and natural gas is used extensively in manufacturing and construction.

Table 5.8. Fuel and energy consumption in manufacturing industries and construction sector in WM scenario, TJ

	2010	2015	2020	2025	2030
Fuels in iron and steel	16.0	17.7	19.5	21.5	23.8
Fuels in non-ferrous metals	89.0	98.3	108.5	119.8	132.2
Fuels in chemicals	221.0	244.0	269.4	297.4	328.4
Fuels in pulp, paper and print	88.0	97.2	107.3	118.4	130.8
Fuels in food, beverages and tobacco	112.0	123.7	136.5	150.7	166.4
Fuels in other	6,349.0	7,009.8	7,739.4	8,544.9	9,434.3
Electricity	7,534.0	9,893.0	11,260.6	12,713.4	14,181.9
Heat	7,660.0	7,848.0	8,035.2	8,179.2	8,323.2
Total energy in manufacturing industries and construction	22,069.0	25,331.6	27,676.3	30,145.4	32,721.0

The overall energy consumption in the manufacturing industries and construction sector is expected to grow by almost 50 per cent by 2030 compared to 2010 (see Table 5.8).

Since the most fuels are used in other industries, then also the main share of GHG emissions come from this sub-sector. The share of GHG emissions from coal and oil shale use for cement production was almost 50 per cent of total GHG emissions in the manufacturing industries and construction sector due to their relatively high carbon emission factor. GHG emissions from diesel, natural gas, oil shale and coal combined emitted around 80 per cent of total emissions from the manufacturing industries and construction sector in 2010.

Table 5.9. Total GHG emissions from manufacturing industries and construction in WM scenario, Gg

		2010	2015	2020	2025	2030
Manufacturing industries and construction	CO_2	504.9	557.4	615.5	679.5	750.2
	CH_4	0.1	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	509.1	562.1	620.6	685.2	756.5

The overall structure of fuels and energy consumed in the manufacturing industries and construction sector is expected to remain quite steady for the entire period from 2010-2030. No major structural changes are projected.

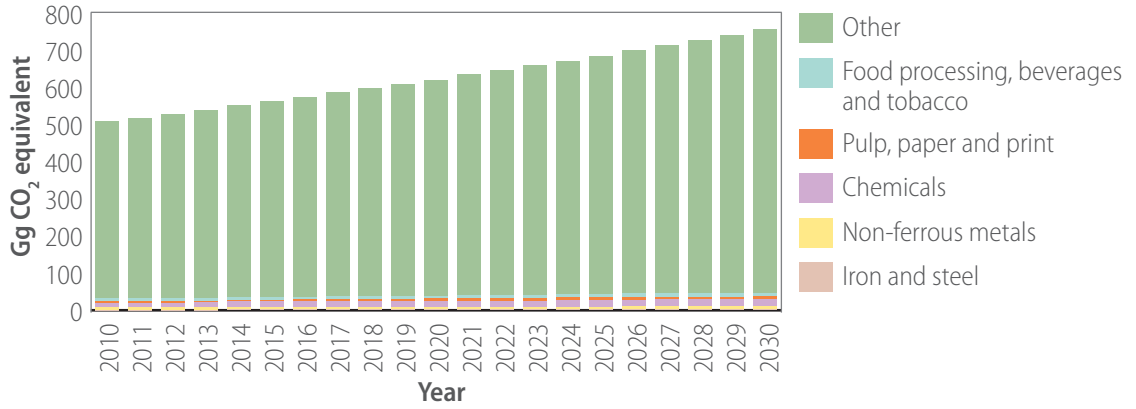

Figure 5.4. Total GHG emissions from manufacturing industries and construction in WM scenario, Gg CO_2 equivalent

GHG emissions are expected to increase by around 49 per cent in 2030 compared to 2010 in the WM scenario (see Table 5.9 and Figure 5.4).

5.3.1.2.3. Transport (excluding international aviation and marine bunkering)

The main share of GHG emissions in the transport sector originate from road transport. Historically the share of road transport GHG emissions has been over 90 per cent of total transport GHG emissions. Although new vehicles are more environmentally friendly and efficient, the share of those vehicles is relatively small. Therefore the consumption of motor fuels is expected to increase in future.

Table 5.10. Fuel and energy consumption in transport sector in WM scenario, TJ

	2010	2015	2020	2025	2030
Fuels in national aviation	24.3	26.8	29.6	32.6	36.0
Fuels in road transport	28,374.0	30,233.0	32,219.9	34,343.9	36,614.6
Fuels in railways	2,125.0	2,146.3	2,167.9	2,189.7	2,211.6
Fuels in inland waterways	319.0	335.3	352.4	370.3	389.2
Electricity	206.0	348.2	394.9	445.9	497.4
Heat	100.0	107.8	112.9	118.3	123.9
Total energy in transport	31,148.3	33,197.4	35,277.6	37,500.7	39,872.7

Total fuel and energy consumption in the transport sector is expected to increase by around 28 per cent by 2030 compared to 2010 (see Table 5.10). This increase is mainly related to the increase in gasoline and diesel consumption in road transportation.

Table 5.11. GHG emissions from transport sector in WM scenario, Gg

		2010	2015	2020	2025	2030
Transport	CO_2	2,233.8	2,351.5	2,500.0	2,661.8	2,831.3
	CH_4	0.3	0.4	0.4	0.4	0.4
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	2,258.9	2,378.1	2,528.2	2,691.6	2,862.9

Total GHG emissions from the transport sector are expected to increase by around 27 per cent by 2030 compared to 2010 (see Table 5.11 and Figure 5.5). The share of GHG emissions from road transport is projected to increase slightly throughout the period from 2010-2030 (by around 1 per cent total).

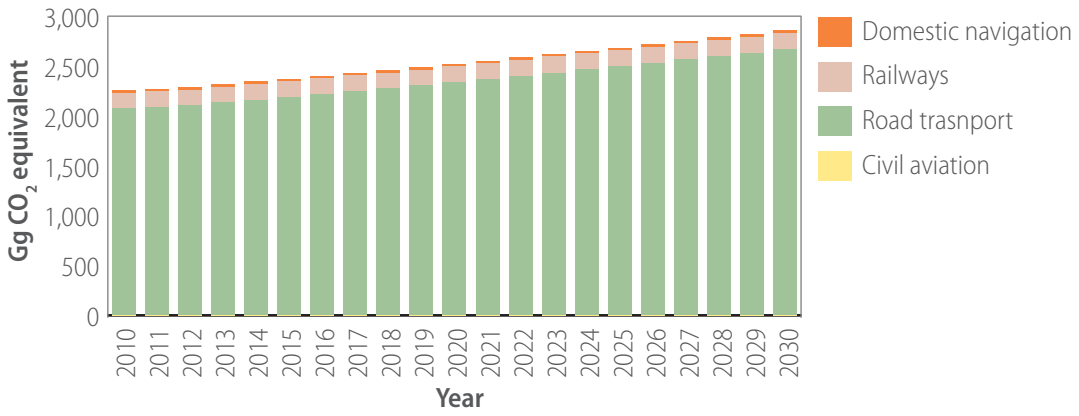

Figure 5.5. Total GHG emissions from transport in WM scenario, Gg CO_2 equivalent

5.3.1.2.4. Other sectors

Other sectors include energy consumption in the commercial/institutional, residential and agriculture/forestry/fisheries sectors. In current projections GHG emissions from military use of fuels is included in other sectors. (In the National Inventory Report of Estonia these GHG emissions are reported separately under 1.A.5, not 1.A.4.) Historically the most energy (including fuels) has been consumed in the residential sector. The share of biomass used in households was *ca* 85 per cent of all fuels used in households in 2010. Diesel used in off-road transportation forms the biggest share of fuels in agriculture/forestry/fisheries. The activity data used in the projections is presented in Table 5.12.

Table 5.12. Fuel and energy consumption in other sectors in WM scenario, TJ

		2010	2015	2020	2025	2030
Commercial/institutional	Fuels	1,644.0	1,723.7	1,803.2	1,886.6	1,974.0
	Electricity	9,123.0	10,339.2	11,725.8	13,238.6	14,767.8
	Heat	6,542.0	6,270.0	5,999.0	5,596.0	5,193.0

		2010	2015	2020	2025	2030
Residential	Fuels	20,900.0	20,723.7	20,549.1	20,376.3	20,205.2
	Electricity	7,283.0	7,767.0	8,686.6	9,871.9	11,070.0
	Heat	14,792.0	14,249.0	13,526.0	12,421.0	11,316.0
Agriculture/forestry/fisheries	Fuels	2,785.0	2,854.2	2,925.1	2,997.9	3,072.6
	Electricity	679.0	893.1	1,012.9	1,143.6	1,275.7
	Heat	446.0	457.0	468.0	477.0	485.0
Total	Fuels	25,329.0	25,301.6	25,277.4	25,260.8	25,251.8
	Electricity	17,085.0	18,999.3	21,425.3	24,254.1	27,113.5
	Heat	21,780.0	20,976.0	19,993.0	18,494.0	16,994.0

Heat consumption is expected to decrease in other sectors. This decrease is a result of measures and programmes that cover the development and implementation of regulations on the energy performance of buildings, the modernisation of the renovation and construction of buildings, tax policy measures, improvement of the skills of construction specialists, applied R&D to ensure analysis of the state of repairs of buildings and technical options in modernising them.

Table 5.13. Total GHG emissions from other sectors in WM scenario, Gg

		2010	2015	2020	2025	2030
Commercial/institutional	CO_2	86.2	90.7	94.9	99.4	104.0
	CH_4	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	87.4	91.8	96.1	100.6	105.3
Residential	CO_2	198.3	198.3	198.3	198.3	198.3
	CH_4	5.4	5.4	5.3	5.3	5.2
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	335.0	333.7	332.4	331.1	329.8
Agriculture/forestry/fisheries	CO_2	241.9	248.4	254.6	261.0	267.6
	CH_4	0.0	0.0	0.0	0.0	0.0
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	264.6	271.7	278.5	285.6	292.7
TOTAL	CO_2	526.5	537.4	547.9	558.7	570.0
	CH_4	5.5	5.4	5.4	5.3	5.3
	N_2O	0.1	0.1	0.1	0.1	0.2
	Total CO_2 eq.	687.0	697.2	707.0	717.2	727.8

The reduction in biomass used in households will lead to a decrease in GHG emissions from the residential sector. Other fuels used in households are expected to remain at the same level throughout the period from 2010-2030. Therefore CO_2 emissions from the residential sector will also remain at the 2010 level. The increase in GHG emissions from agriculture/forestry/fisheries is related to growing demand for and use of motor fuels in agricultural machines. GHG emissions from other sectors are expected to grow by around 6 per cent by 2030 compared to 2010 (see Table 5.13 and Figure 5.6).

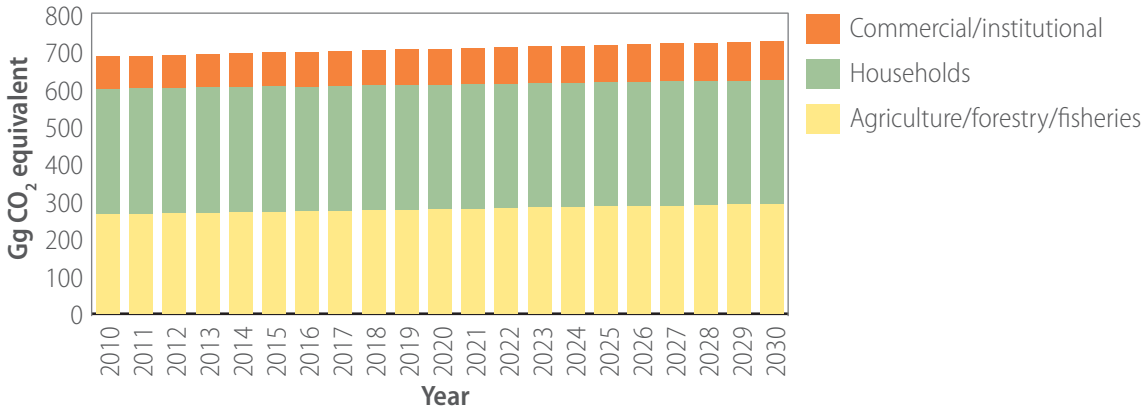

Figure 5.6. Total GHG emissions from other sectors in WM scenario, Gg CO_2 equivalent

5.3.1.2.5. Energy sector total

Total GHG emissions in the WM scenario are presented in Table 5.14.

Table 5.14. Total GHG emissions in energy sector in WM scenario, Gg

		2010	2015	2020	2025	2030
Energy industries	CO_2	14,160.5	11,786.3	10,468.0	9,675.3	8,996.8
	CH_4	0.6	0.6	0.6	0.6	0.5
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	14,201.0	11,825.9	10,514.8	9,720.5	9,040.3
Manufacturing industries and construction	CO_2	504.9	557.4	615.5	679.5	750.2
	CH_4	0.1	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	509.1	562.1	620.6	685.2	756.5
Transport	CO_2	2,233.8	2,351.5	2,500.0	2,661.8	2,831.3
	CH_4	0.3	0.4	0.4	0.4	0.4
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	2,258.9	2,378.1	2,528.2	2,691.6	2,862.9
Other sectors	CO_2	526.5	537.4	547.9	558.7	570.0
	CH_4	5.5	5.4	5.4	5.3	5.3
	N_2O	0.1	0.1	0.1	0.1	0.2
	Total CO_2 eq.	687.0	697.2	707.0	717.2	727.8
Fugitive emissions from fuels	CH_4	4.0	4.3	4.0	3.9	3.8
	Total CO_2 eq.	83.2	89.5	83.4	81.6	79.8
Energy total	CO_2	17,425.7	15,232.7	14,131.4	13,575.3	13,148.3
	CH_4	10.4	10.7	10.4	10.3	10.1
	N_2O	0.3	0.3	0.3	0.3	0.3
	Total CO_2 eq.	17,739.3	15,552.9	14,454.0	13,896.1	13,467.4

Total GHG emissions from the energy sector are expected to decrease by around 24 per cent by 2030 compared to 2010.

5.3.1.3. Industrial processes

The mineral products and chemical industry are the sources of CO_2 emissions in the industrial processes sector. Data from eight companies is included in the projections. In the mineral products sector the main share of emissions (*ca* 91 per cent in 2010) comes from cement production. Other CO_2 emissions from the production of mineral products come from lime, glass, lightweight gravel, bricks and tiles production and from soda ash use.

Ammonia production is the only production in the chemical industry branch. There is also only one company in Estonia producing ammonia (AS Nitrofert). Due to the low market prices of ammonia there was no ammonia production in 2010. However, it is expected that production of ammonia will resume in the future.

The consumption of fluorinated GHGs (HFCs, PFCs and SF_6) in Estonia depends on imports. F-gases are imported either in bulk by trade or industry for domestic productive consumption (manufacturing) – filling newly manufactured products and refilling of equipment – or imported preliminary and final products respective equipment already filled with F-gases.

Table 5.15. Total GHG emissions from industrial processes sector in WM scenario, Gg

		2010	2015	2020	2025	2030
Mineral products	CO_2	339.4	421.4	458.6	499.6	544.5
Chemical industry	CO_2	0.0	262.9	262.9	262.9	262.9
Consumption of halocarbons and SF_6	HFCs (CO_2 eq.)	156.3	184.7	218.1	229.1	240.5
	SF_6 (CO_2 eq.)	3.8	4.1	4.3	4.5	4.7
	Total CO_2 eq.	160.1	188.8	222.5	233.6	245.2
Industrial processes total	Total CO_2 eq.	499.5	873.1	944.0	996.1	1,052.7

GHG emissions are projected to increase in all sub-sectors under industrial processes. Total GHG emissions are expected to more than double by 2030 compared to 2010 (see Table 5.15 and Figure 5.7). The main share of this increase is related to cement and ammonia production.

Figure 5.7. Total GHG emissions from industrial processes in WM scenario, Gg CO_2 equivalent

5.3.1.4. Solvent and other product use

Emissions from solvent and other product use sector in Estonia are divided into the following categories: paint application; degreasing and dry cleaning; chemical products; manufacturing and processing; and other (including the printing industry, domestic solvent use and other product use). Under this category, mainly CO_2 emissions are occurring (except N_2O emissions from the use of N_2O for anaesthesia).

Table 5.16. Total GHG emissions from solvent and other product use in WM scenario, Gg

		2010	2015	2020	2025	2030
Paint application	CO_2	5.2	4.7	4.7	4.7	4.6
Degreasing and dry cleaning	CO_2	2.3	1.8	1.8	1.8	1.8
Chemical products, manufacturing and processing	CO_2	0.3	0.4	0.4	0.4	0.4
Other	CO_2	5.0	5.8	5.8	5.7	5.7
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	9.8	12.0	12.0	11.9	8.8
Solvent and other product use total	CO_2	12.9	12.8	12.7	12.6	12.4
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	17.6	19.0	18.9	18.8	15.5

The decrease in total GHG emissions from the solvent and other product use sector is expected to be 12 per cent by 2030 compared to 2010 (see Table 5.16 and Figure 5.8).

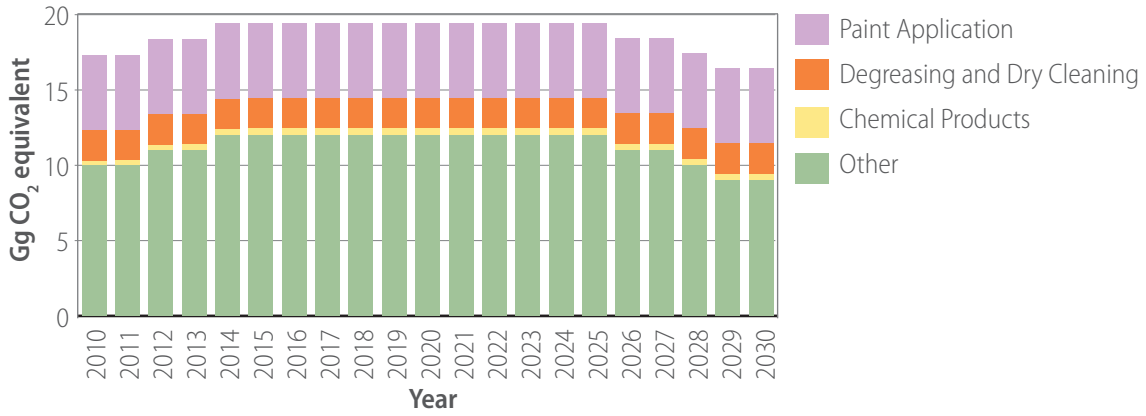

Figure 5.8. Total GHG emissions from solvent and other product use in WM scenario, Gg CO_2 equivalent

5.3.1.5. Agriculture

In the agriculture sector CH_4 is emitted from enteric fermentation and manure management. N_2O is emitted from manure management and agricultural soils. No CO_2 emissions occur in the agriculture sector. CH_4 and N_2O emissions from field burning of agricultural residues occurred in Estonia from 1990-2006. Since 2007 the burning of crop residues is prohibited by Estonian law. Therefore no GHG emissions have occurred in this sector since 2007.

Projections on the number of livestock are received from the Ministry of Agriculture and are presented in Table 5.17.

Table 5.17. Projected number of livestock, thousand heads

	2010	2015	2020	2025	2030
Cattle	236.3	236.9	243.7	241.0	241.0
Sheep	78.6	80.0	82.0	84.0	86.0
Goats	4.1	4.2	4.4	4.6	4.8
Horses	6.8	5.1	5.0	5.0	5.0
Swine	371.7	360.0	352.0	360.0	365.0
Poultry	2,046.4	2,046.0	2,046.0	2,046.0	2,046.0

Projections on GHG emissions from agriculture are presented in Table 5.18.

Table 5.18. Total GHG emissions from agriculture in WM scenario, Gg

		2010	2015	2020	2025	2030
Enteric fermentation	**CH_4**	19.3	19.0	20.2	20.3	20.3
	Total CO_2 eq.	405.4	398.2	425.2	426.5	426.6
Manure management	**CH_4**	2.3	2.3	2.4	2.4	2.4
	N_2O	0.3	0.3	0.3	0.3	0.3
	Total CO_2 eq.	150.0	149.2	150.7	151.2	151.5
Agricultural soils	**N_2O**	2.3	2.2	2.3	2.2	2.2
	Total CO_2 eq.	698.2	688.3	719.8	694.6	695.4
Agriculture total	**CH_4**	21.7	21.3	22.6	22.7	22.7
	N_2O	2.6	2.5	2.6	2.6	2.6
	TOTAL CO_2 eq.	1,253.6	1,235.7	1,295.6	1,272.3	1,273.5

GHG emissions from the agriculture sector are expected to remain at around the same level from 2010-2030 (with an increase of 1.6 per cent by 2030 compared to 2010). This slight increase is related to the fact that both the number of cattle and the amount of fertilizers used in agricultural lands are expected to increase by 2030 compared to 2010 (see Table 5.18 and Figure 5.9).

Figure 5.9. Total GHG emissions from agriculture in WM scenario, Gg CO_2 equivalent

5.3.1.6. LULUCF

The LULUCF sector includes emissions and removals of GHGs from forest land, cropland, grassland, wetlands, settlements and other land. There are a number of factors that have affected the use

of land over the last 20 years. The most important of these is land reform, but also accession to the European Union and economic peaks and troughs.

Forest area grew steadily until 2004. As there are several EU support schemes at present for agriculture activities, only a slight increase in forest land is foreseen in the future (mainly conversion of grassland to forest land). The area of cropland increased since 2004-2010 and is not expected to increase further. Grasslands should continue to decline in the near future, mainly due to natural afforestation. The area of infrastructure and settlements is expanding continuously, at the expense of all other mineral lands. The predicted area of land use classes is shown in Table 5.19.

Table 5.19. Projected land use in LULUCF sector in WM scenario, kHa

	2010	2015	2020	2025	2030
Forest land	2,253.5	2,252.3	2,251.1	2,249.9	2,248.8
Cropland	1,078.3	1,076.4	1,074.5	1,072.6	1,070.7
Grassland	346.3	340.9	335.5	330.1	324.7
Wetlands	499.1	501.3	503.4	505.5	507.7
Settlements	300.7	309.1	317.5	325.9	334.3
Other land	44.8	42.7	40.7	38.6	33.6
Total	4,522.7	4,522.7	4,522.7	4,522.7	4,522.7

Table 5.20. Total GHG emissions and removals from LULUCF sector in WM scenario, Gg

		2010	2015	2020	2025	2030
Forest land	CO_2	-4,013.2	-3,925.4	-3,837.5	-3,749.7	-3,661.9
	CH_4	0.0	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	-4,013.1	-3,923.5	-3,835.5	-3,747.6	-3,659.6
Cropland	CO_2	103.2	101.8	100.4	99.0	97.6
Grassland	CO_2	-160.7	-147.1	-133.4	-119.7	-106.0
	CH_4	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	-160.7	-147.0	-133.2	-119.5	-105.8
Wetlands	CO_2	13.6	24.7	35.8	46.8	57.9
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	14.5	25.6	36.7	47.8	58.8
Settlements	CO_2	298.4	307.8	317.2	326.6	336.1
Other land	CO_2	0.0	20.9	41.8	62.6	83.5
TOTAL	CO_2	-3,758.7	-3,617.3	-3,475.8	-3,334.3	-3,192.8
	CH_4	0.0	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	-3,757.8	-3,614.4	-3,472.7	-3,331.1	-3,189.5

In general, GHG emissions are expected to remain stable or increase in the near future (see Table 5.20).

5.3.1.7. Waste

The main GHGs in the waste sector are methane and nitrous oxide. No CO_2 is emitted from the waste sector. The main share of methane from the waste sector comes from solid waste disposal on land. Nitrous oxide is emitted from wastewater handling, biological treatment and waste incineration. The measure concerning solid waste disposal on land is taken into account in the projections – the percentage of biodegradable waste in the total amount by weight of municipal waste deposited in a landfill shall not exceed 45 per cent by 2010, 30 per cent by 2013 and 20 per cent by 2020.

Table 5.21. Total GHG emissions from waste sector in WM scenario, Gg

		2010	2015	2020	2025	2030
Solid waste disposal on land	CH_4	12.9	10.7	7.6	7.6	7.6
	Total CO_2 eq.	271.3	225.1	160.0	160.0	160.0
Wastewater handling	CH_4	0.3	0.3	0.3	0.3	0.3
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	40.1	40.6	40.6	40.4	39.9
Waste incineration	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	0.1	0.1	0.1	0.1	0.1
Other (biological treatment)	CH_4	3.2	3.2	3.3	3.4	3.5
	N_2O	0.2	0.2	0.2	0.3	0.3
	Total CO_2 eq.	140.9	142.7	147.0	151.5	156.0
Waste total	CH_4	16.4	14.2	11.2	11.3	11.5
	N_2O	0.3	0.4	0.4	0.4	0.4
	Total CO_2 eq.	452.4	408.5	347.7	351.9	356.0

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 municipal waste deposited in landfill. This will lead to a reduction in GHG emissions in solid waste disposal on land of 41 per cent by 2030 compared to 2010. The total reduction in GHG emissions in the waste sector is projected to be 21 per cent by 2030 compared to 2010 (see Table 5.21 and Figure 5.10).

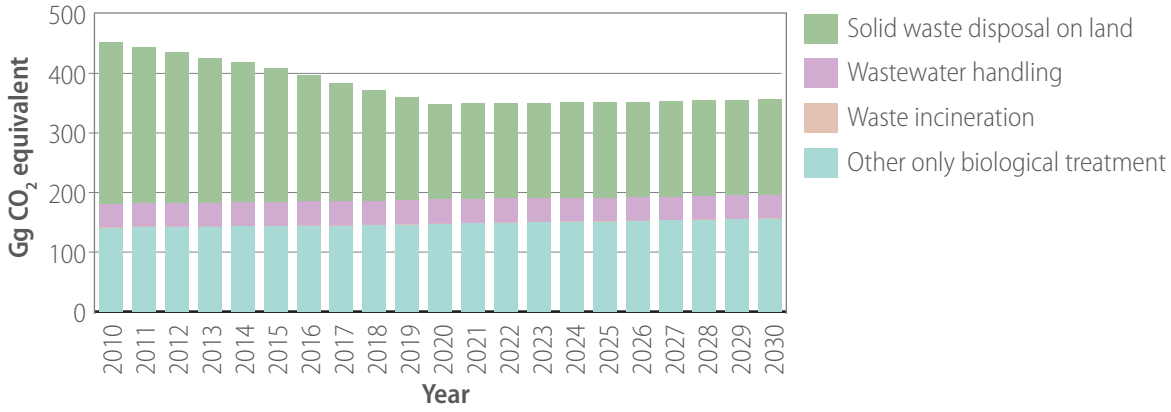

Figure 5.10. Total GHG emissions from waste in WM scenario, Gg CO_2 equivalent

5.3.1.8. Total GHG emissions in WM scenario

Total GHG emissions in the WM scenario are presented in Table 5.22.

Table 5.22. Total GHG emissions in WM scenario (without LULUCF), Gg

		2010	2015	2020	2025	2030
Energy (including fugitive emissions from fuels)	CO_2	17,425.7	15,232.7	14,131.4	13,575.3	13,148.3
	CH_4	10.4	10.7	10.4	10.3	10.1
	N_2O	0.3	0.3	0.3	0.3	0.3
	Total CO_2 eq.	17,739.3	15,552.9	14,454.0	13,896.1	13,467.4
Industrial processes	Total CO_2 eq.	499.5	873.1	944.0	996.1	1,052.7
Solvent and other product use	CO_2	12.9	12.8	12.7	12.6	12.4
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	17.7	19.0	18.9	18.8	15.5
Agriculture	CH_4	21.7	21.3	22.6	22.7	22.7
	N_2O	2.6	2.5	2.6	2.6	2.6
	Total CO_2 eq.	1,253.6	1,235.7	1,295.6	1,272.3	1,273.5
Waste	CH_4	16.4	14.2	11.2	11.3	11.5
	N_2O	0.3	0.4	0.4	0.4	0.4
	Total CO_2 eq.	452.4	408.5	347.7	351.9	356.0
Total WM scenario	CO_2	17,938.1	16,118.5	15,088.1	14,584.0	14,213.4
	CH_4	48.5	46.2	44.3	44.3	44.3
	N_2O	3.2	3.2	3.4	3.3	3.3
	Total CO_2 eq.	19,962.3	18,089.2	17,060.3	16,535.2	16,165.1

The total GHG emissions of Estonia in the WM scenario (without LULUCF) are expected to decrease by around 19 per cent by 2030 compared to 2010, as shown in Table 5.22 and Figure 5.11. This decrease is mostly connected to the reduction in GHG emissions from the energy sector.

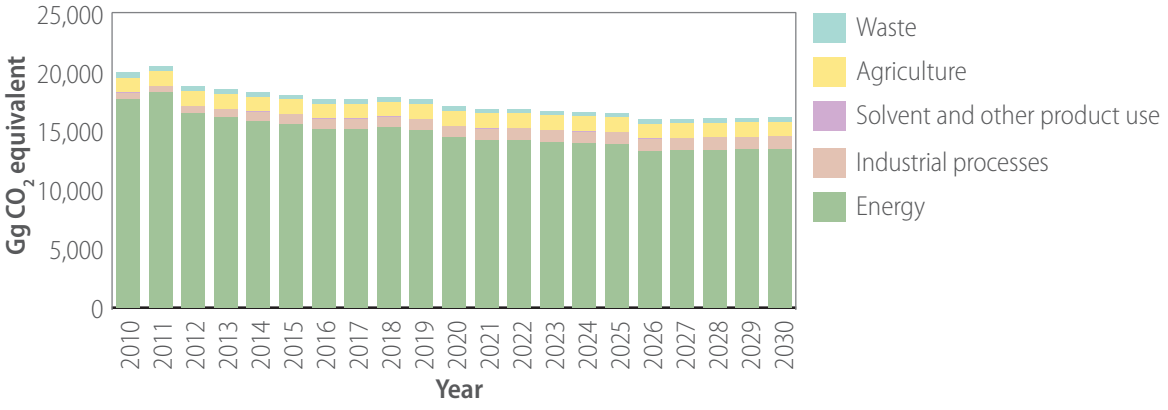

Figure 5.11. Total GHG emissions in WM scenario (without LULUCF), Gg CO_2 equivalent

5.3.2. With Additional Measures (WAM) scenario for 2010-2030

The WAM scenario includes all policies and measures applied in the WM scenario as well as additional measures that are planned but have yet to be implemented or adopted.

5.3.2.1. Energy industries

The measures taken into account in the WAM scenario are actually planned to be implemented in manufacturing industries and construction. These measures are basically energy efficiency measures that will lead to a reduction in consumption of heat and electricity. This reduction in consumption will in turn lead to a reduction in heat and electricity produced. Therefore these measures will reduce GHG emissions from public electricity and heat production.

Table 5.23. Total GHG emissions from public electricity and heat production in WAM scenario, Gg

		2010	2015	2020	2025	2030
Public electricity and heat production	CO_2	13,741.7	10,244.7	7,525.5	6,675.3	6,229.5
	CH_4	0.5	0.5	0.5	0.5	0.4
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	13,781.4	10,281.1	7,566.1	6,714.3	6,266.8

In the WAM scenario, the total GHG emissions from public electricity and heat production are expected to decrease by 55 per cent by 2030 compared to 2010 (see Table 5.23 and Figure 5.12).

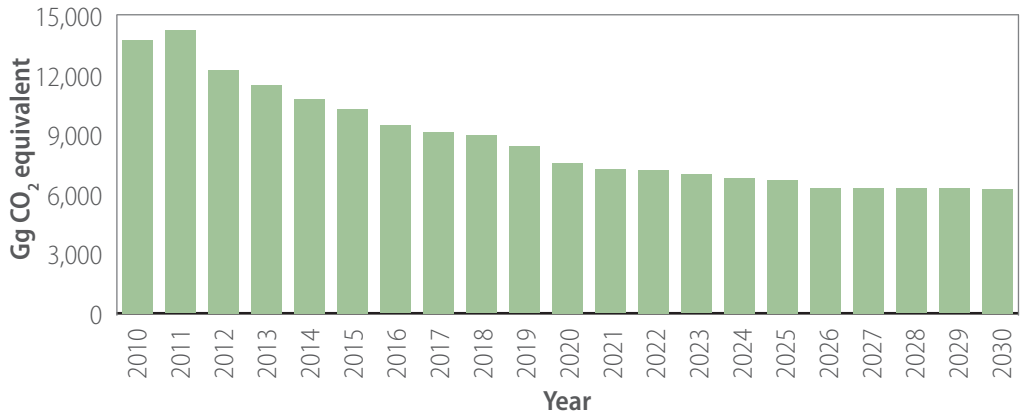

Figure 5.12. Total GHG emissions from public electricity and heat production in WAM scenario, Gg CO_2 equivalent

5.3.2.2. Manufacturing industries and construction

The measures included in the WAM scenario in the manufacturing industries and construction sector are mainly related to energy conservation – encouragement to perform energy audits in industries and small enterprises; contribution to the improvement of energy auditors' qualifications with respect to industrial energy conservation issues; fostering energy consultants' participation in European Union projects related to energy conservation in industry; better financing opportunities for energy conservation measures in industries and small enterprises; and development of databases and methods for the benchmarking of companies.

Table 5.24. Total GHG emissions from manufacturing industries and construction in WAM scenario, Gg

		2010	2015	2020	2025	2030
Manufacturing industries and construction	CO_2	504.9	501.3	548.1	612.1	682.9
	CH_4	0.1	0.1	0.1	0.1	0.1
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	509.1	505.7	552.9	617.5	688.9

GHG emission reductions in the WAM scenario under the manufacturing industries and construction sector only include fuel use reduction. The energy saved through reduced consumption of electricity and heat will lead to additional GHG emission reductions in the energy industries sector.

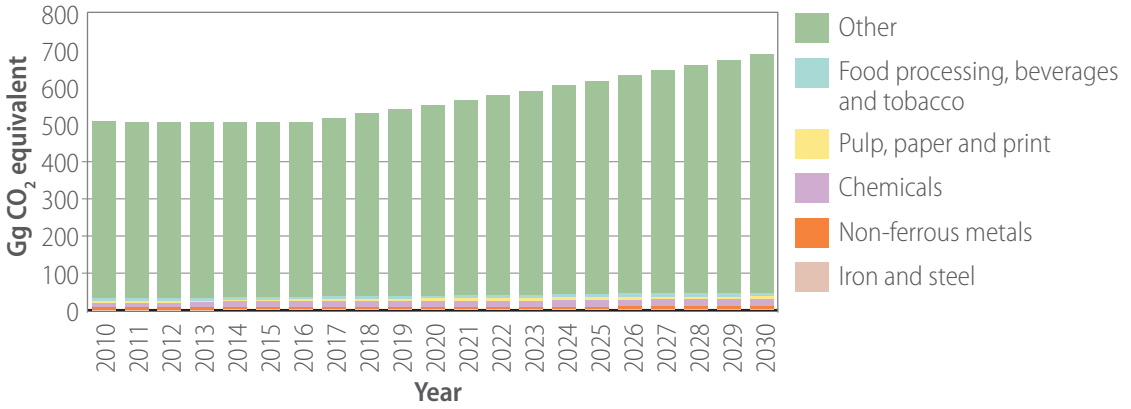

Figure 5.13. Total GHG emissions from manufacturing industries and construction in WAM scenario, Gg CO_2 equivalent

5.3.2.3. Transport (excluding international aviation and marine bunkering)

In the WAM scenario it is projected that the share of renewable fuels used in transport will increase to 10 per cent by 2020 from fuels used in transport.

Table 5.25. Total GHG emissions from transport in WAM scenario, Gg

		2010	2015	2020	2025	2030
Transport	CO_2	2,233.8	2,242.1	2,266.6	2,412.8	2,565.7
	CH_4	0.3	0.3	0.3	0.4	0.4
	N_2O	0.1	0.1	0.1	0.1	0.1
	Total CO_2 eq.	2,258.9	2,267.7	2,292.8	2,440.5	2,595.1

The increase of the share of renewable fuels used in transport is expected to lead to decreased GHG emissions in the WAM scenario compared to the WM scenario in 2020. The increase of GHG emissions in the WAM scenario is expected to be around 15 per cent by 2030 compared to 2010 (see Table 5.25 and Figure 5.14).

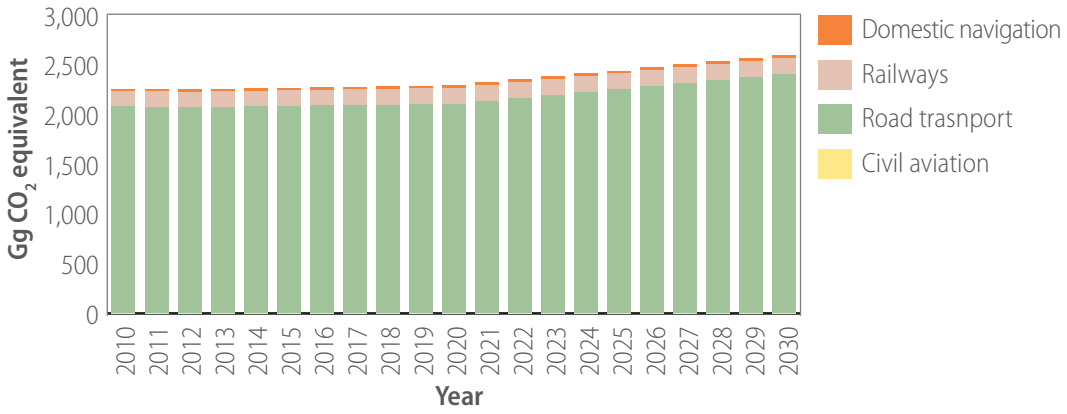

Figure 5.14. Total GHG emissions from transport in WAM scenario, Gg CO_2 equivalent

5.3.2.4. Other sectors

Since no additional measures are foreseen to reduce GHG emissions from industrial processes, agriculture, LULUCF and the waste sector, the projections of emissions in the WAM scenario are expected to be equal to those in the WM scenario.

5.3.2.5. Total GHG emissions in WAM scenario

Projections on GHG emissions in the WAM scenario are presented in Table 5.26.

Table 5.26. Total GHG emissions in WAM scenario (without LULUCF), Gg

		2010	2015	2020	2025	2030
Energy (including fugitive emissions from fuels)	CO_2	17,425.7	14,817.9	13,626.0	12,996.9	12,785.9
	CH_4	10.4	10.6	10.3	10.1	10.0
	N_2O	0.3	0.3	0.3	0.3	0.3
	Total CO_2 eq.	17,739.3	15,134.3	13,943.4	13,312.3	13,099.5
Industrial processes	Total CO_2 eq.	499.5	873.1	944.0	996.1	1,052.7
Solvent and other product use	CO_2	12.9	12.8	12.7	12.6	12.4
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	17.6	19.0	18.9	18.8	15.5
Agriculture	CH_4	21.7	21.3	22.6	22.7	22.7
	N_2O	2.6	2.5	2.6	2.6	2.6
	Total CO_2 eq.	1,253.6	1,235.7	1,295.6	1272.3	1,273.5
Waste	CH_4	16.4	14.2	11.2	11.3	11.5
	N_2O	0.3	0.4	0.4	0.4	0.4
	Total CO_2 eq.	452.4	408.5	347.7	351.9	356.0
Total WAM scenario	CO_2	17,938.1	15,703.8	14,582.7	14,005.6	13,851.0
	CH_4	48.5	46.1	44.1	44.2	44.2
	N_2O	3.2	3.2	3.4	3.3	3.3
	Total CO_2 eq.	19,962.3	17,670.7	16,949.7	15,951.4	15,797.2

The total GHG emissions of Estonia are projected to decrease by 21 per cent by 2030 compared to 2010. The additional reduction in total GHG emissions of the WAM scenario compared to the WM scenario is solely related to the GHG emissions reduction in the energy sector.

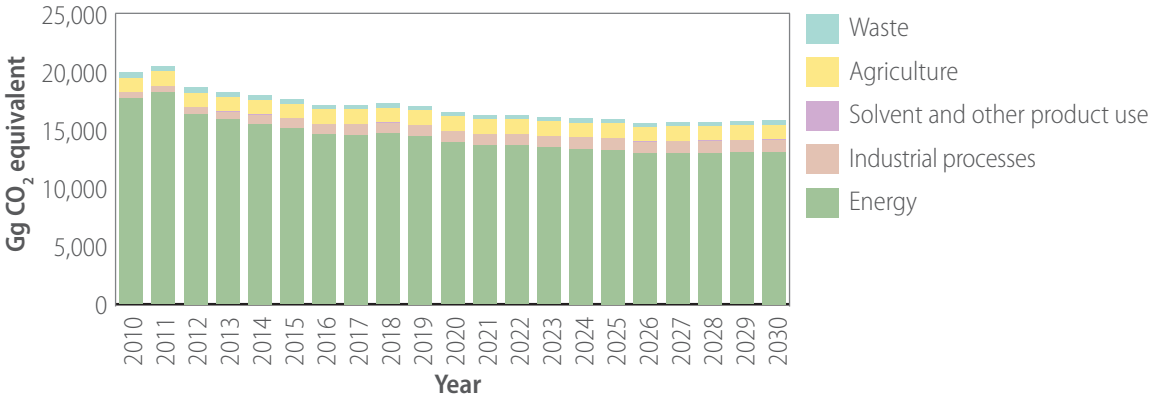

Figure 5.15. Total GHG emissions in WAM scenario (without LULUCF), Gg CO_2 equivalent

5.3.3. Comparison of WM and WAM scenarios and national GHG target

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

Table 5.27. Final consumption of energy in WM and WAM scenarios, TJ

	2010	2015	2020	2025	2030
WM	128,632	135,249	141,326	147,585	154,157
WAM	128,632	133,094	138,806	145,064	151,636

Comparison of both scenarios (see Table 5.27) in 2030 shows that final consumption of energy is expected to decrease from the level of 154,157 TJ in the WM scenario to 151,636 TJ in the WAM scenario. The decrease in fuel consumption will lead to decreased GHG emissions in final consumption sectors. The decrease in electricity and heat consumption will lead to decreased GHG emissions in the energy supply sector.

Figure 5.16. Total GHG emissions in WM and WAM scenarios (without LULUCF), Gg CO_2 equivalent

The difference in total GHG emissions between the WAM and WM scenarios is expected to be around 368 Gg CO_2 equivalent by 2030.

In the EU level Estonia has national GHG emissions target on the emissions that are not covered with the EU ETS. According to the Effort Sharing Decision (406/2009/EC) the emissions not covered with the EU ETS could increase 11 per cent by 2020 compared to 2005 level in Estonia and there are binding annual GHG emission targets for the period 2013-2020. Therefore projected GHG amounts are divided between ETS and non-ETS sectors. The results are presented in Table 5.28

Table 5.28. GHG emissions in ETS and non-ETS sectors in WM and WAM scenarios, Gg CO_2 equivalent

	2005	2010	2015	2020	2025	2030
WM ETS	12,621.8	14,627.1	12,288.8	11,199.9	10,554.9	10,034.9
WM non-ETS	5,825.8	5,448.9	5,925.9	5,999.0	6,133.3	6,299.0
WAM ETS	12,621.8	14,627.1	12,002.9	10,946.6	10,247.2	9,942.9
WAM non-ETS	5,825.8	5,448.9	5,793.2	5,741.8	5,857.2	6,023.2

As seen in Figure 5.17, the projected GHG emissions in non-ETS sectors are expected to stay below the Annual Emission Allocations (AEA) levels.

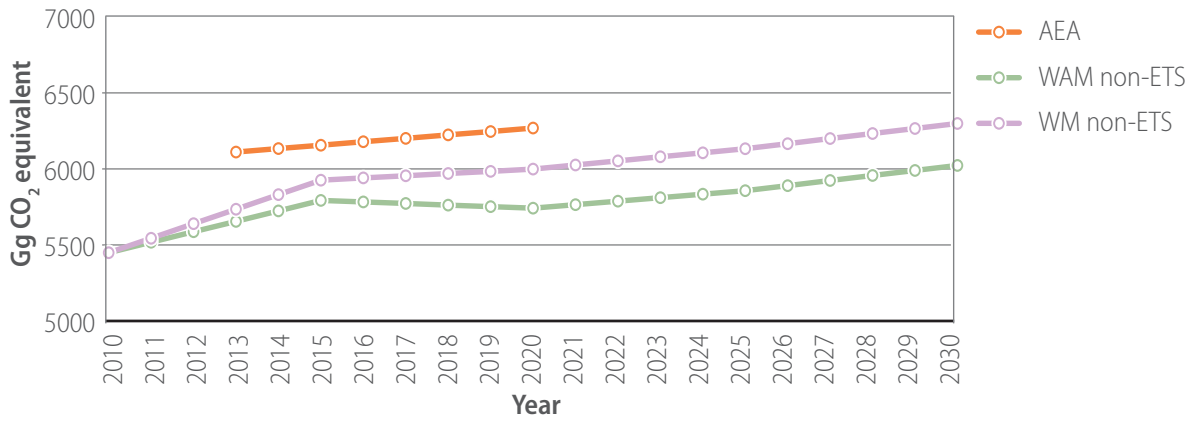

Figure 5.17. Non-ETS projections in WM and WAM scenarios compared to AEA, Gg CO_2 equivalent

The GHG emissions in non-ETS sectors are expected to increase about 16 per cent in the WM and about 11 per cent in the WAM scenario by 2030 compared to 2010.

5.3.4. Sensitivity analysis

The main share of GHG emissions in Estonia is emitted from electricity generation in condensing power plants using oil shale as fuel. Also, Estonia has historically been an exporter of electricity that is produced from oil shale. In 2010, export of electricity was 4,354 GWh and import was 1,100 GWh. This means that net export was around 25 per cent of gross produced electricity. This resulted in higher GHG emissions than in a case where Estonia was an importer of electricity. Therefore the projections on how electricity flows with other countries are expected to change in the future plays an essential role in future GHG emissions.

In the projections, the mining limit of oil shale is set total 20 Mt per year. Since use of oil shale in the shale oil production industry is expected to increase rapidly from 2010-2020, the availability of oil shale for the production of electricity will decrease (the priority in oil shale use being given to the shale oil industry).

To show that the sensitivity of projections is mostly dependant on electricity flows and oil shale, an alternative scenario was compiled. In this scenario it is assumed that although there remains an oil shale mining limit of 20 Mt per year, oil shale will also be able to be imported from Russia. Furthermore, it is assumed that after 2012 no electricity imports or exports will occur. This means that Estonia would meet its entire electricity demand domestically. The production, losses, net imports and final consumption of electricity in the alternative scenario are presented in Table 5.29.

Table 5.29. Production, losses, net imports and final consumption of electricity in alternative scenario, TJ

	2015	2020	2025	2030
Production of electricity	33,417	37,592	42,275	28,568
... including wind	3,294	3,294	3,294	3,294
... including hydro	115	115	115	115
... including CHP	6,094	6,769	6,769	6,769
... including condensing PPs	23,914	27,414	32,097	18,390
Losses of electricity	4,177	4,511	4,862	5,165
Net import of electricity	0	0	0	19,525
Final consumption of electricity	29,241	33,081	37,413	41,793

The increased production of electricity from oil shale will lead to higher GHG emissions. The results of the GHG emissions of the alternative scenario and WM scenario are presented in Table 5.30.

Table 5.30. Total GHG emissions in alternative scenario and WM scenario, Gg CO_2 equivalent

	2015	2020	2025	2030
Total GHG emissions in alternative scenario	17,925.2	19,846.3	21,509.3	17,110.1
Total GHG emissions in WM scenario	18,089.2	17,060.4	16,535.2	16,165.1

As seen in Table 5.30, the GHG emissions in the alternative scenario would be around 945 Gg CO_2 equivalent higher in 2030 compared to the WM scenario.

Another important part is played in GHG emissions projections by the development of electricity generation from renewable energy sources. In current projections it is expected that since support for electricity produced from renewable sources is paid until 600 GWh of electricity from renewable sources is produced, investors will have no interest in investing in power units that do not receive the support. If the limit of 600 GWh of renewable electricity produced is raised, more capacities producing electricity from renewable energy sources are likely to be built.

5.3.5. 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 5.31.

Table 5.31. Total GHG emissions in international bunkers sector, Gg

		2010	2015	2020	2025	2030
International maritime transport	CO_2	695.1	698.2	701.4	704.6	707.8
	CH_4	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	697.7	700.9	704.1	707.4	710.6
International aviation	CO_2	113.6	125.5	138.5	153.0	168.9
	CH_4	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	113.6	125.5	138.5	153.0	168.9
International bunkers total	CO_2	808.7	823.7	839.9	857.5	876.7
	CH_4	0.0	0.0	0.0	0.0	0.0
	N_2O	0.0	0.0	0.0	0.0	0.0
	Total CO_2 eq.	811.4	826.4	842.6	860.4	879.5

GHG emissions from international bunkers are expected to increase by around 8.4 per cent by 2030 compared to 2010.

5.4. Assessment of aggregate effect of policies and measures

The total effect of implemented PaMs is presented in Table 5.32.

Table 5.32. Total effect of implemented and adopted PaMs, Gg CO_2 equivalent

	2015	2020	2025	2030
CO_2	2,711.2	2,761.5	2,757.6	2,756.8
CH_4	84.7	144.6	139.7	134.0
N_2O	86.9	114.9	43.4	43.7

The total effect of planned PaMs is calculated as the difference between the WM and WAM scenarios and is presented in Table 5.33.

Table 5.33. Total effect of planned PaMs, Gg CO_2 equivalent

	2015	2020	2025	2030
GHG	418.6	510.6	583.8	368.8

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

Estonia is using Joint Implementation (JI) and International Emissions Trading (IET). In April 2004 the Government approved the National Programme of Greenhouse Gas Emission Reduction for 2003-2012 (RT L 2004, 59, 990). On 5 May 2004 the Government approved the Ambient Air Protection Act (RT I 2004, 43, 298) where § 153 changed the Law for Ratifying the Kyoto Protocol and conditions and authorization were set for use of the Kyoto flexible mechanisms. Amendments to the Ambient Air Protection Act of 11 March 2007 regulate the use of JI and the issue of double counting concerning the linking of the EU Emission Trading Scheme with the Kyoto flexible mechanisms.

Regarding activities under Kyoto Protocol article 17, in August 2009 the Government decided to sell excess Assigned Amount Units through the Green Investment Scheme. A special working group led by the State Chancellery was created to develop environmentally friendly projects and programmes so as to offer these to potential buyers. Each agreement shall be approved by the Government and the Government will give the mandate to sign the Agreements to the Minister of the Environment.

The legal framework for the Green Investment Scheme is stipulated in the Ambient Air Protection Act. Also, the Kyoto Protocol Ratification Act adopted by the Riigikogu in 2002 established some conditions for International Emission Trading.

Estonia had entered into six agreements with different European governments and 15 agreements with different Japanese companies by February 2013. The proceeds received from these agreements are solely disbursed for Green Investment Scheme projects or programmes.

The primary fields of investments in frames of GIS include:

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

Estonia's national designated focal point for JI has been notified to the UNFCCC:

Ministry of the Environment
Narva mnt 7a
15172 Tallinn
Estonia

Ms. Birgit Aru
Climate and Radiation Department
Ministry of the Environment
Phone: +372 626 2956
Fax: +372 626 2801
Email: birgit.aru@envir.ee

Estonia has also submitted its Joint Implementation Guidelines to the UNFCCC secretariat. This document is available at
http://ji.unfccc.int/UserManagement/FileStorage/QJMAH2PV90E4TGI17O8CLFKWXUDRYZ.

CO_2 emissions in Estonia are below the Kyoto target and Estonia does not need to make any quantitative contributions. Estonia is a host country in JI and a seller in IET. Therefore Estonia does not have a budget for the total use of Kyoto mechanisms.

Table 5.34. Quantitative contribution of Kyoto mechanisms for first commitment period

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

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

The Government of the Republic of Estonia has approved and signed Memorandums of Understanding with the Netherlands (RTL, 06.08.2003, 90, 1341), Denmark (RT II, 06.10.2003, 25, 126), Sweden (RTII, 28.06.2005, 16, 49) and Austria (RTII, 07.11.2006, 22, 57) and an Agreement on Joint Implementation of Emission Reductions of Greenhouse Gases with Finland (RT II, 16.12.2002, 37, 183). On 1 May 2004 the Agreement on a Testing Ground For Application of the Kyoto Mechanisms on Energy Projects in the Baltic Sea Region was approved (II, 16.06.2004, 22, 92). Estonia is one of the Parties.

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VI

VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

6.1. Introduction

Climate change can already be perceived at a growing rate in Europe and around the world, with the average global temperature continuing to rise. As a result of climate change, the temperature of both land and sea will rise, and the amount, intensity and distribution of precipitation will change, bringing about a rise in the average sea level and the risk of coastal erosion. Natural processes will change, glaciers will melt, water scarcity will increase in certain areas and an expansion in desertification will be observed. According to various scenarios, the frequency of extreme weather phenomena will increase. Climate change will have profound economic and social consequences that will be more serious in some areas and sectors than elsewhere. The impact of climate change will presumably be stronger on certain social groups such as the elderly, the disabled and low-income households. The inhabitants of urban areas are more vulnerable to climate change, being threatened by risks related to heat waves, floods and the rise in sea levels. The increasing frequency of such phenomena is also likely to increase the scope of catastrophes, which will cause considerable economic losses, public health issues and deaths. In Northern Europe, climate change is likely to manifest itself in the following ways: a temperature rise larger than the global average; a decrease in snow and ice cover; an increase in river flows; the spread of southern species to northern regions and certain species coming under pressure or becoming extinct; and more frequent winter storms. In northern and north-eastern Europe, the amount of precipitation is expected to rise (by approx. 20 per cent per annum on average; considerably more in winter). Floods and erosion in coastal regions can be expected as well. In northern and north-eastern Europe, climate change may also bring about positive effects such as a decrease in energy demand for heating during cold periods, more rapid growth of plants and forests, and an increase in summer tourism. In order to benefit from this, adaptation measures will need to be taken.

Even though climate change is not likely to be as extreme in Estonia as in many other countries in the EU (notably in southern Europe) and around the world, and although some effects can be considered positive, we expect a continued rise in temperatures and a resulting decrease in ice and snow cover; more frequent heat waves and droughts in summer; more health problems and forest fires caused by longer heat waves; more storms and power failures; more floods; changes in vegetation, species and habitats; invasions of alien species (incl. new plant pests and infectious agents); and other adverse effects. This chapter discusses the possible impact of climate change on coastal areas, water management, forestry, peatlands, agriculture, the energy sector, industry, construction and infrastructure, public health and tourism. Detailed sector-specific analyses of possible climate change impact in Estonia still need to be carried out.

6.2. Estonian climate – observed changes

This overview describes the climatic changes in Estonia that have been observed in recent decades. 1966 was chosen as the start of the study period for numerous reasons: it was in that year that meteorological observations began to be conducted throughout the Soviet Union at uniform observation

times (synoptic observation times) – every three hours at 3:00, 6:00, 9:00 and 12:00 Greenwich Mean Time. A correction for wetting was added to every precipitation measurement. The series of observations since 1966 can therefore be considered homogeneous. Additionally, the data from this period are generally accessible in digital format from the database of the Weather Service of the Estonian Environmental Agency (EtEA). The data below contain extensive citations concerning climate change in Estonia from the recently published book *Eesti kliima minevikus ja tänapäeval* /The Estonian Climate in the Past and Today/.

Air temperature has increased at a more rapid rate in Estonia in the second half of the 20th century than the global average. Climate warming was especially intense from 1966-2010 (Figure 6.1). January characterises the highest increase in temperature. The annual average temperature has increased by 1.8 degrees. Statistically significant warming is also characteristic of April, July and August.

The monthly mean maximum and minimum temperatures have increased in parallel with average warming. It is interesting to note that the increase in the maximum temperature is higher from April to October (except June) while the same applies to the minimum temperature from December to February. The daily temperature range therefore indicates an increasing trend in the warm half-year, especially in April and May, while a decreasing trend can be noted in winter.

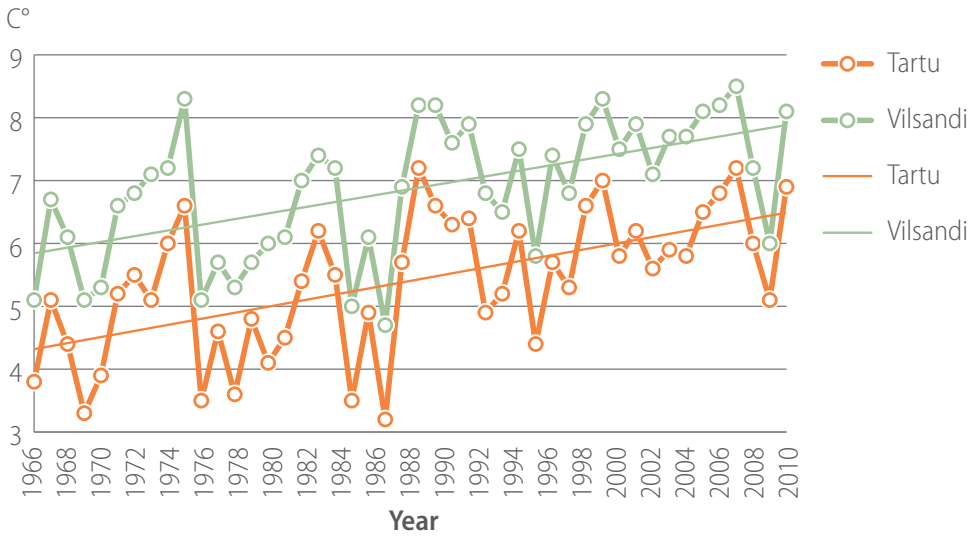

Figure 6.1. Time series of annual average temperature in Vilsandi and Tartu and their linear trends
Source: (Tarand et al., 2013)

Precipitation constitutes the climate indicator with the biggest variability in time and space. Large fluctuations of precipitation can be observed between single days, weeks, months, seasons and even years. The difference in precipitation between locations situated close to one another may be significant, especially in summer. As the measuring methodology of precipitation has changed over time, it is quite difficult to ascertain trends in precipitation. However, the opinion that the amount of precipitation in winter will increase in Northern Europe as the climate becomes warmer is generally recognised.

In the period 1966-2010, it is apparent that the increase in annual precipitation is statistically significant in some Estonian meteorological stations and insignificant in others. Precipitation has increased in certain areas – north-eastern Estonia, southern and south-eastern Estonia, along the shores of Lake Peipus and in the coastal areas on the Gulf of Riga. No significant increase has been noted in observation stations elsewhere. A positive trend has above all been noted in January and June, and to a lesser extent in February, March and August. However, a decreasing trend in precipitation has been observed in April, May and September. In summary, it may be stated that precipitation has somewhat increased in winter and summer and decreased in spring and autumn. The time series of territorially average precipitation in Estonia indicates periodic fluctuations of approximately 25-30 years (Figure 6.2).

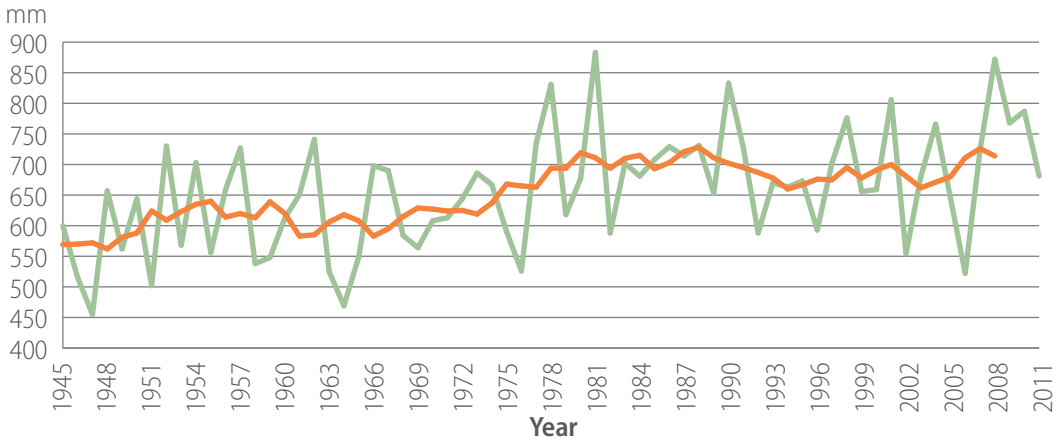

Figure 6.2. Time series of territorially average precipitation in Estonia from 1945-2012 and its seven-year moving average
Source: (Tammets and Jaagus, 2013)

Being aware of changes in extremities is often more interesting and practically necessary than being aware of changes in average precipitation values. It has been ascertained that events of extremely high and low values of precipitation became more frequent in the period from 1957-2009.

It is understandable that changes in snow cover are closely related to changes in air temperature and precipitation. As the air temperature increases, the number of days with snow cover should decrease and the snow cover itself should become more erratic. However, an increase in winter precipitation may result in thicker snow cover.

The duration of snow cover has generally decreased in Estonia in the last few decades, but due to its high variability this trend is not statistically significant. While a number of mild winters with little snow were recorded in the late 1980s and early 1990s, such winters have become scarcer in the last few years and snowy winters have become more frequent.

It is extremely difficult to adequately assess long-term changes in wind speed as it largely depends on the obstacles to wind situated close to the measuring site. However, research has been conducted into changes in wind directions in the period from 1966-2008. This indicates that the proportion of westerly and south-westerly winds has significantly increased in winter while the proportion of south-easterly and easterly winds has decreased (Figure 6.3).

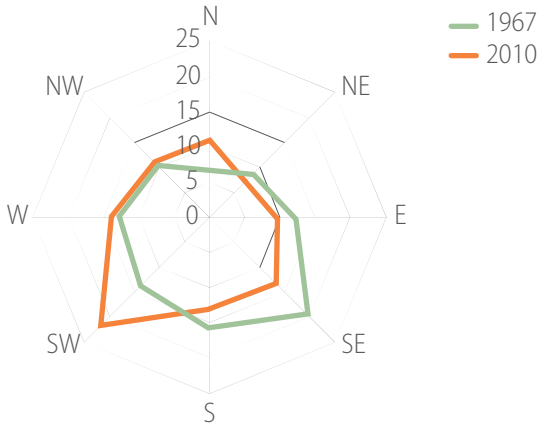

Figure 6.3. Winter wind rose changes based on data from Vilsandi, depicted according to trend of wind roses in 1966/67 and 2009/2010
Source: (Jaagus and Kull, 2011)

Extreme climate phenomena occur in Estonia from time to time. In summer, hot weather and unstable air stratification along with thunderstorms result in whirlwinds (tornadoes/waterspouts) of destructive force. In winter, the most hazardous climate phenomena have been powerful snowstorms accompanying cyclones, resulting in the obstruction and even closure of road traffic.

6.3. Expected impact of climate change

6.3.1. Coastal areas

The possible impact of climate change on coastal areas was considered in the overview of the impact of climate change on aquatic ecosystems and groundwater in Estonia prepared in 2012 on the basis of scientific papers related to climate change published by Estonian scientists. This subchapter cites the results of this research to a major extent.

The Estonian coastline is generally greatly partitioned and characterised by an abundance of various coast types and their rapid alternation. Estonia has over 1,500 islands, with a total coastline (including the islands) measuring *ca* 3,800 kilometres. The Estonian coast is also heavily affected by land uplift, which amounts to 2.8 mm per year in north-western Estonia. When considering the impact of the climate on the sea coast, three main aspects can be highlighted:

1. changes in sea level (long-term mean change as well as aperiodic changes resulting from storm surges);
2. changes in the hydrodynamics of the coastal sea, i.e. waves and currents; and
3. changes in ice conditions.

The global sea level rose by 1.6 ± 0.2 mm a^{-1} from 1961-2003 according to the adjusted estimate and, according to forecasts, will rise by an additional 0.8-2.0 metres by 2100. Regional sea level trends generally differ from the global average due to the uneven rise and fall of the Earth's crust. The main

hazards related to the rise in sea level are flooding of coastal areas, erosion of sand beaches and destruction of port and harbour structures. Several valuable natural ecosystems are also threatened, encompassing both marine and mainland ecosystems and including rare plant communities and bird nesting grounds. In various parts of the Baltic Sea the post-Ice Age land uplift is continuing at various speeds; on the Estonian coast, it remains from 0.5-3.5 mm a^{-1}, which is approximately equal to the rise in the global sea level.

In the Baltic Sea, the phenomenon of the temporary increase and decrease in the water level caused by winds plays a significant role in shaping the water level. Climate models predict increased warming for the 21st century and a cyclonic increase in Northern Europe accompanied by the strengthening of westerly winds during the cold half-year by 2-3 m/s and less during the warm half-year. Its impact on the water level is not particularly significant.

The most notable aperiodic phenomena are rises in the water level caused by storms, i.e. storm surges that are rapid, short-term (1-2 days) and local. They are above all related to strong south-westerly and westerly storms. A constant wind of 20 m/s blowing from a certain direction that is favourable to a bay brings about a steady inclination of the water surface and a stationary water level increase of approximately 92 cm at the end of the bay. A constant wind of 30 m/s can cause a water level increase of 240 cm. If these events are preceded by a generally higher water level throughout the Baltic Sea, the rise in the water level may amount to a catastrophic 250-300 cm. The water level in bays (e.g. the Gulf of Riga) is not linear compared to the wind speed; the rise in the level increases as the wind speed grows. Therefore, a gale blowing from a favourable direction at a speed of 29 m/s could cause an increase in the water level of 215 cm in the Gulf of Riga, while wind that is blowing just 1 m/s faster (30 m/s) would bring about a rise of 240 cm. If storm strength increases – which seems inevitable in the event of general warming of the atmosphere and an increase in energy – the maximum water levels are also likely to rise. For a very high water level to come about, not only the wind speed but also the path of a cyclone is important, i.e. the eye must pass a few hundred kilometres to the north of Estonia. Cyclones that pass directly over Estonia or from the south do not significantly increase the water level. Therefore, many conditions have to coincide, and the likelihood of such a phenomenon increases as the frequency of cyclones continues to increase.

The increased number of storms along with the higher water level and lack of ice cover during milder winters has had a significant impact on accretion and detrition processes along the Estonian coast. Ice suppresses the movement of the water surface and protects the coast from erosion caused by breaking waves. Research into the connections between hydrodynamic factors and the dynamics of coastal processes has indicated that the main changes on the coast take place over a few (1-3) stormy days during the year, as heavy storms and high water levels are short-term phenomena in Estonia and the quadratic dependence of effort on speed means that the impact of storms is drastic. Periods of rapid development generally alternate with long-term stable conditions on the Estonian coast. During storms, damage is also significantly increased by the fact that high-speed currents and storm waves that are fundamental to coastal erosion and sediment transport generally affect the coast 1-2 m above the average coastline.

6.3.2. Water management

In the following subchapter the results of estimations of the impact of climate change on water resources in Estonia are presented (Country Case Study on Climate Change Impact and Adaptation Assessments in the Republic of Estonia). River runoff is one of the main characteristics describing available water resources. Additionally the impact of possible climate change on the groundwater level and recharge has been analysed.

6.3.2.1. River runoff

The annual runoff series of Estonian rivers indicate considerable variability in the time scale caused by precipitation and evaporation fluctuations. Two kinds of periodical fluctuations of river runoff and water level can be observed: 1) short-term fluctuations with a duration of 3-4 years; and 2) long-term fluctuations with a duration of 26-32 years.

In southern and eastern Estonia, the modelled annual curve of runoff is similar to the baseline (1961-1990). There, changes in the annual course of runoff will be less remarkable. The runoff maximum in spring will move to a month earlier, but will not decrease.

Northern Estonia is typical of a limestone plateau and karst region. It has a great groundwater inflow that slows the runoff decrease after the spring maximum and increases the level of runoff minimum in summer. Both the maximum in spring and the minimum in summer will shift to earlier in the event of climate change. In the case of climate warming, the spring maximum should diminish while the autumn maximum will increase and become the main one for the year.

Possible changes in the annual course of runoff should be more substantial in western Estonia, in areas with a maritime climate. Instead of two maxima (spring and autumn) and two minima (winter and summer) there will only be two main hydrological seasons – the maximum during the cold half-year (November-April) and the minimum during the warm period (May-October).

Table 6.1. Ratio between maximum and minimum of monthly mean runoff values for baseline period and modelled for 2100 using HADMID scenario

Region	Baseline (1961-1990)			Modelled for 2100			Modelled/observed		
	Max	Min	Max/Min	Max	Min	Max/Min	Max	Min	Max/Min
Southern Estonia	1.64	0.34	5.07	1.44	0.45	3.36	-0.20	0.10	-1.71
Eastern Estonia	2.44	0.27	9.55	1.80	0.33	5.78	-0.64	0.06	-3.78
Northern Estonia	1.87	0.39	5.13	1.59	0.46	3.61	-0.27	0.06	-1.52
Western Estonia	2.33	0.27	8.80	1.79	0.34	5.35	-0.53	0.07	-3.45
Western Estonian archipelago	2.11	0.25	8.44	2.01	0.24	8.38	-0.10	-0.01	-0.06

This indicates that a remarkable change in minimum runoff is not projected in the case of climate warming, but the decrease in maximum runoff may be significant for all regions of Estonia except the western Estonian archipelago (Table 6.1). This means that the ratio between the Q_{max} and Q_{min} will decrease. We can draw the following conclusions:

1. the results show that the increase in precipitation on discharge is more pronounced in autumn and the effect of temperature in winter, especially in the western part of Estonia;
2. the small rivers and brooks in the western Estonian archipelago and the western coastal area are the most vulnerable to decreasing runoff during the first half of the summer minimum runoff period; and
3. predicted changes in river runoff indicate a practically zero marginal effect on water supply in Estonia, because total annual runoff will increase markedly and the seasonal variability of run-off will decrease.

6.3.2.2. Groundwater

Assessment of possible climate change on the groundwater regime and groundwater resources in Estonia was determined in two ways:

- impact on the groundwater table; and
- change in groundwater recharge, i.e. the infiltration rate of precipitated water.

Changes in the mean annual groundwater level and their seasonal variability have been calculated for three incremental scenarios (T +4°C and P 0%; T +4°C and P +20%; and T +4°C and P -20%). The long-term data (1961-1990) collected from the four groundwater observation sites in different landscape and geohydrological regions were used for groundwater table fluctuation analysis and climate change impact modelling (Table 6.2).

Table 6.2. Observed and modelled annual mean groundwater level in studied wells using GCM scenarios (meters from land surface)

Observation region	Baseline	T+4°C, P 0%	T+4°C, P +20%	T+4°C, P -20%
VK214 (Väike-Maarja)	-3.08	-2.65	-2.51	-2.97
Modelled - Baseline	*	**+0.43**	**+0.57**	**+0.11**
VK999-C (Tooma)	-16.59	-16.65	-15.10	-15.76
Modelled - Baseline	*	**-0.06**	**+1.49**	**+0.83**
VK1165 (Õisu)	-1.78	-1.73	-1.62	-1.87
Modelled - Baseline	*	**+0.05**	**+0.16**	**+0.09**
VK1207 (Piigaste)	-3.51	-3.36	-3.32	-3.76
Modelled - Baseline	*	**+0.15**	**+0.19**	**+0.25**

The predicted increase in groundwater recharge and attendant rise in the groundwater table will simultaneously be conducive to and complicate water management in some rural areas where centralised water supply systems have not yet been built. In Estonia, the majority of the rural population obtains its domestic water from shallow wells. Owing to the rise in the groundwater table, both the productivity and reliability of shallow wells will be significantly improved.

On the other hand, the rising of the groundwater table and thinning of the aeration zone will make it more difficult to cultivate arable land suffering from excessive moisture in time,

especially in lowland areas. The thickness of the aeration zone – which mostly varies from 1-3 m in Estonia at present – will be reduced by half on average and the total area of wetlands will significantly expand due to the increase in infiltration. To guarantee the productivity of agriculture and forestry, extensive amelioration should be carried out in the coming decades. Therefore, it is necessary to reconstruct almost all of the existing drainage systems on agricultural land which will be used.

It may be expected that as a result of climate change the relative increment of groundwater recharge will increase depending, in general, on the hydrogeological conditions of catchments by 20-40 per cent on average, due to the shortening and warming of the winter period. The most intensive accretion of groundwater recharge occurs in western Estonia (the Kasari and Keila river basin), as well as in northern Estonia, especially the karstified Pandivere uplands (the Valgejõgi and Jägala river basin). Owing to climate change the ratio of groundwater recharge to total surface runoff will increase from 30 per cent to 40 per cent.

6.3.2.3. Integrated water management

The estimated total water demand does not exceed the river runoff values in any climate change scenario. In general, potential climate change will not cause any serious consequences for water quantity resources in Estonia.

Changes in hydrological conditions should also be translated into changes in the ecology of waterbodies, because a number of ecological processes depend on hydrological conditions. It can be concluded that a positive impact of climate warming on the ecological state of waterbodies will prevail in Estonia (Table 6.3). The most negative consequences are related to the lengthening of the period with minimum runoff in summer. If minimum runoff increases, it will act as a positive factor for the water management of rivers, especially for wastewater discharge and recreational use.

Table 6.3. Summarised conclusions of climate change impact on water regime and water management

Change	Positive impact	Negative impact
Increase in winter minimum runoff	Favourable ecological conditions in waterbodies	Unstable ice cover and thermal regime
Decrease in maximum runoff in spring	Diminishing of floods in spring	Lengthening of period with minimum runoff in summer
Lengthening of period with minimum runoff in summer	Better ecological conditions in drained forest areas	Unfavourable ecological conditions in small rivers and shallow lakes
Increase in maximum runoff in autumn	Favourable ecological conditions in water bodies	More floods in autumn and inadequate drainage of agricultural land
Changes in agricultural discharge	Smaller peak flow in spring, diminishing of pollution load and wash-out of fertilisers	Problems for farmers during harvest period in autumn
Water level changes	Decrease in flooded areas around lakes during high water periods	Possible drop in water level below ecologically optimal limit in shallow lakes by end of summer

6.3.3 Forestry

Approximately half of the Estonian mainland is covered in forests, which play an important role in the country's economy and environmental protection. The proportion of forests in the total area of the country has increased steadily over the last 60 years and by around a third since the 1950s. This increase has mainly been due to the abandonment of grasslands and the overgrowing of wetlands. Pine, birch and spruce are the dominant tree species in Estonia.

The more frequent and lengthened spring/summer drought periods favour the development of root rot and the reproduction of bark beetles and raises the fire risk in forests. In addition to several local Estonian pests, the rise of temperature in summer and milder winters also create potentially favourable living conditions for those that have generally appeared en masse in southern Estonia.

Heterobasidion annosum and honey fungus, which cause root rot, are the biggest threats among the plant pathogens and diseases found in Estonian forests. The stress caused by water shortages due to root damage in the drought period makes trees vulnerable to stem pests. Until the middle of the last century, root rot occurred mainly in spruce forests, although there is also data on damaged pines, junipers and deciduous trees. Spruce forest stands are currently even more damaged, but pine forest stands are also suffering from root rot. It is estimated that even more coniferous forest stands will be infected in the future, leading to greater economic damage.

Although insect damage forms a small part of all damage to forest stands, the area of spruce forest stands damaged by the European spruce bark beetle has increased over the last few decades. The numbers of this insect species have been affected by the development of two generations per summer instead of one generation, as was prevalent earlier. Favourable meteorological conditions during the flight period of the insect at the end of April and beginning of May and the impact of drought on trees, as an indirect cause, also play a significant role. During the flight period, even a short period of dry and warm weather provides the insect with good preconditions for successful development and, along with the spread of root rot, the beetle continues to cause additional damage to forests.

Taking into consideration the frequency of forest fires, Estonia's forests are divided into areas of high, medium and low fire risk. Human activity is the most common cause of forest fires. As damaged forest stands have generally been felled at the right time to date, potential massive post-fire reproduction of forest pests has been avoided. 60% of forest fires occur in May and June; as such, the increase in the frequency of spring/summer droughts also increases the risk of forest fires.

In the case of overly moist Estonian forest site types, trees have generally been felled when the ground is frozen. Due to the shortening of winter periods with low temperatures, Estonia's forest soils do not freeze to a sufficient depth, which may bring about greater damage to the soil in the course of felling work than in previous periods. The negative impact can be mitigated by means of maintaining drainage systems in order for tree roots that are raised due to high groundwater to be able to penetrate deeper into the soil. As a positive effect, this will make forest stands more resistant to storms. The post-felling processing of tree stumps with tree rot antagonists is important in order to reduce tree rot damage.

Research has verified that pine and spruce also grow well in habitats with temperatures 5 °C higher than in Estonia, provided that growth is not accompanied by drought periods. A possible rise in temperature will therefore not bring about significant changes in the tree species of Estonian forests. However, changes in the proportions of species are possible. Due to the change in natural conditions, the conditions will improve for species in Estonia that are at the northern edge of their natural habitat and which have been rare in Estonia to date; likewise, conditions will decline or become unsuitable for species that are at the southern edge of their natural habitat. Based on the above, forest management and protection strategies need to be constantly updated and implemented.

6.3.4. Peatlands

Peatlands form the majority of Estonia's wetlands, in addition to coastal wetlands, deltas and some floodplains. The total area of peatlands amounts to 1,009,101 ha, i.e. 22.3 per cent of the territory of Estonia. During the last hundred years, approximately 70 per cent of mires in Estonia have been drained for various reasons, thereby increasing their susceptibility to changes in meteorological conditions. In Central and Eastern Europe – regions where snow traditionally forms a large part of the annual volume of precipitation – the proportion of rain has constantly increased due to warmer winters in the last few decades, bringing about increased river runoff and more frequent flooding (Impact of climate change on aquatic…, 2012).

Seasonal changes (the formation, duration and melting of snow and ice cover) have a major impact on the nutrient supplies and inflow of wetlands and the biological processes related to them, including peat formation. Recent studies suggest that nutrient-poor peatlands may accumulate more carbon in warmer climatic conditions and that nutrient-rich peatlands may potentially serve as additional sources of carbon in the atmosphere (Impact of climate change on aquatic..., 2012).

Peat production is an important industry in Estonia, and its turnover is directly related to meteorological conditions. Due to climate change, the winter snow water supply decreases, resulting in an earlier decrease in the water level in spring and the lengthening of the period of peat production. However, greater climate variability is predicted due to climate change; therefore the number of days suitable for peat production per year may differ even more than it currently does. More frequent drought periods with extremely high temperatures in the summer may cause a suspension of production for fire safety purposes, so it is essential to be prepared for a heightened risk of bog fires (above all peat bogs).

6.3.5. Agriculture

It is difficult to assess the overall impact of climate change on agriculture in Estonia. Climate change will mainly impact plant production and grasslands, and both positive and negative factors may occur. Taking into consideration the latitude of Estonia, the positive factors accompanying climate warming will probably dominate at first.

The increase in temperature and in the volume of precipitation will have a positive effect on grassland productivity. According to estimates, a rise in the average annual temperature by 1°C may improve the dry matter harvest of perennial forage crops by as much as 0.17 tons per hectare. The growing period will be lengthened and a higher number of cuttings will be available from grasslands – three times instead of the two in the last few years. Increased temperatures and a higher volume of precipitation will result in the acceleration of growth and development of graminaceous plants and the suitable harvest time will shift to an earlier period. This will ensure better fodder for livestock in summer and winter. However, due to the importance of livestock farming, grazed grasslands will be more sensitive than mown meadows to climate warming that brings about drought periods.

An increase in the average temperature will lengthen the vegetation period and the sowing and harvest periods. In the vegetation period, more heat than is necessary for the growth and development of plants will accumulate. The development of arable crops will quicken and the vegetation period will shorten. According to research, the optimal sowing period will shift forward by 4-11 days on average, and in order to achieve the maximum harvest the entire vegetation period should be lengthened by 10-30 days on average. This will help use arable land more efficiently and disperse the workload of agricultural producers. The lengthened vegetation period will additionally allow for the growing of new plant species and varieties in Estonia.

The possible negative effects of climate change on agriculture are above all an increase in the frequency of extraordinary meteorological phenomena (droughts, excessive moisture, flooding etc.) and the spread of plant diseases, plant pests and infectious animal diseases. Climate change may also affect the numbers of pollinators and their population diversity.

As Estonia's meteorological conditions on average are close to optimal for the primary plant species grown, there are negative manifestations for various meteorological factors in relation to extreme meteorological phenomena. For example, drought and excessive moisture alike could reduce a harvest in the same year.

In the vegetation period, the water requirement of arable crops will increase and the risk of ground desiccation may arise, especially from May to July. Soils with a lighter structure will suffer most.

As the average temperature rises, especially in winter and early spring, plants and animals will become more susceptible to pests and diseases. The possibility of the spread of diseases from southern regions will rise. For example, bluetongue disease, which to date has commonly been found in the Mediterranean, has spread to Central and Northern Europe in relation to climate change and the adaptation of the virus. The bacterial disease caused by the *Erwinia amylovora* bacteria poses a great threat to Estonian Rosaceae trees and bushes. This bacterial disease, originating from North America, is considered to be one of the most dangerous fruit tree diseases in the world, and is now also common in Europe.

Despite the hazards, Estonian agriculture will most likely be initially more productive and competitive as a result of climate change.

6.3.6. Energy, power supply and industry

Climate change will have a varied impact on the energy sector. On the one hand, the rise in winter temperatures will reduce the consumption of heat energy in the cold half-year, while higher temperatures in summer and more frequent short-term heat waves (7-10 days on average) will increase the need to cool buildings, for which electricity will be consumed. It should be considered at this point that the decline in the need for heat energy will not be proportional to the rise in the winter temperature, as a higher winter temperature is above all related to windy weather and the spread of warm and damp air over Estonia. An additional amount of energy is required to retain a comfortable temperature due to higher humidity and greater wind speed. It should also be considered that as the energy consumption of buildings decreases, the heat losses in district heating networks will be proportionally larger than in the case of maximum consumption during cold winters. The heat losses from old and depreciated district heating utility lines may also increase due to the fact that the ground above the utility lines does not freeze during mild winters and rainwater seeps into the soil throughout the season, thereby increasing the thermal conductivity of the soil.

In power supply, climate risks are above all related to the transmission network and the distribution network. Electricity distribution losses will increase to a small extent on overhead transmission lines due to higher humidity and higher summer temperatures while more frequent storms may bring about more interruptions to supply. The expected storm damage will mainly become more frequent in the winter period and in areas with marshy soil where the ground does not freeze in mild winters, which are hard to access and where the risk of wind throw is great. An alleviating measure is building cable lines that are more resistant to smaller trees and branches that are uprooted or broken off during a storm and less affected by transmission losses caused by precipitation and humidity (CCSP, 2007). In addition to increased wind load, when planning transmission networks and posts it should also be considered that glaze or freezing rain may occur more frequently during mild winters, creating a layer of ice on posts and power lines. The thickness of the layer may even exceed 70 mm and will add a weight of more than 415 grams per running metre of power line. A glaze layer of 20 mm is already considered to be a particularly hazardous meteorological phenomenon.

The winter climate that accompanies climate change may also affect the price of the raw materials used to produce energy. The price of woodchips may rise in the event of erratic weather in winter as the forests with low site quality that are the most suitable for producing woodchips are often situated in excessively moist areas where the ground does not freeze sufficiently during mild winters and the raw materials may become inaccessible to heavy forestry equipment. However, a longer vegetation period favours the growth of herbaceous biomass; in bioenergetics it may therefore be more advantageous to use herbaceous biomass more extensively, either by means of biogas or direct combustion. The meteorological conditions for producing peat will become more favourable on average as the period of high transpiration in the summer will lengthen. At the same time, year-to-year variability will increase and it is therefore possible that in some years the production of peat will be impracticable.

Among other sources of renewable energy, wind power will benefit most from climate change as wind speeds in the cold half-year – when demand for energy is high – have shown a clear increasing trend; however, when building wind farms it is also important to note the changes in wind direction in order not to lose the potential extra energy arising from increased speed due to incorrect placement of wind turbines, which could result in mutual hindrance of the operation thereof.

6.3.7. Construction work and infrastructure (highways, ports, bridges, water supply and sewerage and telecommunications)

The expected impact of climate change on construction work and infrastructure will above all become apparent in winter. The most important impact will be the replacement of stable winter weather marked by sub-zero degrees with variable weather marked by thaws and sub-zero degrees alike, accompanied by a change in the character of winter precipitation – the probability of slush, wet snow, glaze and freezing rain increasing. When coming into contact with frozen road surfaces (as well as bridges and overpasses), precipitation of this kind causes slipperiness; there will be an increased need for equipment used for de-icing and for salt/chemicals, which in turn will have a negative impact on the surrounding natural environment and the durability of the road surface. The costs of maintaining infrastructure will rise due to the increased necessity for de-icing, the longer period of the freeze/thaw cycle and a higher moisture content of the track formation caused by the higher water level in the autumn/winter. Attention should be turned to the increase in the frequency of intense snowstorms in conditions of climate change, which will presumably cause more frequent arrival of southern cyclones to our latitude –meaning that the occurrence of such intense snowstorms will become more frequent, above all at the start of winter (Paljak, 2007; Mändla et al., 2012).

It is essential to take into consideration the snow load caused by deep snow on construction work, especially of production buildings and warehouses with large roof areas. The arrival of humid air masses with a western flow will bring about frequent and intense snowfall at temperatures around 0 degrees, which favours the accumulation of a thickened snow layer on roofs with a low angle of inclination and on articulated roofs (Handbook of Estonian snow cover, 2006).

A shorter period with snow cover and the faster transpiration of soil water caused by higher temperatures in summer will bring about a decline in the productivity of the upper groundwater layer; thereby wells may remain dry in low-density areas and karst areas. Investments must therefore be made in the construction of a public water supply or bore wells.

However, southern cyclones accompanied by individual, intense periods of rain may be forecast in summer periods in high temperature conditions. Due to the limited capacity of rainwater piping, this may lead to local flooding in lower-lying parts of cities. In order to avoid such situations, it is expedient to take into consideration the construction of rainwater systems with a higher capacity in future planning processes.

In aviation, flights may be delayed or cancelled more frequently due to weather risks, and an increase in the cost of organising air traffic and maintaining runways may be expected. Thick fog and

low-level clouds that worsen visibility will become more frequent during the cold half-year, especially in coastal regions. Similarly to road traffic, southern cyclones accompanied by intense snowstorms may become more frequent and pose a hazard in the first half of the winter; such storms may hinder the maintenance of runways for up to an entire day.

6.3.8. Human health

No extensive research has been conducted in Estonia in relation to the impact of climate change on human health. However, for example, a Master's thesis was defended in 2013 at the University of Tartu on the topic 'The extremely hot summer of 2010 in Estonia and its impact on all-cause mortality'. Much research has been carried out in other Northern and Eastern European countries, and the results of these analyses can also be applied to Estonia. No significant impact can be foreseen on human health, yet some trends are noteworthy.

Health damage suffered during extremely hot weather may cause heat stroke and intensification of chronic illnesses or even be lethal. The main causes that have increased mortality during heat waves have been cardiovascular, cerebrovascular and respiratory diseases. Such weather may also increase mortality due to external causes, including deaths resulting from drowning as people attempt to cool themselves more often in bodies of water. High summer temperatures affect people's choice of clothing and the amount of time spent outdoors. People may therefore be more exposed to ultraviolet radiation, which in turn increases the frequency of sunburn and skin cancer.

The rise in the average autumn, winter and spring temperatures will probably have a positive impact on Estonians: mortality related to cold winter weather may decline. Milder winters also reduce the risk of mortality due to heart, cardiovascular and respiratory diseases as the number of very cold days is reduced. However, the common view is that the constant grey, snowless and gloomy weather and more frequent rainfall in winter contribute to seasonal depression becoming more frequent and severe.

Changes in the prevalence of infectious diseases are one of the first signs of the impact of global climate warming on human health.

Research conducted in Sweden indicates a correlation between a slight increase in temperature and an increase in cases of tick-borne encephalitis. As a result of efficient vaccination, the prevalence of this disease in Estonia has decreased substantially. On the other hand, the prevalence of Lyme disease has significantly increased. Studies have also shown that a rise in the annual temperature results in a higher density of ticks, which is an important factor in transmitting these diseases.

A suitable climate is an important precondition for the arrival, formation and spread of 'exotic' diseases in Europe. For example, although cases of malaria have not been observed in Europe since the second half of the 20th century, mosquitoes that are potentially malaria-carrying exist in most regions of Europe. In relation to climate warming, a seasonal spread of malaria from Turkey and Azerbaijan to Eastern European countries may come about and thereby increase the prevalence of

this disease unless respective inspections are in place. This will increase the spread of malaria in airports in particular when people infected by mosquitoes travel by plane.

Leishmaniasis, endemic to Mediterranean countries, has also become topical. Climate warming increases the risk that this disease will spread further north. Climate warming will also most likely accelerate the spread of human-borne infectious diseases such as tuberculosis and HIV as people travel to new locations to escape drought and other consequences of climate warming. Warmer springs and summers and milder winters caused by climate change may also result in an increased number of cases of gastrointestinal diseases.

Climate change could also increase the risk of food- and waterborne diseases in various regions of Europe. Higher water temperatures increase the growth rate of certain pathogens, which can result in an increased number of cases of salmonellosis and campylobacteriosis. Interruptions to the drinking water supply and sewerage may occur during more frequent flooding and heavy rain, which could result in a decline in the quality and safety of drinking water. For example, being infected with cryptosporidiosis is associated with water sources that are polluted during heavy rain.

6.3.9. Tourism

The impact of climate change is above all apparent in the case of domestic tourists and tourists from nearby regions who are able to plan their activities according to the weather. Seasonal tourist behaviour will change: mild snowless winters with erratic weather will reduce winter tourism, especially in southern Estonia and around Aegviidu, where winter sports have traditionally formed a significant proportion of the annual tourism flow (Vassiljev et al., 2010). However, the lengthening warm period in the summer will promote summer tourism. Domestic tourism and tourism from nearby regions will therefore be more concentrated in the summer and the winter flow of tourists – which is preferable in terms of equalising the load – will decrease. No significant changes are forecast in holiday expectations, as seaside resorts are unable to compete with southern destinations due to the erratic weather. Extensive, toxic blue-green algae blooms in warmer seawater may also pose a serious problem for coastal tourism.

6.4. Vulnerability

To date, there have not been many risk analyses concerning vulnerability to climate change in Estonia. In the European Environment Agency report 'Climate Change, impacts and vulnerability to climate change in Europe 2012', Estonia is considered to be among countries with no or marginal potential vulnerability to climate change.

From 2009 to 2011 an EU project 'Baltic Challenges and Chances for local and regional development generated by Climate Change – BalticClimate' was implemented to enable municipalities, regions and local stakeholders in the Baltic Sea region to deal with the issue of climate change in an

integrated, cooperative, and sustainable way, in terms of day-to-day business as well as long-term strategies. The focus was on small and medium sized cities and rural areas and their surrounding regions within the Baltic Sea Region.

One of the project's objectives was to identify how the climate change phenomenon would also present opportunities and not only obstacles for the development of municipalities and regions when they are accounting for climate change information in their long term strategies and planning. BalticClimate, originally a project within the Baltic Sea Region Programme 2007-2013, was awarded status as part of a flagship project that anticipates regional and local impacts of climate change through research within the EU Strategy for the Baltic Sea Region. In Estonia the project was transnationally managed by the Tallinn Centre of Stockholm Environment Institute.

A spectrum of actors of key institutions and authorities participated in a number of exercises making up the vulnerability assessment on climate change focussing on the sectors of agriculture, energy, housing and transport.

The vulnerability assessment[1] was based on a participatory approach in order to study factors that limit or facilitate local ability to manage climate through mitigation and adaptation strategies. Seven local/regional level assessments were conducted in the Target Areas supported by similar material and guidelines and previous introduction by an external scientific team. The supporting material[2] consisted of information for two climate change scenarios A2 and B2 using the regional climate model RCA3 (Kjellström et al., 2005) with boundary conditions from the global models ECHAM4 and ECHAM5 from the Max-Planck Institute in Meteorology. Guidelines were provided for participatory activities outlining how to perform a systematic assessment of the local/regional challenges and chances for future development. It consisted of an integrated vulnerability framework which included ten concrete exercises highlighting key aspects in such an assessment such as visions of future society, exposure to climate and socioeconomic stressors, social sensitivity, adaptive capacity, key stakeholders and division of responsibility as well as facilitating factors and barriers to creating adaptation measures.

The Estonian Target Area (TA) did not choose one IPCC storyline explicitly but according to Estonian TA predictions of increasing population, Asia-pulled global economic growth with growing role of local communities and increased environmental awareness, Estonia's future scenario was to be positioned in the middle of the proposed four scenarios. Out of the identified climatic and socioeconomic stressors the activities, or sectors, that were seen to be most sensitive were the agricultural sector and the infrastructure. These areas were by far, influenced by the most stressors, which in turn made them highly sensitive. The agricultural sector was seen as being affected through decreased productivity, changing species, increasing periods of rain and loss of nutrients. In the case of infrastructure no similar details were elaborated on how it would be affected.

[1] Alberth, J., Wilk, J., Vihma, M. & Hjerpe, M. (2011). Climate Change Impact and Vulnerability Assessment. Experiences from Target Areas. Report and Online Publication of the EU Project BalticClimate.

[2] For details see: Alberth, J., Vihma, M., Wilk, J., Strandberg, G. & Hjerpe, M. (2012): Final Supporting Material for Climate Change Impacts and Vulnerability Assessment. Guideline/Report and Online Publication of the EU Project BalticClimate.

6.5. Adaptation measures

6.5.1. National efforts

6.5.1.1. National strategies and development plans

To date, Estonia has largely been engaged in preparing for emergencies and mitigating climate change (reducing greenhouse gas emissions) and has no separate strategy or action plan for adaptation to the impact of the climate change. Various projects have been and continue to be implemented, and the effects of climate change have been discussed in numerous research papers, but the information is scattered between areas and agencies. Some of the adaptation measures are discussed in the following acts, area-related strategies and action plans:

- Emergency Act;
- Water Act (areas exposed to floods);
- Development Plan of the Area of Government of the Ministry of the Interior for 2013-2016;
- Estonian Environmental Strategy 2030;
- Estonian Forestry Development Plan until 2020 and its Action Plan;
- Nature Conservation Development Plan until 2020;
- Ministry of the Environment Development Plan 2013-2016;
- National Environmental Action Plan of Estonia 2007-2013;
- Action Plan for Mitigation of and Adaptation to Climate Change in the Agricultural Sector;
- Public Health Development Plan 2009-2020;
- Estonian Rural Development Plan 2007-2013;
- National Security Concept of Estonia 2010.

In preparing to adapt to climate change, Estonia has actively dealt with *ensuring preparedness for emergencies and crisis management* at the national level. The crisis management field is regulated by the Emergency Act, which entered into force in 2009 and which provides the legal basis for crisis management, including for preparing for and resolving emergencies and ensuring the continuous operation of vital services. The Act also regulates the declaration, resolution and termination of emergency situations. The crisis management field is a so-called horizontal field where each ministry is responsible for the implementation of the activities related to crisis management in their field of governance, with the Ministry of the Interior as the co-ordinator. The Crisis Committee of the Government of the Republic, the regional crisis committees and the crisis committees of the local government have certain functions as well. Under the Emergency Act, *emergency risk assessment* and *response plans* must be prepared. The Government of the Republic has established a list of emergencies for which risk assessments are prepared and has appointed the leading and other involved agencies to prepare emergency risk assessments and response plans. The emergencies specified in Table 6.3 are related to weather.

Table 6.3. Weather-related emergencies on list of emergencies

Emergency	Risk assessment prepared by
Extensive forest or landscape fire[3]	Rescue Board
Flood in densely populated area[4]	Rescue Board
Storm with severe consequences[5]	Rescue Board
Mass injuries or deaths upon formation or break-up of ice	Rescue Board
Epidemic[6]	Health Board
Extremely cold weather[7]	Rescue Board
Extremely hot weather[8]	Health Board
Mass influx of refugees to state	Ministry of Social Affairs
Events abroad threatening life and health which affect large numbers of Estonians	Ministry of Foreign Affairs

In addition, other emergencies and existing risk assessments are indirectly associated with extreme weather phenomena (coastal pollution due to storms, poisoning etc.).

On the basis of the risk assessments, the Ministry of the Interior prepares a summary of emergency risk assessments for submission to the Crisis Committee of the Government of the Republic for approval. The Summary of Emergency Risk Assessment 2013 prepared by the Ministry of the Interior analysed the following emergencies in connection with climate change: extensive forest and landscape fires; storms; floods in densely populated areas; mass injuries or deaths upon the formation or break-up of ice; epidemics; extremely cold weather; extremely hot weather; and the mass influx of refugees to the state (incl. due to natural disasters).

Emergency response plans represent the second most important activity after risk assessment when preparing for emergencies. The following emergency plans have been prepared to respond to weather-related risks: 1) extensive forest or landscape fire emergency plan[9]; 2) storm emergency plan[10]; 3) densely populated area flood emergency plan[11]; and 4) emergency plan for mass injuries or deaths upon the formation or break-up of ice[12].

The law also regulates the *liability of agencies upon ensuring vital services*. The organiser of a vital service must regularly prepare and submit to the Ministry of the Interior an overview of the status of organisation for the continuous operation of a vital service. The provider of a vital service is in charge of compiling a risk assessment of continuous operation and for the preparation of a continuous operation plan. Continuous operation risk assessments and plans of vital service providers were prepared for the first time in 2011, and on the basis thereof an overview of the status of the continuous operation of vital services was compiled.

[3] Rescue Board 2013, Emergency Risk Assessment: Extensive Forest or Landscape Fire
[4] Rescue Board 2013, Emergency Risk Assessment: Flood in Densely Populated Area
[5] Rescue Board 2013, Emergency Risk Assessment: Storm with Severe Consequences
[6] Health Board 2013, Emergency Risk Assessment of Epidemics
[7] Rescue Board 2013, Emergency Risk Assessment: Extremely Cold Weather
[8] Rescue Board 2013, Emergency Risk Assessment: Extremely Hot Weather
[9] https://www.siseministeerium.ee/public/HOLP/Metsa-voi_maastikutulekahjust_pohjustatud_hadaolukorra_LP.pdf.
[10] https://www.siseministeerium.ee/public/HOLP/Tormist_pohjustatud_hadaolukorra_LP.pdf.
[11] https://www.siseministeerium.ee/public/HOLP/Uleujutusest_pohjustatud_hadaolukorra_LP.pdf.
[12] https://www.siseministeerium.ee/public/HOLP/Jaa_tekkimisest_voi_lagunemisest_pohjustatud_hadaolukorra_LP.pdf

In 2011 the Ministry of the Interior prepared an analysis of the Emergency Act for the purpose of analysing how the Act and its implementing acts had been implemented in practice in the previous two years and what the impact on society thereof was. The analysis highlighted the main substantive problems upon enforcing the Act as well as possible proposals for solutions.

In 2013 the business law firm Sorainen composed a legal analysis of the crisis management field at the request of the Ministry of the Interior which focused on the organisation of national crisis management as a horizontal field and the implementation of measures established in responding to emergency situations.

A number of emergency training events involving various parties were held from 2010-2012 to check the preparedness of the state to respond to emergencies. As a result, proposals to improve the system have been made.

New equipment to eliminate the consequences of storms and floods has been acquired.

Some websites have been created in Estonia for giving information to stakeholders:

- http://www.rescue.ee/loodusjoud provides information about major accidents and emergencies in Estonia. On the website, agencies and authorities publish notices about their response to emergencies and provide guidance on how to cope with various emergencies, including extreme weather conditions (snowstorms, thunderstorms, floods, earthquakes and frost);
- The real-time sea level information system http://on-line.msi.ttu.ee/kaart.php?en provides information about the sea level in various parts of Estonia.

The Development Plan of the Area of Government of the Ministry of the Interior for 2013-2016 sets out goals for the further development of crisis management. Among others, the following measures are planned for 2013-2016: the introduction of a uniform methodology for the assessment of planning which takes into account the results of emergency risk assessments; preparing the regional parts of emergency risk assessments; updating the emergency risk assessments prepared by the Rescue Board; development of a system of measures for the assessment of crisis management effectiveness; introduction of crisis management software for the performance of rescue work and the resolution of emergencies; advising local governments on the organisation of the work of crisis committees and other crisis management issues in order to ensure the establishment of crisis committees in all local governments; the annual organisation of at least one staff training event and at least one regional crisis management training event in each rescue centre; the annual organisation of a training event for the crisis response team and staff of the Rescue Board in the crisis management working environment; and the creation of formal education on crisis management.

In 2012 the Government established a national spatial plan titled 'Estonia 2030+' and its action plan. The major global developments of spatial impact highlighted in the plan include climate change.

In connection with the implementation of Directive 2007/60/EC, the Ministry of the Environment has assessed floods that have occurred in Estonia, ascertaining those with a serious adverse impact and, in accordance with Directive no. 75 of the Minister of the Environment of 17 January 2012, 20 areas with flood exposure were identified. In addition, flood danger lists and risk lists of exposure areas must be prepared by the end of 2013 and risk area management plans aimed at reducing the likelihood of floods and their impact on human health, the environment, cultural heritage and economic activities must be prepared by the end of 2015.

Since the results of climate change could affect the attainment of the goals established in the Water Framework Directive, the impact of climate change will be integrated into updated water management plans by the end of 2015. These plans will indicate how climate change has been taken into account in the assessment of pressure factors and effects, in the drafting of the monitoring programme and in the selection of measures.

The agricultural sector has been relatively more active in raising awareness of the impact of climate change and in attending to it and, in accordance with Directive no. 24 of the Minister of Agriculture of 26 January 2011, a working group was established to draw up an action plan to mitigate and adapt to climate change in the agricultural sector. In 2011, five working group meetings were held, as a result of which the aforementioned action plan was drawn up for the purpose of mapping and analysing the possibilities of reducing greenhouse gas emissions and adapting to climate change in the sector, revising existing measures, making proposals for their improvement and creating new measures.

Under the guidance of the Ministry of Finance and the Government Office, the guidance document for drafting development plans entitled 'Mandatory topics of all area-based development plans' is being updated, discussing the mitigation and adaptation to climate change as a horizontal area that should start running through various development plans. A list of the climate criteria that should to be taken into account when drawing up development plans will be made.

Given that climate change affects the economy, society and the environment at large, it is important to ensure that all relevant sectors and administrative levels are bound into adaptation measures and that a national strategic action framework is established. Simultaneously, horizontal and vertical approaches are both required: alongside the national strategy and action plan, action also needs to be taken by local authorities, enterprises and the private sector. The state also supports voluntary efforts aimed at preventing dangers and responding to emergencies.

6.5.1.2. The overview of progress towards national adaptation strategy

In order to take effective adaptation measures in a timely manner in all areas and at all administrative levels, a more strategic nationally coordinated approach is required in the form of a national strategy and action plan for adapting to climate change, which integrates all the issues and priorities relating to the given subject.

Clear directions for moving towards national climate change adaptation strategies arose from the EU White paper on adapting to climate change: Towards a European framework for action (COM (2009) 147/4) with a view to considering mandatory adaptation strategies from 2012. In April 2013, the European Commission launched an EU Strategy on adaptation to climate change to encourage all Member States to adopt comprehensive adaptation strategies.

The drafting of the Estonian national strategy and action plan for adapting to climate change was commenced in 2013 in the framework of the project titled 'Elaboration of Estonia's draft national climate change adaptation strategy and action plan', which is part of the programme 'Integrated marine and inland water management' of the European Economic Area Financial Mechanism 2009–2014. The project will come to an end at the beginning of 2016 and the project promoter is Estonian Environmental Research Centre. The project activities include aggregation of available scientific information about climate change impacts, creation of Estonia specific climate change scenarios, assessment of sector specific negative and positive impacts of climate change, proposition of potential climate change adaptation measures, estimation of indicative cost of proposed adaptation measures and their prioritisation, elaboration of Estonia's draft climate change adaptation strategy and development of an action plan for the implementation of proposed measures. The project will eventually enhance Estonia's preparedness and capacity to respond to the impacts of climate change at local, regional and national level, developing a coherent approach and improving coordination.

On the basis of the strategy and action plan elaborated in the course of the given project, the Ministry of the Environment will make a proposal to the Government of the Republic to start the process of composing the national climate change adaptation strategy. The Government will then decide whether the strategy will be one comprehensive document or the topics will be integrated into national area-related strategies and development plans.

6.5.2. Actions at the local level

To date, the regions that are most frequently affected by weather conditions have been the most active in implementing adaptation measures. Following the January storm in 2005, the local authorities of the most vulnerable coastal areas adopted detailed action plans to attend to the consequences of extreme weather conditions. They have largely focused on the crisis management level and paid little attention to preventing storm damage.

The involvement of the regional level in situation-based *risk assessment* has been very different in Estonia. According to risk assessment instructions, the competent authority submits the regional part of an emergency risk assessment to the regional crisis committee for review. To date, local governments have not been greatly involved in preparing emergency risk assessments. Some local governments (e.g. Pärnu and Tallinn) have prepared risk assessments on their own initiative.

An *emergency response plan* must describe, where necessary, the regional and local government level. The guidelines for preparing an emergency plan do not specify the need to describe the regional level in the plan. Therefore, the regional level has lacked clarity as to whether and which plans must be

prepared; it has been done according to local initiative. Most emergency plans describe the general duties of the local government upon responding to emergencies (e.g. forest fires, storms and floods).

Under the Emergency Act, *regional crisis committees* (4) and *crisis committees of local governments* have been established. A rural municipality or city government shall form a permanent crisis committee of the local government to operate in the local government area. A local government with fewer than 40,000 inhabitants may form a joint crisis committee with one or several other local governments.

Electronic landscape maps of the flood exposure areas in Tallinn, Kuressaare, Haapsalu, Pärnu and Tartu are available on the website of the Land Board at http://geoportaal.maaamet.ee, where the regions in which floods occur when a certain water level is exceeded can be viewed in a digital environment.

In processing plans, **Tallinn City Government** takes into account the flood areas considered in city districts' comprehensive plans and environmental impact strategic assessment reports. Extreme environmental events and circumstances were discussed in the emergency risk assessment of Tallinn prepared in 2012. From the point of view of adapting to climate change, risk assessment covers the following topics: storms; hurricanes with heavy rainfall or snowfall; floods in densely populated areas; extremely cold or hot weather; long and extensive failures of utility networks; and extensive forest or landscape fires. Upon planning risk reduction measures, Tallinn considers it important to quickly and promptly inform the population, to provide authorities responding to emergencies with good training and modern equipment and to ensure cooperation between state authorities, local governments and non-profit organisations in terms of restoration work.

Since 2008, the City of Tallinn has constantly monitored the situation to ensure readiness for possible extreme weather phenomena. Information gathered using radar (wind speed and direction, shape and quantity of precipitation and cloud movement) helps to much more accurately observe the formation of weather conditions, forecast possible consequences and warn residents, aviation and energy companies and the Rescue Board of the occurrence of potential emergencies (e.g. thunderstorms).

In addition, the sea level is monitored via the online system of the Marine Systems Institute of Tallinn University of Technology. Water level sensors have been installed in Mustjõe Stream, Tiskre Stream and Lake Ülemiste. The information obtained from these sources allows for more accurate monitoring of the change in the water level and, where necessary, for making preparations for notification and reaction.

Tallinn's risk assessment points out that the risks of the natural environment must be taken into account in construction planning for the purpose of preventing severe consequences of natural disasters. For instance, the construction of buildings in areas where the risk of flooding is high should be avoided. In Tallinn, a dangerous water level is 120 cm or more, but a rise of up to 2.5 m is taken into account in plans. The hydrometeorological monitoring network is being improved and automated, in the course of which hydrology stations are being automated, the coastal sea network is

being made denser, the meteorological network is being further developed and a wave height meter is being installed in the Gulf of Finland.

The flooding of coastal areas is also a concern in Tallinn. Floods can wash out streets and roads in the city and cause traffic stoppages, and streets can become unusable. Tallinn considers it necessary to develop an early warning system and improve the notification of residents, the organisation of training, the drafting of action plans of rescue authorities and enterprises and the development of cooperation with research institutions in modelling floods.

Since 2007 **Tartu** has carried out risk assessment of the likelihood of floods in the city and its surroundings. In the City of Tartu the requirement when drawing up plans is that the ground height of the planned area must not be lower than 34.00 metres above Kronstadt zero[13]. A shut-off valve has been constructed on a culvert between the Emajõgi River and the Supilinn district for the purpose of preventing and mitigating the impact of floods. Also, in a flood, it is prohibited to travel by power-driven water craft on the Emajõgi River in order to prevent damage to bank defences. In 2012, a crisis training event entitled 'Emergency in Tartu' was organised in Tartu for the purpose of staging a crisis situation and testing cooperation between authorities in extremely cold weather.

Pärnu City Government takes flood-exposed areas into account when drawing up plans. In Pärnu, a dangerous water level is 160 cm or more. During the January storm in 2005, the water level in Pärnu rose to 273 cm above sea level. In 2007, the drafting of the 'Pärnu Comprehensive Plan until 2025' was initiated. The document has not yet been adopted, but the draft contains measures to prevent the impact of floods. In order to reduce possible harmful effects of flooding on human health, the environment, cultural heritage and economic activities, the plan provides for eight safety-ensuring conditions upon the development of flood-exposed areas. These conditions are already taken into account in the drafting of detailed plans.

In addition, a risk assessment of the City of Pärnu was prepared in 2004 and later revised. In 2010, the crisis committee of the City of Pärnu was established. In its activities the committee follows this risk assessment and an action plan involving 31 different cases (e.g. emergency risk assessment prepared up by the Rescue Board in 2011 – extremely cold weather, extremely hot weather, storms, floods in densely populated areas etc.).

The website of Pärnu City Government http://www.parnu.ee/index.php?id=1613 has a sea water level map (Marine Systems Institute), a flooded area scheme (Pärnu City Government), a flooded area map (geoportal of the Land Board) and guidelines prepared by the Rescue Board on what to do in the event of a flood risk and for moving on ice.

From 2012-2013 Pärnu City Government participated in the 'Coastal flood warning system for the Baltic Sea' project. AS Regio led the project, which was financed by the European Space Agency. Its purpose was to carry out a feasibility study for the purpose of creating a flood warning system for

[13] KRONSTADT SEA-GAUGE, a metal rod with marks for measuring the Baltic sea level.

the coastal areas of the Baltic Sea. The system created makes the most of existing space technology: remote surveillance of the Earth and positioning and satellite communication. The system uses data from surveillance of the planet as input for the water level forecasting model; the GNSS signal to measure the water level in real time using buoys; and satellite communication to exchange information in emergencies when on-ground communication is not functioning. As a result of the project, a modelled map situation of the location of the waterline in the coming 48 hours which end users can easily understand was developed. The system can also be used by residents, local authorities and the rescue service.

Haapsalu City Government has entered its flood-exposed areas in the layout of the city's comprehensive plan, which is accessible on the city's website. A dangerous water level in Haapsalu is 140 cm or more. Since the 2005 flood the city has established a rule that a building permit will not be granted to a building whose floor height is less than 2.2 m above sea level.

Harju County Government was a partner in the Baltic Climate project, as part of which a tool for three important groups of respondents to climate change was made: policymakers, planners and undertakings (http://www.toolkit.balticclimate.org/et/). This tool enables knowledge and experience to be shared between professionals reacting to climate change at the local and regional level who may not necessarily be climate change experts but who play an important role in preparing and financing measures related to climate change and in making decisions related to implementation.

The governor of Harju County has initiated the strategic assessment of the environmental impact of the Harju County plan 2030+. In the course of drawing up the new plan, all of the effects of climate change in Harju County can be assessed and respective adaptation measures can be planned. The Harju County Development Strategy 2025 is being revised, in the course of which goals will be able to be set and activities planned to adapt to the impact of climate change. Upon drawing up plans, flood-exposed areas have been taken into account in Harju County in recent years on the basis of the Report on Risks Relating to Flood Exposure issued by the Ministry of the Environment. For instance, the comprehensive plan of the Haabersti district of the City of Tallinn includes a map of the seashore areas exposed to erosion and flood and shore collapses. The explanatory memorandum to the plan discusses where and how these risks must be taken into account, what prevention and alleviation measures need to be taken etc.

Many **other local authorities** have attended to risks arising from climate change when making development plans, when renovating water supply and sewerage and other utility networks and when drafting detailed and comprehensive plans. Water undertakings regularly check the condition of water pipelines in order to ensure the quick outflow of stormwater from the city in the event of heavy rain.

Although there are active local authorities, knowledge of the impact of climate change and ways of adapting to it at the regional and local levels in Estonia is insufficient. It is important to improve awareness and information exchange so that the assessment of the impact of climate change and the planning and implementation of preventive measures will become more active at the local level.

Against a backdrop of ongoing climate change, adaptation should become a natural part of national and local action plans, ensuring sustainable development in the future. The existence of a national adaptation strategy will make it easier to obtain funds from sources of the European Union for the purpose of increasing resilience to climate change.

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VII

FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY, INCLUDING INFORMATION UNDER ARTICLES 10 AND 11 OF KYOTO PROTOCOL

Estonia is not an Annex II party therefore the provisions of Article 4.3, 4.4 and 4.5 are not applicable. Information on activities, actions and programmes undertaken in fulfilment of its commitments under Article 10 are included in the relevant sections of the NC6 (see Annex II). Estonia´s contribution to fast start finance projects is covered in Chapter 9.8.1.

VIII

RESEARCH AND SYSTEMATIC OBSERVATION

8.1. General policy of research and systematic observation

All ministries in the Republic of Estonia are engaged in the research and development (R&D) needed to shape policy in their area of government and to meet their objectives, but 82.5 per cent of the resources appropriated from the state budget for R&D activities are appropriated by means of the budget of the Ministry of Education and Research (MER). In 2007, the Riigikogu approved the 'Estonian Research and Development and Innovation Strategy 2007-2013'. In the 'Knowledge-based Estonia' strategy, the Government set the goal of bringing the total cost of R&D to 1.9 per cent of GDP by 2010 and to 3 per cent of GDP by 2014. Upon preparing the competitiveness strategy 'Estonia 2020', the reference levels of Estonian research and development activities were adjusted: 2 per cent of GDP by 2015 and 3 per cent of GDP by 2020. Above all, thanks to the doubling of the R&D volume of the private sector, R&D investments rose to 2.37 per cent of GDP in 2011. This level exceeds the EU average and is characteristic of developed industrialised countries.

The MER is responsible for the planning, coordination and implementation of and supervision over education and research policy as regards the Estonian strategic R&D development plans, while the Research Policy Committee advises the Minister of Education and Research on matters related to the shaping of Estonia's research policy. The Research and Development Organisation Act provides the grounds for the organisation of R&D. The Research and Development Council (RDC) advises the Government on matters related to R&D strategy.

The Estonian Research Council (ERC) was established with the objective of organising the system of R&D financing. It commenced its activities in 2012. The new organisation was established on the basis of the Estonian Science Foundation and was merged with the Archimedes Foundation. The ERC is engaged in financing research, analysing financing results, the promotion of science and developing international scientific cooperation. The ERC additionally administers the Estonian Research Information System (ETIS, www.etis.ee), the state register in which data related to Estonian R&D activities is centralised.

Compared to the data reported in Estonia's Fifth National Communication under the United Nations Framework Convention on Climate Change (UNFCCC), expenses on R&D activities have increased (Figure 8.1).The resources prescribed for such activities are divided in the Estonian state budget between structural aid of the European Union and R&D financing resources. R&D work is financed by the following means within the framework of the system of the Estonian Ministry of Education and Research:

1) targeted financing;
2) baseline funding;
3) research funding;
4) development funding;
5) support for centres of excellence;
6) national research and development programmes; and
7) compensation of the maintenance expenses of R&D institutions.

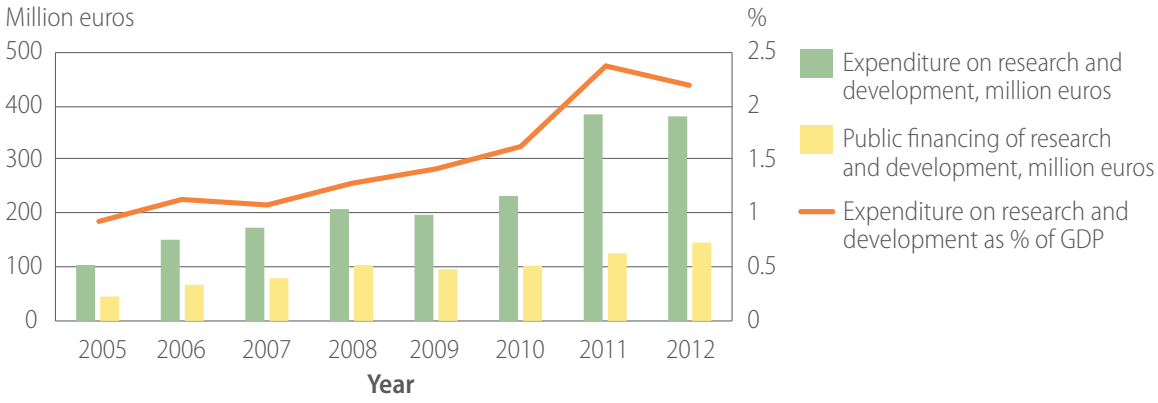

Figure 8.1. Financing of research and development activities
Source: www.stat.ee

Five R&D programmes are co-financed with the aid of the Structural Funds:

- the Estonian Energy Technology Programme;
- the Estonian Biotechnology Programme;
- the Estonian Higher Education Information and Communications Technology and Research and Development Activities Programme;
- the Estonian Environmental Protection and Technology Programme; and
- the Estonian Health Care Programme.

The Department of International Research Cooperation of the ERC organises participation in international research programmes, including advisory servicesrelated to the EU 7th Framework Programme (FP) for Research and Technical Development Horizon 2020 and the Cooperation Programme COST, as well as cooperation with Science Europe and the European Science Foundation. The ERC additionally coordinates participation in such cooperation programmes as BONUS, ERA-NET and EUROCORES.

At present, more than EUR 25 million has been allocated to Estonian scientists within the framework of 7th FP projects; therefore, compared to the final results of the 6th FP, the Estonian budget per scientist has increased significantly. Estonia's partners number 1,647 organisations from 62 countries; the country's success rate is 23.1 per cent, which is somewhat higher than the EU-27 average of 21.8 per cent. Information concerning successful projects in Estonia is centralised in a database which can be found online at http://edukad.etag.ee/.

8.1.1. R&D programmes and funding of research and systematic observations

The objective of the '**Mobilitas' Researcher Mobility Programme** (2008-2015) is to enliven the international exchange of researchers and knowledge. Through the programme, post-doctoral and leading researchers are able to apply for grants to conduct research in Estonia and abroad. The

total budget of the programme is EUR 20.3 million, of which up to 85 per cent is financed from the resources of the European Social Fund; the minimum state funding is 10 per cent, while self-financing by the Estonian R&D institutions involved in the programme as partners amounts to at least 5 per cent of the programme budget.

The '**KESTA**' **Environmental Protection and Technology R&D Programme** focuses on analysing and preventing research-based environmental risks and on developing sustainable technology. The projects implemented in the programme address, for example, applied research on ecosystem matter cycles and conditions of biodiversity, innovative environmental technological solutions and risk analysis encompassing the environmental hazards in Estonia. The projects listed below are related to researching climate change.

- Developing applied research in the priority fields of environmental protection and technology
  - Applied studies in nature conservation (LOORA)
  - Estimation of environmental response to future climate projections in Estonia using dynamic models of air, sea and catchment areas (EstKliima)
- Supporting research activities concerning objects on the Estonian Research Infrastructures Roadmap related to the field of environmental protection and technology
  - Estonian Environmental Observatory research and development activities regarding the biosphere and atmosphere (BioAtmos)
- Analysing coherence between state-run and academic environmental information systems and funding development projects of analytical capability to support research on biodiversity informatics and climatic and environmental changes
  - Geoinformatic development of biodiversity, soil and earth data systems (ERMAS)
- Developing research-based prognoses to respond to threats in a prompt and precise manner
  - Developing research-based prognoses and quantifying risks to respond to threats in a quick and accurate way in the context of the Estonian mainland, bodies of water, seaboard and atmosphere (TERIKVANT)

Estimation of environmental response to future climate projections in Estonia using dynamic models of air, sea and catchment areas (EstKliima)

The objective of the project is receiving scientifically reasoned knowledge of and providing adequate opinions on possible climate change and the consequence thereof on the Estonian coastal sea, seaboard and rivers by using a comprehensive approach: dynamic modelling of the condition of the atmosphere, mainland, marine area and the coastal areas.

The knowledge and opinions will be based on scenarios prepared for Estonia and the immediate vicinity of the country on the basis of regional climate models (RCM). The scenarios are related to long-term data analysis trends. The results of the models of the atmosphere, sea, catchment areas and coastal processes will be used for the analysis.

The results of the project will enable the provision of research-based and adequate information for adopting policy decisions related to climate and environmental change on the state level, the planning and implementation of future-oriented practical activities pertaining to environmental protection and the making of decisions concerning the spatial planning of marine areas. The project will likewise aid in performing Estonia's obligations arising from the EU Water Framework Directive, EU Habitats Directive, EU Marine Strategy Framework Directive, the HELCOM Baltic Sea Action Plan, EU biodiversity policy and elaborating a strategy for adapting to climate change in Estonia. Estonia's capability in fields related to climate and environmental change will increase.

The following scientific research establishments participate in the project: the Marine Systems Institute of the Tallinn University of Technology (TUT), Department of Environmental Engineering of the TUT, Institute of Physics of the University of Tartu (UT), Department of Geography of the UT, Estonian Marine Institute of the UT, Institute of Ecology of Tallinn University and the Institute of Forestry and Rural Engineering of the Estonian University of Life Sciences.

BONUS is a programme related to the Baltic Sea whose institutional organiser is BONUS EEIG, representing ten organisations that finance research in nine countries bordering the Baltic Sea: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. VIABLE ECOSYSTEMS, the first joint call, was announced within the framework of the programme in 2012.

Applying for a Post-doctoral Research Grant – ERMOS (Estonian Research Mobility Scheme). This programme was created with the objective of developing and diversifying Estonian research potential through the international mobility of researchers and exchange of experience, thereby activating the international exchange of knowledge and supporting the development of the careers of young researchers. ERMOS is co-financed by the European Union within the framework of the FP7 Marie Curie COFUND Action. The grants, co-financed with the COFUND Action of the PEOPLE Programme of FP7, enable young researchers to mix with the academic world by continuing their work in their field of science in Estonian R&D institutions. Relocation support of EUR 6,500 is paid to post-doctoral fellows who relocate to Estonia from abroad to conduct research projects and a fee for overhead charges of 5 per cent in relation to remuneration and research costs is paid to the receiving institution.

Transnational mobility programmes provide various options for the financing of research co-operation. The PARROT Programme offers travel grants in order to work with French scientists. Post-doctoral grants are offered by the Japanese Society for the Promotion of Science (JSPS) and University College London (UCL SSEES).

There are two main financing instruments for which the ERC is responsible: **institutional research funding**, which allows R&D institutions to finance high-level R&D activities and upgrade, supplement and maintain the infrastructure necessary for this purpose; and **personal research funding**, which is a grant awarded so as to finance a high-level R&D project of a person or research group working for an R&D institution. It is applied for in a public call on the terms and conditions and pursuant to the procedure established by the ERC and approved by the MER.

The three main activities of the **Environmental Investment Centre** (EIC) are channelling the proceeds of the exploitation of the environment into environmental projects; acting as the implementing agency for the environmental projects funded by the EU Cohesion Fund, European Regional Development Fund and European Social Fund; and implementing the Green Investment Scheme (sale of excess CO_2 quota and supervising investments).

The EIC examines applications received, monitors the conducting of projects and inspects expenses related to projects, the implementation of projects and the purposeful use of resources. The environmental programme is divided into the following sub-programmes:

- ambient air protection;
- water management;
- waste management;
- environment management;
- nature conservation;
- forestry;
- fisheries;
- environmental awareness;
- marine environment; and
- Earth's crust.

A total of EUR 3.4 billion has been allocated to Estonia to support various fields in the period 2007-2013. In the environmental sector and through the EIC, a total of EUR 728.6 million is intermediated for a range of activities, including EUR 626.4 million from the Cohesion Fund, EUR 101.7 million from the European Regional Development Fund and EUR 3.2 million from the European Social Fund. The EIC provided a total of EUR 14.4 million in financing for ambient air protection programme projects from 2009-2012 (Table 8.1).

In 2011 a programme 'Developing Environmental Surveillance and Data Acquisition' was confirmed through which the European Regional Development Fund will grant EUR 1.53 million to Estonia to develop the environmental surveillance and data usage programme. The present environmental

surveillance data and the needs of the data users will be reviewed. Solutions will be found to acquire data that has not been accessible up to now. The deadline of the programme is the end of 2015.

Table 8.1. Financing of ambient air protection programme and number of projects financed, 2009-2012

Year	Amount (EUR)	Number of projects
2009	2,020,928.45	21
2010	2,490,408.32	35
2011	6,473,242.36	51
2012	3,430,068.25	33
Total	14,414,647.38	140

Source: Estonian Environmental Investment Centre

Switzerland contributing to Estonia's environmental monitoring: the non-returnable foreign aid granted to Estonia included 8.5 million francs directed to improving the sustainability of environmental monitoring in the field of air, waste and radiation. With the support of the cooperation programme lasting until 2015 Estonia's environmental monitoring system will be modernised and expanded, with the objective to raise the quality of service and thereby improve the speed and reliability of data communication. The funds are also being used to upgrade sampling equipment, environmental monitoring stations, laboratories and other environmental monitoring equipment.

8.1.2. Systematic observations

Climate observations comprise of systematic meteorological, atmospheric, oceanographic and terrestrial monitoring.

Ensuring operative and continuous provision of meteorological and hydrological forecasts, warnings and monitoring of data for the public and for authorities is the strategic objective of the **Estonian Environment Agency** (EtEA) weather service. The Estonian system that involves 107 monitoring stations includes a synoptic and climatology observation programme, an aerological observation programme, an actinometric observation programme, an inland water hydrometry observation programme, a lake research programme, a swamp research programme, a coastal sea observation programme and an ionising radiation level observation programme. The EtEA weather service performs the obligations of a national meteorological service in Estonia pursuant to its statutes and the recommendations of the World Meteorological Organisation (WMO).

EtEA weather service participates in several climate-oriented programmes of the World Meteorological Organisation (WMO) including the Global Climate Observing System (GCOS). Since 1999 Tartu-Tõravere Meteorological station has been included in the Baseline Surface Radiation Network (BSRN). The data transmitted through the BSRN is used by World Climate Research Programme (WCRP), Global Energy and Water Exchange Project (GEWEX), Global Climate Observing System (GCOS) and Global Atmospheric Watch (GAW).

Other main duties of the **EtEA** include organising environment-related applied research and testing activities, participating in international cooperation and international projects within the limits of its competence and organising environment-related exchange of information with international and domestic institutions.

The Estonian Environmental Research Centre (EERC) is the leading institution in Estonia for the research of the International Cooperation Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems. Development and maintenance of Estonian Air Quality Management System is an important task of the EERC Air Quality Management Department. This system pools all continuous ambient air measurement in Estonia (both national level and company internal monitoring), air pollution modelling, air pollution index calculation and other air quality data. Ambient air measurement results can be seen in real-time on Estonian Air Quality Management System website.

Tartu Observatory focuses on implementing remote monitoring methods and increasing the reliability of the results thereof in the fields of remote monitoring and atmospheric sciences.

Estonian Marine Institute, **University of Tartu** is the largest Estonian organisation to conduct marine research and monitoring, while forecasting environmental factors and changes in the condition thereof with the help of an elaborated system of indicators and forecasting models.

The competence of the **Marine Systems Institute of Tallinn University of Technology** includes systematically learning the physical and biochemical processes of the Baltic Sea in the context of the impact of the atmosphere, mainland and human activity as well as developing marine information systems and condition analysis and forecasting methods.

8.2. Research

The Estonian Environment Agency[1], Tartu Observatory, the Institute of Ecology and Earth Sciences of the University of Tartu, the Laboratory of Atmospheric Physics of the University of Tartu, the Estonian Marine Institute of the University of Tartu, the Estonian University of Life Sciences, the Institute of Ecology of Tallinn University, the Marine Systems Institute of Tallinn University of Technology, the Centre for Nonlinear Studies of the Institute of Cybernetics of Tallinn University of Technology, the Geological Survey of Estonia, the Tallinn Centre of the Stockholm Environmental Institute and the Estonian Environmental Research Centre have conducted research related to climate and climate change.

[1] In June 2013, the Estonian Environment Agency (EtEA) commenced operations on the basis of the Estonian Meteorological and Hydrological Institute (EMHI) and the Estonian Environment Information Centre (EEIC) and assumed the duties, rights and obligations of the merged institutions.

8.2.1. Climate process and climate system studies, including paleoclimate studies

The area of activity of the **Estonian Environment Agency** (EtEA) is collecting, processing, analysing and publishing reliable and comparable environmental data, reporting on the state of the Estonian environment and the factors affecting it, and maintaining the relevant databases. The EtEA has a number of departments in relation to climate and climate change research: the main function of the *Ambient Air Department* is data collection, processing and analysis, emission inventory management and improvement, maintaining and developing Point Sources register, database of fuel monitoring and counselling the users of the aforesaid database, reporting on national and international levels; the main function of *Waste Department* is to monitor and process data about waste generation, including data on biodegradable waste having influence to climate change processes; the main function of the *Environmental Management Department* is administering the National Environment Monitoring Programme, maintaining national environmental monitoring database and the interlinking mechanisms thereof that centralises the environmental monitoring records; the main function of the *Nature Conservation Department* is administering the nature information data network, maintaining a register of the protected natural features and natural values and processing and analysing nature information; the main function of the *Meteorological Observation Department* is administering the meteorological observation network, processing and analysing monitored data, preparing climate analysis and maintaining meteorological databases; the main function of the *Hydrology Department* is administering the hydrological observation network, processing and analysing relevant data and maintaining hydrological databases; one of the the main functions of the *Forest Monitoring Department* is preparing and submitting of national reports on forestry, land use changes, and emission and removal of greenhouse gases; ; the main function of the *Information Department* is to organise the activities of the Centre in relation to external and internal communication, coordinate the publication of environmental information and to perform the duties of a competent authority of the EMAS (Environmental Management and Audit Scheme) and the European Union Eco-label.

The **Institute of Ecology** is a research and development institution of **Tallinn University** whose fields of research include analysing the influences of climate change and the hydrodynamics of coastal seas on the development of various types of coasts; modelling coastal developments and forecasting changes in coastal zones; analysing the condition and development of wetland ecosystems and the factors affecting them, above all researching the impact of disturbances on the structure, functioning and nutrient cycles of wetland ecosystems; developing research methods for, and the scientific principles of, the ecological restoration of wetlands; evaluating the temporal-spatial impact of natural and anthropogenic processes on the condition of ecosystems, developing paleoecological research methods and modelling ecosystem development scenarios.

TUT has been a partner in the 'CELA: Climate Change Technology Transfer Centres in Europe and Latin America (2011-2013)' project, which is financed within the framework of the Alfa III Programme of the European Commission with the aim of improving cooperation pertaining to climate change between European and Latin American universities. The Research and Transfer Centre of the Faculty of Life Sciences of Hamburg University of Applied Sciences is coordinating the

project. The objectives of the project are to improve the quality of research and technology transfer in Latin American universities in the field of climate change, to strengthen the role of institutions of higher education in ensuring sustainable socioeconomic development proceeding from the impact of climate change and to improve cooperation in the field of research and technology transfer between European and Latin American universities.

8.2.2. Modelling and prediction, including general circulation models

In 2009 and 2010 researchers from the **Laboratory of Atmospheric Physics** at the **University of Tartu** (UT) completed the regional reanalysis database of the Estonian climate, BaltAn65+, covering the years 1965-2005, applying the numerical model HIRLAM. The project was financed by the Environmental Investment Centre. The laboratory is also involved in EstKliima, a regional climate modelling project for the Baltic Sea region. The role of the Institute of Physics of UT in the project is fine-scaling the projections of global climate models for the Baltic Sea region. A database of Estonian air pollution sources was created on the basis of the data of the Estonian Environmental Research Centre for the purpose of providing feedback on atmospheric aerosols and gaseous admixtures (absorption and scattering of solar radiation and cloud formation) in meteorological models. Since July 2012, a pre-operational application of the SILAM model with this database has been used by the EtEA weather service with real-time output available online at http://meteo.physic.ut.ee/silam.

The **Centre for Nonlinear Studies** (CENS) was founded in 1999 at the **Institute of Cybernetics of the Tallinn University of Technology** in order to coordinate the research activities of the research groups of the respective field. The activities of CENS include the research and competence of nonlinear processes along with a respective degree course. CENS participated in the Centres of Excellence Programme in 2002-2007 and 2011-2015. CENS is engaged in theoretical and experimental research on nonlinear expression phenomena and bringing the new knowledge to society and industry, taking into consideration the priority fields of both Estonia and the EU (materials technology, medicine and protection of the environment). The research focuses on wave propagation in solid matter, at sea and in optical environments, soft matter physics, cellular energetics and nonlinear conductivity theory. CENS currently involves 5 working groups whose research topics include wave dynamics, for example analysis of the wave dynamics of Tallinn Bay and wave propagation at sea.

8.2.3. Research on the impacts of climate change

Several ongoing international remote observation projects at **Tartu Observatory** (TO) are related to assessing the causes and consequences of climate change. These include the FP7 projects 'Strategic Partnership for Improved Basin-scale Water Quality Parameter Retrieval from Optical Signatures' (WaterS, 2010-2014), 'Forest Management Strategies to Enhance the Mitigation Potential of European Forests' (FORMIT, 2012-2016) and 'Global Lakes Sentinel Services' (GLASS, 2012-2016). Several KESTA and support projects at TO are also related to issues pertaining to climate change, as well as some COST projects ('Expected Climate Change and Options for European Silviculture, 2009-2012'). The participation of TO in the project BioAtmos (2012-2014)

of the Estonian Environmental Observatory is related to the climatology and environmental impact of solar radiation, similarly to participation in the KESTA project 'Estonian Radiation Climate (2012-2015)' led by the UT.

The **Institute of Ecology and Earth Sciences of the University of Tartu** has participated in several international research projects. Examples include:

- 'Climate and Environmental Changes in Polar Regions Related to Global Changes and their Influence on Climate Variability in Northern Europe (2012-2015)', focussing on conducting basic research into the climate and environmental changes in polar regions.

- 'Global Warming and Material Cycling in Landscapes. Global Warming- and Human-Induced Changes of Landscape Structure and Functions: Modelling and Ecotechnological Regulation of Material Fluxes in Landscapes (2013-2018)', focussing on the temporal-spatial dynamics of Estonian landscapes and analysis of related changes in material cycling caused by natural and anthropogenic factors. The tasks of the research to be conducted in the course of the project are: (1) analysing the influences of changes in the Arctic climate on Estonian and Baltic region ecosystems and landscapes; (2) studying anthropogenic landscape changes and developing optimal models and decision support systems for landscape and ecosystem management; (3) analysing both climate change-induced and anthropogenic impact on the nutrient and carbon cycling of landscapes; and (4) developing methods for the better regulation of material fluxes based on enhanced environmental/technological solutions.

The **Institute of Ecology of Tallinn University** is engaged in applied research, researching the issues of oil shale mining and air pollution (in Northeastern Estonia) and research and expert analyses related to the status of the environment and nature conservation.

8.2.4. Socio-economic analysis, including analysis of both the impacts of climate change and response options

The **Ministry of Agriculture** is participating in the joint research programming initiative 'Agriculture, Food Security and Climate Change FACCE-JPI' whose objective is to promote cooperation, joint activities and the creation of a network of researchers in the fields of agriculture, food security and climate change. The initiative brings together 67 research groups from 17 countries, including Estonia. By harmonising national programmes for scientific research, FACCE-JPI also aims to reduce duplication in scientific research and enhance the financing of all research activities. Such cooperation promotes communication and creates synergy between European modellers. In 2012, the Governing Board of FACCE-JPI approved the Strategic Research Agenda, which sets out the five core research themes in the fields of agriculture, food security and climate change:

- sustainable food security under climate change;
- environmentally sustainable intensification of agricultural systems;

- trade-off between food security, biodiversity and ecosystem services;
- adaptation to climate change; and
- mitigation of climate change.

The long-, medium-and short-term priorities are specified for each research theme and joint measures are planned with the objective of strengthening infrastructure and research programmes and improving training, capability and knowledge exchange in Europe. Within the framework of the initiative, scientists from the **Institute of Agricultural and Environmental Sciences** of the **Estonian University of Life Sciences** are involved in the activities of the MACSUR knowledge hub whose objective is to centralise national research activities related to assessing the risk of climate change by linking, developing and interpreting various models so as to use them to assess the risk of climate change on European agriculture.

The **Tallinn Centre of the Stockholm Environment Institute** (SEI) has participated in numerous international climate-related cooperation programmes and projects as the coordinator and/or a participant for over fifteen years via its climate and energy programmes. The institute has acquired experience in various fields, for example the implementation of the European Union Emission Trading Scheme, preparation of national allocation plans, provision of training to operators participating in the trading scheme, preparation of the technical documentation for the implementation of the Kyoto Flexible Mechanisms in relation to energy efficiency, conversion of district heating stations to operate on biofuels and other renewable energy projects such as pellet plants and wind farms. SEI participates in the projects of the European Commission (EC), FP6 and FP7, the Intelligent Energy Europe programme, the European Regional Development Fund (ERDF) and the INTERREG programme, as well as the Eco-Innovation Action Plan of the CIP (Competitiveness and Innovation Framework Programme) and projects of the 'Leonardo da Vinci' programme of the European Union that are either directly or indirectly related to meeting the objectives of mitigating climate change as provided in the UNFCCC and directives of the European Union. SEI Tallinn also has analysed the possible developments of moving to a low-carbon economy in relation to Estonian economic policy until 2050 in relation to climate change and handles possible scenarios for reducing greenhouse gas emissions by using the macroeconomic model LEAP (Long Range Energy Alternatives Planning System) developed in the SEI USA Centre. SEI Tallinn analyses national energy economy development plans from the viewpoint of environmental impact assessment and also uses the assessment of optimal options to mitigate climate change in the energy sector as the basis for its analyses. At present, the research work of essentially all four programmes of the institute is related to various issues pertaining to climate change.

8.2.5. Research and development on mitigation and adaptation technologies

The purpose of the activities of the **Geological Survey of Estonia** (GSE) is to provide services to the state and the private sector in relation to the Earth's crust. The GSE was involved in the project 'Climate Change: Impact, Costs and Adaptation in the Baltic Sea Region (BaltCICA, 2009-2012)'.

The BaltCICA project of the Baltic Sea Region Programme (BSR III) of the EC was the immediate successor to the project 'Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region (ASTRA)' which was successfully completed in 2007. 24 partners from eight countries participated in the project, with the Geological Survey of Finland (GTK) functioning as the lead partner. The work focussed on the impact of the rise in sea level accompanying climate change in coastal regions. As regards Estonia, the object of research was the west coast, from Häädemeeste to Haapsalu.

The primary purpose of the project 'Strategy for Adaptation to Climate Change in the Baltic Sea Region (BALTADAPT, 2010-2013)' was to elaborate a strategy to adapt to climate change in the Baltic Sea region resulting from the impact of climate change on ecosystems and coastal regions on the basis of information encompassing the entire Baltic Sea region. The role of the **Estonian Marine Institute of the University of Tartu** (EMIUT) in the project was to analyse the policy of development of legislation related to climate change in Estonia as well as research related to best practice for adaptation. EMIUT also contributes to working groups engaged in research related to Baltic Sea ecosystems and coastal regions.

The ENVIRON Centre of Excellence in Environmental Adaptation, coordinated by the **Estonian University of Life Sciences**, was established as a project-based institution in 2011. Researchers from the centre study the adaptation of plants and ecosystems to the environment and biotic stress in order to understand the response of ecosystems in the temperate zone to global climate change. Ecosystems have a significant capacity to adapt to environmental perturbations, but this is generally not considered in climate change projections. The centre conducts research based on interdisciplinary experimental and modelling approaches that allows quantitative forecasting of the response of ecosystems to global climate change with the help of knowledge of molecular stress mechanisms. The results serve as the basis for sustainable management of the natural resources of Estonia and the Nordic countries and for the planning of long-term land use in agriculture and forestry.

The main providers of financing for the Centre of Excellence are the European Regional Development Fund, the Ministry of Education and Research and the Estonian University of Life Sciences. The total cost of the project is EUR 3.2 million and its period of activity is 2011-2015. The centre includes five leading research groups from the Institute of Agriculture and Environmental Sciences of the Estonian University of Life Sciences, the University of Tartu and Tallinn University of Technology. More than 50 scientists and approximately 50 PhD students are involved. The scientific activities of the centre are supported by a board of foreign experts which is composed of leading scientists from around the world.

8.2.6. Research in support of the national greenhouse gas inventory

Developments in the energy sector

In 2012, the Ministry of the Environment signed a contract with the Estonian Environmental Research Centre (EERC) to implement the project 'Elaboration of Country-specific Emission

Factors of Greenhouses Gases in the Energy Sector'. The project was financed by the Environmental Investment Centre (EIC) and its purpose was to develop country-specific emission factors so as to estimate greenhouse gas emissions in key categories and other important categories of the energy sector. The project comprised two parts: 1) calorific values of fuels and country-specific emission factors of greenhouse gases calculated on the basis of existing data; and 2) calorific values of fuels and country-specific emission factors of greenhouse gases on the basis of measurement results. The main objective of the research is to improve the Estonian national greenhouse gas inventory emission estimates in the energy sector.

Developments in the LULUCF sector

A project titled 'Research on greenhouse gas emissions in land-use, land-use change and forestry sector in the framework of UNFCCC and Kyōto protocol reporting' (Table 8.2) was launched in June 2013, funded by the EIC. However, many of the activities provide only preliminary assessment and further research, verification and analysis is necessary in the future.

Table 8.2. Developments in the LULUCF sector

	Project activities	Description and outcome	Agency/agent	Deadline
1	Changes in cropland soil organic carbon stocks	Conducting fieldwork, resampling previous sample plots and estimating carbon stock changes in cultivated mineral and organic soils. Developing country-specific emission factors for cropland mineral and organic soils.	Agricultural Research Centre of Estonia	28.02.2014
2	Changes in grassland soil organic carbon stocks	Conducting fieldwork, resampling previous sample plots and estimating carbon stock changes in natural and semi-natural grassland soils. Developing country-specific emission factors for grassland soils.	Agricultural Research Centre of Estonia	30.11.2014
3	Harvested wood products-half-life values	Give an overview of studies made about half-life values of harvested wood products (HWP) in neighbouring countries (Finland, Sweden etc). Give suggestions on most appropriate methodologies suitable for estimating HWP half-life values in Estonia for paper, wood panels and sawn wood.	Märt Riistop[2]	09.12.2013
4	Harvested wood product-emissions and removals resulting from changes in the pool of harvested wood products	Give an overview of methodologies implemented for estimating emissions and removals resulting from changes in the pool of harvested wood products in neighbouring countries. Give an overview of available data present for conducting emission estimates for HWP in Estonia. Refer to existing data gaps. Recommend the most suitable methodology for estimating HWP emissions and removals in Estonia.	For-Info LLC[3]	15.03.2014
5	Belowground carbon cycle in forests- soil respiration	Soil respiration measurements in 8 different pine and spruce stand types- Cladina, Myrtillus, Vaccinium, Fragaria, Calamagrostis alvar, Oxaclis, Polytrichum.	Mai Kukumägi[4]	01.12.2013
6	Belowground carbon cycle in forests- soil, litter and fineroots	Determine fineroot biomass, increment and turnover rates, decomposition of tree litter and fine root litter on 8 ICP Forests sample plots. Obtained data is input for soil carbon cycle calculations.	University of Tartu	20.05.2014

[2] Estonian Forest and Wood Industries Association
[3] Limited Liability Company
[4] University of Tartu

Project activities		Description and outcome	Agency/agent	Deadline
7	Belowground carbon cycle in forests- chemical analysis of soil, fineroots and litter	Determine chemical composition of soil, fineroots and tree litter. Obtained data is input for soil carbon cycle calculations.	Estonian Environmental Research Centre	01.03.2014
8	Forest litter	Conduct fieldwork, inter alia, gathering monthly tree litter on ICP Forests sample plots (mainly spruce and pine forests), data analysis, determine annual litter input to soil.	Estonian Environment Agency	01.06.2014
9	Afforestation/reforestation (AR)	Determine the location (georeference) and area of afforestation and reforestation activities for the period 1990-2012 using NFI datasets, old forestry maps, and aerial photographs. Create digital AR maps. Conduct fieldwork on AR areas, determine stand composition, biomass, soil type and annual land-use changes.	Metsakorralduse Büroo LLC	30.06.2014
10	Natural forests	Based on available NFI and other datasets as well as fieldwork, determine the area and location of natural forests according to new reporting requirements for the second Kyōto commitment period. Create GIS map.	Metsaruum LLC	30.11.2014

In addition, starting from October 2013, forest fires are inventoried by Estonian Environment Agency, determining georeferenced area, type of burning, damage of biomass (trees, dead organic matter) and soils.

Estonian Environment Agency has also ordered a review study from University of Life Sciences on 'Forest soil emissions depending on the type and intensity of forest felling' (deadline Dec. 2014).

8.3. Systematic observation

National environmental monitoring programme: The Environmental Monitoring Act, which entered into force in 1999, provides for the organisation of environmental monitoring, the procedure for processing and storing the data obtained and the relationships between those carrying out environmental monitoring and owners or possessors of immovables. Environmental monitoring is defined as continuous observation of the state of the environment and the factors affecting it, and its main objectives are forecasting the status of the environment and receiving data needed to prepare programmes, plans and development plans.

The main duties of the **EtEA** include organising environment-related applied research and testing activities, participating in international cooperation and international projects within the limits of its competence and organising environment-related exchange of information with international and domestic institutions. The list of international obligations of the EtEA is as follows: serving as a national focal point for the European Environment Agency (EEA) and the UNEP/Info-terra network; exchanging environmental information with the EEA, EUROSTAT, the European Commission, the UN Environment Programme and other international and domestic institutions; and reporting for the aforesaid institutions. The main objectives of the environmental monitoring of the EtEA are forecasting changes in environmental factors and the state of the environment (by means of continuous monitoring and assessment of environmental factors and the status of the environment) with the help of the elaborated system of indicators and forecast models. There are twelve environmental

monitoring sub-programmes: meteorological and hydrological monitoring, ambient air monitoring, integrated monitoring, radiation monitoring, forestry monitoring, soil monitoring, marine monitoring, nature diversity and landscape monitoring, seismic monitoring, groundwater monitoring, inland water bodies monitoring and the support programme. Research of climate change is also conducted within the framework of the majority of the monitoring programmes.

International cooperation:

The **Estonian Environmental Research Institute** (under the Estonian Environmental Research Centre) specialises in research in environmental chemistry and nature conservation. The institute has participated in a number of international projects, such as the 'International Co-operative Programme on Effects on Materials including Historic and Cultural Monuments' as well as studies of persistent organic pollutants in the ambient air of Central and Eastern European countries. The Institute is engaged in close cooperation with numerous leading scientific institutions, both domestic and around the world.

European Monitoring and Evaluation Programme (EMEP) is a scientifically based and policy-driven programme under the Convention on Long-range Transboundary Air Pollution for international cooperation to solve transboundary air pollution problems. Estonia started conducting long-range monitoring of air pollution in 1994 at the Vilsandi and Lahemaa monitoring stations and later at the Saarejärv monitoring station. In order to foster the required international cooperation in research into and monitoring of pollutant effects, the Working Group on Effects was established under the Convention on Long-range Transboundary Air Pollution in 1980 and held its first meeting in 1981. The convention involves countries in the United Nations Economic Commission for Europe (UNECE) region and has its secretariat with the UNECE.

EtEA weather service participates in the work of numerous international organisations: it is a cooperating member of the European Centre for Medium-Range Weather Forecasts (ECMWF) since 2005, a cooperating member of the European Centre for the Exploitation of Meteorological Satellites (EUMETSAT) since 2006 and a full member of the latter since 2013. EtEA weather service also participates in the work of the weather forecasting consortium HIRLAM (2007), the European Meteorological Services Network (EUMETNET, 2007) and the Nordic Weather Radar Network (NORDRAD, 2010). Estonian data is visible in the Pan-European network for meteorological warnings (METEOALARM) since 2010. EtEA weather service participates in several climate-oriented programmes of the World Meteorological Organisation (WMO): World Climate Programme (WCP), Global Climate Observing System (GCOS), Global Precipitation Climatology Centre (GPCC), Climate Information and Prediction Services (CLIPS) and the work of the Baseline Surface Radiation Network (BSRN) of the World Climate Research Programme (WCRP). EtEA weather service cooperates with the Marine Systems Institute of the TUT for implementing the High Resolution Operational Model for the Baltic Sea (HIROMB). EtEA weather service is additionally involved in the following cooperation projects: Advanced Weather Radar Network for the Baltic Sea Region (BALTRAD, 2011-2014) of INTERREG IV B, Modernisation of Hydrometric, Meteorological and Coastal Sea Monitoring Network for Enhancing the Capacity of Environmental

Monitoring (2010-2013) and Estonian Radiation Climate (2012-2015). EtEA weather service co-operated with University of Tartu to create regional re-analysis database BaltAn65+.

The GCOS Surface Network (GSN) and GCOS Upper Air Network (GUAN) are two critically important meteorological networks within the Global Climate Observing System for understanding climate change. The GSN station located in Tartu carries out actinometrical observations studying the radiation fluxes in Earth atmosphere and their transformation on the surface. In Tartu episodic measurements of solar radiation were carried out already at the beginning of the 20th century and in the 1930s and has therefore one of the longest records of observations in Northern-Europe. Since 1999 Tartu-Tõravere Meteorological station has been included in the Baseline Surface Radiation Network (BSRN). The data transmitted through the BSRN is used by World Climate Research Programme (WCRP), Global Energy and Water Exchange Project (GEWEX), Global Climate Observing System (GCOS) and Global Atmospheric Watch (GAW).

8.3.1. Climate observing systems, including those measuring atmospheric constituents

The **Estonian Environmental Research Centre** (EERC) conducts research on the basis of national programmes and provides a respective service to several environmental institutions, including the Environmental Board, within the framework of environmental monitoring. The EERC is the leading institution in the country for air monitoring research, operating all of its national ambient air monitoring stations. Operating services are additionally offered to manage private monitoring stations belonging to companies. The EERC has mobile ambient air laboratories for additional ambient air research.

The Air Quality Management Department organises ambient air monitoring and measurements in the EERC. The main field of activity of the department is sampling ambient air, emission gases and indoor premises and determining the pollutant content and pollutant level calculation assessment of the ambient air (air quality modelling) on the local and regional scale. The department is responsible for international and national air monitoring in Estonia, conducting national ambient air quality monitoring in cities and background areas (using a total of nine permanent monitoring stations) and for precipitation monitoring in Estonia.

The Climate Department of the EERC is *inter alia* tasked with phasing out ozone-depleting substances in order to avoid the harmful impact of ozone layer depletion on human health and nature. A contract between the Ministry of the Environment and the Estonian Environmental Research Centre and the 'National Programme for Phasing out Ozone-Depleting Substances' approved by the Government of the Republic in 1999 serve as the basis for this work.

The responsibilities of the **EtEA** weather service include all of the activities typically carried out by a national meteorological and hydrological service: handling meteorological issues connected to the protection of the environment; making weather forecasts; collecting, processing and storing the results of meteorological and hydrological measurements; conducting a climatological survey of Estonia; making the results of its work public; providing special services for public and private

interest groups on a commercial basis; and cooperating with foreign and international meteorological institutions, especially the WMO. It provides free services regarding the previous day's weather, short-term weather forecasts concerning Estonia and its territorial waters, weather forecasts for up to five days ahead for Estonia as a whole and for separate regions, a monthly weather forecast, storm warnings, a highway weather forecast, data concerning ultraviolet radiation and the ozone layer in Estonia and weather measurements from national weather stations and for world cities.

Tartu Observatory (TO) focuses on implementing remote monitoring methods and increasing the reliability of the results thereof in the fields of remote monitoring and atmospheric sciences. It has intensified its cooperation with the European Centre for the Exploitation of Meteorological Satellites (EUMETSAT) and strengthened ties with its European colleagues. Remote monitoring is closely related to radiation climatology, which has been a field of research of TO in the past, with an emphasis on classic radiation balance, the integral radiation energy absorbed and dissipated on the ground and the reflection properties of the surface. The surface is predominantly covered with the biosphere, and the effect of radiation on the biosphere and its effect on the atmosphere significantly depends on the spectral composition of the radiation in addition to irradiance. Ultraviolet (UV) radiation is particularly effective in its impact and the regular registration of the spectres thereof has been conducted at TO since 2004.

Since 2002, measurements of spectral aerosol optical depth and characteristics representing the size of particles have been conducted at Tõravere in the AERONET system. As regards the climatology of solar radiation and the dissipation of thermal radiation from the Earth, changes in atmospheric characteristics and the vertical structure of cloudiness are vital, and research into this has recently commenced. Methods of determining the water vapour content of the atmosphere have been compared and the reliability of the GPS method has been confirmed. The main factors that shape atmospheric counter-radiation – an essential component of the greenhouse effect – are water vapour and low-lying clouds. Local contributions of both have been detected during the summer and winter months. Ongoing climatology research is closely related to enhancing methods of accounting for the impact of the atmosphere in remote monitoring applications. The principles of variability and a regular temporal change of doses weighed for the biological impact of solar radiation are also being researched. The long-term high-quality radiation data time series of the EtEA weather service's Tartu-Tõravere weather station, which date back to the early 1950s, prove especially useful.

8.3.2. Ocean climate observing systems

The **Marine Systems Institute of Tallinn University of Technology** is an educational, research and development institution of the university. It is competent to conduct basic and applied research for systematic learning of the physical and biochemical processes of the Baltic Sea in the context of the impact of the atmosphere, mainland and human activity as well as to develop marine information systems and condition analysis and forecasting methods.

The objective of the 'Prototype Operational Continuity for the GMES Ocean Monitoring and Forecasting Service (2012-2014)' project is to develop the MyOcean2 system and launch an ocean

monitoring and forecasting component within the framework of the GMES marine services that would provide intermediaries and end-users with information concerning the physical status and ecosystems of the ocean.

The objective of the 'European Coastal-shelf Sea Operational Observing and Forecasting System' project (ECOOP, 2007-2010) was to integrate the existing operational coastal and regional sea monitoring and forecasting systems in Europe and the further development thereof into a pan-European network in order to ensure the registration of environmental and climate change, forecasting the further course of such change, preparing prompt and high-quality forecasts, disseminating information related to the marine environment and facilitating decision-making.

The objectives of the grant project 'Application of an Operational Oceanographic Model System to Study the Baltic Sea Large-scale and Mesoscale Circulation Patterns (2008-2011)' of the Estonian Science Foundation were to deconstruct the Baltic Sea's large-scale and mesoscale physical variability into dominant, objectively determined patterns/modes of temporally variable amplitude; to relate the amplitude variations, where possible, to variations in external forcing; and to study and interpret the corresponding physical reasons.

Estonian Marine Institute, University of Tartu (EMIUT) is a modern research institution whose main objectives are continuing the long-standing Estonian traditions of marine research and developing the field in Estonia and throughout the Baltic Sea region. It is the largest Estonian organisation to conduct marine research, and as such affects the direction in various fields of marine research on the regional scale. The main objectives of environmental monitoring are forecasting environmental factors and changes in the condition thereof with the help of an elaborate system of indicators and forecasting models. The data collected within the framework of environmental monitoring serves as the basis for planning and implementing environmental measures and adjusting them, where necessary.

The main purposes of the KESTA project 'The Status of Marine Biodiversity and its Potential Future in the Estonian Coastal Sea' are to develop a theoretical framework to describe the spatial and temporal variability of Estonia's marine biodiversity; to implement the received data, models and knowledge to describe scenarios of changes in the marine environment with a view to changing sources of effect, including new human impact and climate change; and to publish the results of the model thus created in leading professional journals and in a user-friendly online environment by means of public map applications. Close cooperation with colleagues in the respective field from foreign countries is ongoing through global joint programmes and international research organisations to achieve these objectives.

8.3.3. Terrestrial climate observing systems

The Air Quality Management Department of the **EERC** is responsible for the management and conducting of national programme integrated monitoring. The EERC is the leading institution in Estonia in research of the International Cooperation Programme on Integrated Monitoring of Air

Pollution Effects on Ecosystems. The objective of integrated monitoring is long-term observation of the biological, hydrological, chemical and physical indicators of various small ecosystems and catchment areas in order to determine the impact of natural factors, climate change, air pollution and other human activities on matter cycles (e.g. the nitrogen cycle and carbon cycle). The objective of researching the condition of the chosen ecosystems is to determine the causal connections between the changes taking place and the environmental factors that would enable the modelling of the conditions of and changes in ecosystems, or in other words, forecasting them proceeding from changes in various environmental parameters. The results are compared with the indicators of the respective monitoring stations of other European countries, which allows for broader generalisation of the monitoring results of various countries and similar trends to be determined. The department is also engaged in the long-term European Monitoring and Evaluation Programme (EMEP) under the Convention on Long-range Transboundary Air Pollution. The data of international cooperation programmes is forwarded to international databases.

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IX

EDUCATION, TRAINING AND PUBLIC AWARENESS

9.1. Introduction

This chapter provides an overview of activities that have been designed to increase climate-related awareness and general trends in society over the last five years. The development of climate education is mostly observable in general education, which increases environmental awareness and sustainability. The activities described in Chapter IX likewise present Estonia's aspirations to implement the New Delhi Work Programme, which was adopted at the 8th Conference of the Parties (COP 8) in 2002 in order to perform the obligations provided under Article 6 of the United Nations Framework Convention on Climate Change. The objective of the Work Programme is to encourage interest groups to reduce climate change denial and scepticism by means of education, participation of the general public and awareness-raising.

When examining various polls, a trend of increasing awareness and environmentally friendly behaviour among Estonians is evident, but Estonia has much further to go before it reaches the level of countries where environmental education has been systematically embraced for decades. However, the generalisation may be made that as abundant consumption has lasted for a short period of time in Estonia and a consumer society has not yet firmly developed, especially in rural areas, sustainable lifestyles and reuse are motivated by natural subsistence needs in many Estonian families. As civil society develops, an increase in the number of civic initiatives can be seen in the country. Citizens have thus started having a say and participating in shaping their physical and social environment more actively. More and more people are grasping the importance of individually contributing to the protection of the environment, including combating climate change. The "Let's Do It!" clean-up campaign that was launched as part of a civic initiative can be highlighted as an example, with over 40,000 volunteers across Estonia taking part in 2013. On the whole, several non-governmental organisations play an important role in educating Estonians in the field of climate change. In addition, the government has turned its attention to more systematic promotion of environmental education. A lot of work has also been performed at the local level: for example, three cities (Tallinn, Kuressaare and Rakvere) have joined the Covenant of Mayors and thereby assumed the obligation to reduce CO_2 emissions by 20 per cent by 2020 compared to the base year 2007. Estonia has also participated in several education cooperation projects and has co-financed assistance projects aimed at developing countries with the purpose of raising awareness of climate change.

9.2. General environmental education policy and awareness of climate change

The Ministry of Education and Research (MER) and the Ministry of the Environment (MoE) have been supporting projects that promote environmental awareness for years, but to date there has been no general national strategy for raising the environmental awareness of society in all regions in order to reflect national environmental education priorities and goals and potential domestic and international support schemes or to determine the spheres of responsibility of the ministries in promoting

the field. There are many institutions and organisations that are engaged in informal environmental education, but the field is not systemized – mainly due to project-based financing. The legal status of an institution or organisation poses a limit on the activities of centres; therefore the development of centres and the promotion of mutual cooperation have taken place on the initiative of institutions and organisations themselves. In a constantly changing legal system, it is also essential that citizens be aware of their rights and obligations related to the protection of the environment, be able to use environmental information and participate actively in decision-making related to the environment. Regarding the accessibility of environmental information, it is low, insufficient and scattered in Russian. This makes the Russian-speaking population a target group to whom more attention must be paid when promoting environmental education. When endeavouring to transform the values and behaviour patterns of the population so that they become more environmentally friendly, it is essential that the formal education system and environmental education offered outside formal education is based on uniform principles and that informal environmental education supports and supplements the provisions of national curricula.

In 2011, Minister of the Environment Jaanus Tamkivi therefore approved the 'Development of environmental education in Estonia' programme, which is co-financed by the European Social Fund (ESF). The objective of the programme is to reinvigorate the development of environmental education. The programme became effective as soon as it was signed off, and its completion has been scheduled for August 2015. The minister authorised the Environmental Board to implement the programme, whose financing totals EUR 3.2 million – 85 per cent of which comes from the ESF. The goal of the programme is to positively impact on the regional development of environmental education, the promotion of information society and, indirectly, protection of the environment. The awareness of the population concerning the impact of the decisions and activities of every person on the status of the environment should likewise increase.

The main financial aid in financing activities related to environmental education is received from the environmental awareness programme of the Environmental Investment Centre (EIC). The EIC was founded by the Ministry of Finance in 2000. It is *inter alia* possible to apply for an environmental loan for a specific purpose from the EIC in order to implement certain projects. In the period 2008-2012, the EIC financed approximately 2,000 environmental awareness projects that were either directly or indirectly related to the topic of climate change. The results of the research conducted with the support of the EIC are published on the website of the Ministry of the Environment and, on the basis of research reports, all institutions that are active in the fields of environmental awareness and education are able to plan their activities.

9.2.1. Awareness of the general public of climate change

Two major surveys conducted in the last few years have summarised the awareness of Estonians of the environment and climate change: the survey of the environmental awareness of Estonian citizens carried out in 2012 and the Eurobarometer survey of attitudes of European citizens towards climate change in 2011. The results indicate that although Estonians consider themselves to be generally environmentally aware, their interest tends to be limited to what takes place close to where they

live, whereas a lot of Estonians view the consequences of climate change as a threat that is distant in both space and time. The environmentally friendly activities that were most frequently mentioned are implemented primarily for economic reasons. In general, it may be stated that a sustainable way of life and reuse is motivated by natural subsistence needs in the poorer regions of Estonia and may not always be directly influenced by the need to reduce the carbon footprint. The development of climate-friendly thinking is indicated further by demand for organic products, which has grown every year: the commercial association Eesti Mahe, which brings together Estonia's organic producers and which launched sales of organic products in 2003 with 35 founding members, has grown to incorporate 93 members and its turnover has increased more than five-fold in the last five years. The increase in environmental awareness in society is also indicated by the interest of more and more people in eco-communes that are characterised by the local economy, an ecological lifestyle, intensive social considerations and, quite often, spiritualism. A good example of a functioning community that practises a sustainable lifestyle is the Uus Maailm ('New World') district in Tallinn.

The survey of environmental awareness of Estonian citizens conducted in 2012, which garnered 1,005 respondents, indicated that Estonians generally consider themselves to be environmentally aware (84 per cent). Environment-related information regarding the entire country has become ever more accessible – 64 per cent of the population were of the opinion that it is completely or largely accessible, whereas only 3 per cent felt that it is wholly inaccessible. People are most interested in the environmental status of their home area and its surroundings (95 per cent being very or rather interested). The majority of people are also concerned about the environmental status of the world as a whole, but this interest is relatively moderate (72 per cent) and had decreased slightly since 2010 (from 83 per cent). 98 per cent of respondents were of the opinion that nature conservation is beneficial and 77 per cent completely or more or less agreed that if a choice had to be made between two possibilities – preservation of the environment or development of economically beneficial activities – the environment should not be sacrificed. 81 per cent of respondents consider the status of the environment to be directly related to people's quality of life.

When evaluating sources of energy, the respondents most often favoured wind and timber/biomass in terms of cost, environmental friendliness and national security. Estonians considered nuclear power to be the worst option in all respects bar national security. Concerning the environmentally friendly activities in regard to which the respondents were asked to say whether they act in such a way and, if so, how frequently, the best results were achieved in terms of purchasing foodstuffs with the consideration of not throwing anything away (frequently/seldom 93 per cent), delivering hazardous waste to the designated locations (88 per cent) and waste-sorting (87 per cent). The respondents participated least in joint activities related to the protection of the environment (51 per cent) and the purchasing of products marked with eco-labels or organically produced agricultural products (61 per cent).

The Eurobarometer survey of attitudes of European citizens towards climate change in 2011 showed that a little over half of the 1,001 Estonians interviewed considered climate change to be a major global issue. Poverty, hunger and a lack of drinking water were the issues most frequently raised (59 per cent of respondents), followed by economic status and international terrorism (both

41 per cent). According to the questionnaire, on a scale of 1 to 10 (i.e. lowest to highest) Estonians rank the seriousness of climate change at 6.1 – the lowest of any European Union (EU) Member State. The attitudes of Estonians towards climate change have not changed greatly since summer 2009, when the respective indicator was 6.0. Only a third of respondents stated that they had helped combat climate change in the previous six months, although more than 60 per cent reported that they try to reduce domestic waste and to reuse items and 54 per cent avoid the use of disposable products. Three-quarters of respondents agreed with the statement that combating climate change and increasing energy efficiency will stimulate the economy and employment in the EU.

9.3. Education

In Estonia, the organisation of environmental education is mainly the responsibility of the Ministry of Education and Research and the Ministry of the Environment. The MER shapes the environmental education and environmental awareness of Estonian youth in the broadest meaning. The activities within the sphere of government of the MER determine the minimum content and level of environmental education to be taught to every student in the country.

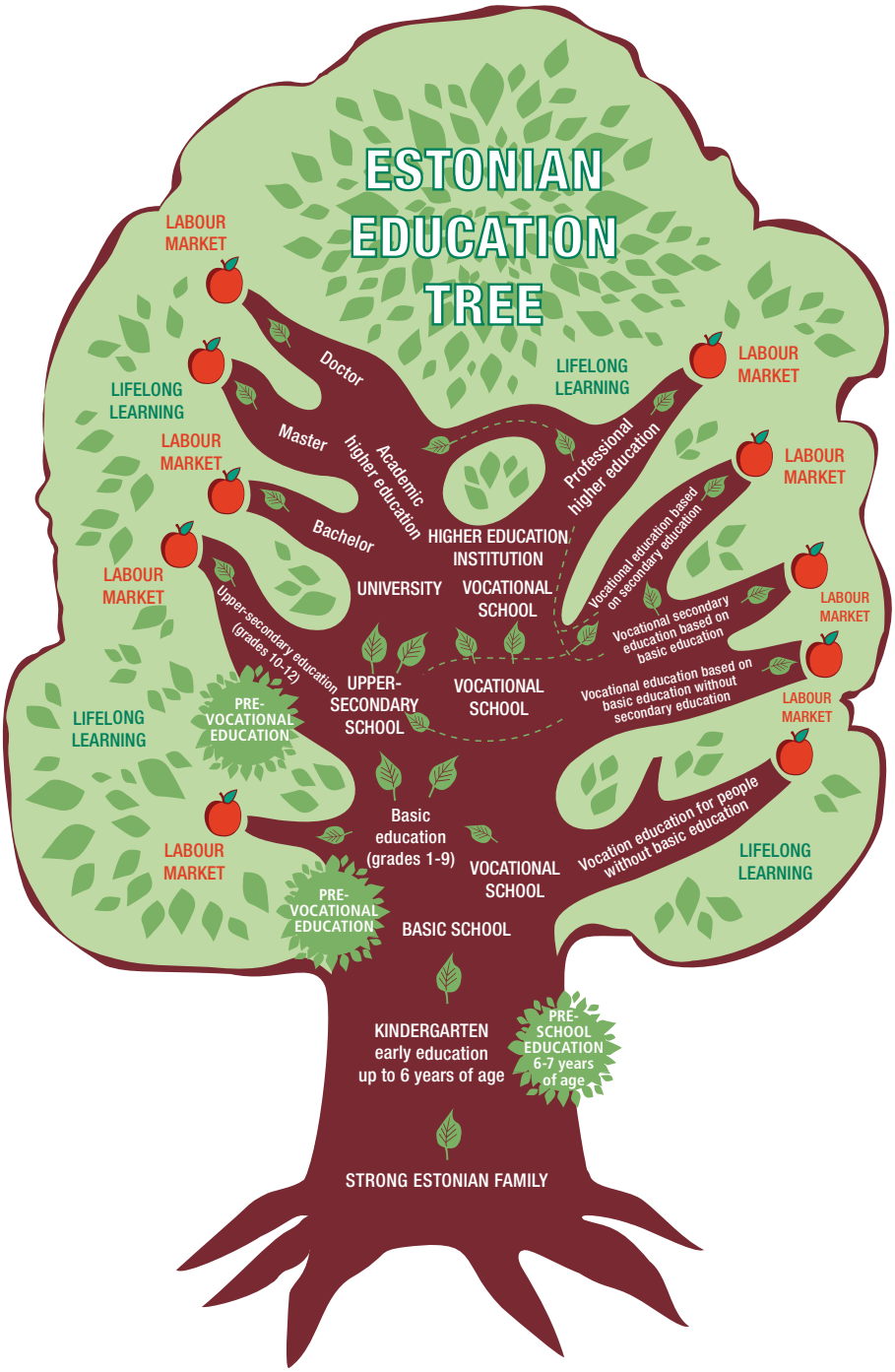

Figure 9. 1 Estonian Education Tree
Source: http://www.hm.ee/index.php?046407

The MoE supports the promotion of sustainable development in Estonia by improving the teaching aids related to the development of the respective infrastructure and offering programmes that support the national curricula to tens of thousands of students all over Estonia free of charge. The Public Relations Department is engaged in the field of environmental education and information in the MoE, incorporating the Environmental Education Bureau (EEB). The main task of the EEB in co-operation with the Ministry of Education and Research, the Environmental Investment Centre and other related institutions, is to promote environmental education through the preparation of sectoral draft legislation and development documents.

The education system is divided into four levels (Figure 9.1). The levels of education are preschool education, basic education (level I), secondary education (level II) – which in turn is divided into general secondary education and vocational secondary education – and higher education (level III).

In 2010, the Government approved the updated basic school and upper secondary school curricula, which give more consideration than previously to education that supports sustainable development, technical and technological education, creative education and museum studies, research studies, outdoor studies and practical activities. These changes presume respective in-service training for teachers and teaching staff of educational institutions in the formal education system and specialists who provide environmental education outside of the formal education system.

9.3.1. General education

The topic of climate change is included in the national curricula of basic schools and upper secondary schools. Climate and changes therein are directly handled in geography lessons in Year 9 and social education lessons in upper secondary school, as well as in the optional courses 'Science and society' and 'The globalising world' in upper secondary school. The impact of climate change on the natural environment and people is also handled within the framework of other subjects (natural history, biology and physics) and the recurrent topic 'The environment and sustainable development' in the curriculum.

The MER supports the participation of students from general education schools in the international environment-related education programmes ***BSP (Baltic Sea Project)*** and ***GLOBE Program***^{TM} in which students research the environment, including climate change, and participate in international communication networks. A total of 110 Estonian schools participate in these programmes. Students from Estonian schools have also participated in the ***Students of Miina Härma Gümnaasium and Tartu Kivilinna Gümnaasium upper secondary schools contributing to research of climate change*** *(2010)* programme and the ***Think globally and act locally*** *(2012)* environment camp held at Tartu Kivilinna Gümnaasium and Miina Härma Gümnaasium upper secondary schools.

The European Shared Treasure database provides information concerning international climate and environment projects in which Estonian schools/institutions have participated as partners (listed hereunder).

The aim of the ***Climate Change: Opportunities for Europe*** (2008-2010) project was to research how the participating countries react to climate change and how schools in the countries could prepare their students and communities/jobs for new opportunities that may come about as a consequence of climate change. The project focused on the possible benefits of global warming.

The objective of the ***Change within the change outside: stop climate change*** (2008-2010) project was to introduce opportunities for implementing responsible and climate-aware principles in various fields of life. The project resulted in the creation of a handbook, a CD collection with games and long-term projects that can be implemented by promoting sustainable education in schools and extracurricular activities.

The ***Innovative science for a cleaner world: Europeans becoming responsible citizens*** (2010-2012) project brought together students and teachers from Norway, Estonia and Germany. One of the objectives was to introduce the environmental issues of the countries to one another. General information was shared in lectures or presentations that were prepared by the students themselves. Visits to various destinations in the partner countries involved in the project enabled a better understanding of the consequences of environmental issues. The main aim was to provide the students with information concerning alternative energy and new environmentally friendly forms of technology.

The ***Learning about air pollution*** (2012-2014) project is designed to raise awareness among students and teachers of global climate change while improving the knowledge and skills of students in mathematics, science and information and communications technology by means of researching air pollution. The project also views the relations between economic development and environmental protection, the development of green technology and the role of individuals in climate change.

9.3.2. Higher education

It is not possible to study climate change as a separate field of specialisation at Estonian universities, but many offer Bachelor's or Master's programmes in environmental studies that *inter alia* include topics related to climate change. Numerous upper secondary schools and vocational educational institutions offer courses in environmental studies or give special consideration to issues related to the environment in their curricula.

Research and development activities related to climate and meteorology and the impact of climate change take place at the University of Tartu, Tallinn University, Tallinn University of Technology and the Estonian University of Life Sciences. Competence at the higher education level in the field of climate and climate change can be obtained within the framework of the curricula of biology, physics, geography, geology, environmental technology, ecology and biota preservation at the University of Tartu and within the framework of the curricula of bioecology and environmental management at Tallinn University. The field of specialisation of geography at Tallinn University of Technology provides competence in the fields of climatology, geology, oceanography, meteorology, hydrology, coastal processes and meteorological and oceanographic measuring systems. The Estonian University of Life Sciences handles the consequences of climate change in the curricula of the use and protection of natural resources. The international joint Master's curriculum 'Materials and processes in sustainable energetics' of Tallinn University of Technology and the University of Tartu aims to achieve sustainable use of energy that is also environmentally and consumer-friendly. Students from Estonia, China, Austria, Nepal, Mexico, Germany, Russia and Latvia have participated in the Master's programme financed by the MER that was launched in 2009. Research and the communication of knowledge in the field of climate change are conducted through various international and domestic projects. Climate change is also handled in several climatology-related theses.

9.4. Public information campaigns

The need to raise the awareness of the population concerning the impact of the decisions and activities of every person on the status of the environment is emphasised in the 'Development of environmental education in Estonia' programme, which was launched in 2011. Notification work to inform and teach people and change their attitudes has been performed at the regional and national levels.

In 2009, a joint project application to perform the tasks arising from the European Climate Package was submitted to the technical secretariat of the Interreg IVA programme of the European Regional Development Fund as a joint endeavour of four Baltic Sea capitals: Riga, Tallinn, Helsinki and Stockholm. The project was entitled 'Combat – Covenant of Mayors in the Central Baltic Capitals'. The Parties to the Covenant of Mayors undertake to unilaterally reduce CO_2 emissions by 20 per cent by 2020, which will be made possible by increasing energy efficiency by 20 per cent and increasing the proportion of renewable energy sources in the total energy balance to 20 per cent. Three Estonian cities have joined the Covenant: Kuressaare, Rakvere and Tallinn. When preparing the schedule for the project, Tallinn focused on introducing existing information and the information still being prepared to citizens. **Energy information days** and local project publications were planned for this purpose. The main objective of the energy information days was to showcase the latest ways of reducing utility costs by pursuing sustainable and environmentally friendly lifestyles. Useful advice was provided to citizens in order to reduce consumption of energy and water, while the benefits of the state and city for sustainable housing were presented and the parties providing sustainable and environmentally friendly building renovation were introduced to potential consumers.

In 2013, **Energy Conservation Week** was held all over Estonia for the fifth time. The idea behind the event is to make people think about consumption of energy and how to reduce it. The week includes various activities and events. The website **www.energiatark.ee**, which was launched especially for the week, provides advice on general environmentally friendly behaviour.

With the aim of promoting walking and cycling as environmentally friendly alternatives to driving, a **car-free day** is held in Estonia on 22 September every year. Over 30 activities were organised in September 2012, which was declared the **month of environmentally friendly mobility**, so as to increase the environmental awareness of citizens of Tallinn. The activities included the use of sustainable transport and combining means of transport to encourage people to leave their cars at home or in a Park & Ride car park and to use public transport and bicycles or to walk more than usual. For example, the use of public transport was promoted by allowing holders of a driver's

licence to use Tallinn's public transport free of charge during European Mobility Week. As a result of the experiment, traffic congestion decreased by 7 per cent compared to the average of the preceding three weeks. The occupancy of public transport was also reviewed in this period, with the respective indicator being 11-12 per cent higher compared to the previous weeks, and parking congestion slightly lower. Numerous events were also conducted in schools and nursery schools and seminars and discussions took place concerning environmentally friendly mobility. The month was reported on in several Estonian and Russian media channels, city district newspapers and on the campaign's website.

9.5. Training events and programmes

Various training programmes have been held whose target groups have been journalists, entrepreneurs and drivers. Forums and seminars designed for a wider audience have also taken place. The main topics under discussion included energy conservation, economical driving and air pollution.

Officials from the Climate and Radiation Department of the Ministry of the Environment have spoken about the climate to various stakeholders as well as basic and upper secondary school students. Information days have been organised for companies with regard to the EU emissions trading scheme and F-gases. Specialists from the Estonian Meteorological and Hydrological Institute have informed the general public of climate-related topics, performing in schools, appearing on television, presenting seminars and giving training events involving dozens of lectures related to climate change: one for officials from the Government Office and the MoE, one on Estonian climate and radiation, the REGIOCLIMA seminar 'Climate change in Estonia' in Tartu, the BALTIC CLIMATE seminar 'Possible climate change in Estonia' and others.

9.5.1. Promoting a low-carbon economy

Both consumers and companies are ever more vigilant when it comes to the social and environmental impact of products. Many companies prepare environmental statements to monitor and mitigate their impact.

The cross-border programme POWER financed by the European Regional Development Fund was completed in 2011. One of the sub-projects of the programme was SEECA (Strategy for Energy Efficiency through Climate Agreements). Following the example of the main Swedish partner to the project, Tallinn prepared handbooks on energy efficiency for companies and offices engaged in catering, commerce and industry. The handbooks were also provided to the departments and city districts of the City of Tallinn. Preparations were made in cooperation with the project partners to enter into climate agreements with undertakings and institutions with the aim of assuming the obligation of implementing a more energy-efficient organisation of work.

A key result of the POWER programme was the roadmap for management of the economy with lower CO_2 emissions for the Tallinn region. The environmental festival 'ROHEVIK – Green Future'

was organised in 2011 with the intention of promoting the principal objectives of the programme. The 'Modern eco-cities' conference was held as the opening event of the festival, which was then followed by the Rohevik conference, focussing on the development of wind power, the options available to smaller communities to implement new and sustainable energy solutions and more. Approximately 2,000 people attended the festival event held on Freedom Square – one of Tallinn's biggest public spaces – indicating a growing interest in environmentally friendly technology.

In 2012, the **Sustainable Development Forum** – which is dedicated to a socially responsible economy with low CO_2 emissions and economical use of natural resources – was organised for the sixth time. The main target groups of the forum are entrepreneurs and those who shape economic policy in Estonia.

9.5.2. Economical driving

There are currently 27 active **eco-driving** instructors in Estonia, and in the last few years young drivers who have been issued with a provisional licence have taken an economical driving course as a mandatory part of their training. The bus drivers from Tallinn Bus Company (TBC) have received training within the framework of the CIVITAS Mimosa (Making Innovation in Mobility and Sustainable Actions) project, as the result of which the fuel consumption of public transport buses has decreased by between 5.3 and 7.6 per cent on average.

A telephone survey concerning economical driving that was conducted in Tallinn in 2011 among companies operating in the fields of waste transport, street cleaning and road building and repairs revealed that 92 per cent of respondents train new lorry drivers and three-quarters consider saving fuel to be necessary. As a result of an international training seminar entitled 'Environmentally friendly transport and gaseous fuels', which was attended by around 60 participants from various companies and institutions, some of the participants commenced negotiations to have their vehicles rebuilt to consume natural gas or biogas. The major companies in Tallinn connected with public services had the need for and importance of economical driving explained to them and were given the possibility to train their drivers as part of a seminar entitled 'Sustainable driving – eco-driving'.

With a view to speeding up the commissioning of electric cars in Estonia and fulfilling the goal undertaken by the state to increase the use of renewable energy in transport by 2020, the Estonian Electromobility Programme (ELMO) was launched in 2011. The Government entered into a contract with the Mitsubishi Corporation for the sale of AAUs in the amount of 10 million AAUs to initiate the programme. It consists of three parts: 500 Mitsubishi iMiev electric cars were commissioned by the Ministry of Social Affairs as an example; the Ministry of Economic Affairs and Communications developed a support system for people to acquire electric cars; and the infrastructure needed to recharge electric cars is to be set up so as to cover the entire country. Distribution of purchase grants and the construction of the recharging network is being organised and managed by KredEx.

9.5.3. Promotion of sustainable transport

The 'Well-organised city mobility – cleaner air and better human environment' forum was held in 2012, attended by 112 people. The forum was part of the activities planned in Tallinn to increase environmental awareness, with the aim of applying for the European Green Capital title in 2018. The objectives of the forum were to gain an overview of effective solutions in European cities and to discuss solutions for the development of public transport, parking, public space, safe school journeys and cycle and pedestrian tracks for the subsequent few years with city officials, experts, educational institutions and non-governmental organisations. A protocol was signed at the end of the forum, within the framework of which the organisation of sustainable transport in the city was supported along with the sustainable development of public transport and the idea of public transport which is free of charge.

9.5.4. Environmental schools for journalists

The Ministry of the Environment regularly organises specialised environmental schools for journalists at which professionals from the respective fields clarify the circumstances related to various decisions. To date, journalists have attended a forest school, a waste school, a fisheries school and an EU financing school. In 2011 journalists also participated in an air-related training event entitled 'Air school – is our air clean?' in Harju County and Lääne-Viru County at which the main topics were ambient air, noise and chemicals, including the impact of ambient air pollution on the climate.

9.6. Public access to environmental information

Access to environmental information in Estonia is mainly regulated by the Public Information Act. In the last decade, various IT solutions have been implemented to ensure better access for the Estonian public to environmental information. A special electronic system called the Draft Legislation Information System (DLIS) has been created to approve draft legislation. Public servants of the state use the information system to approve draft legislation and submit it to the Government; the legislation is also available for public consultation at http://eelnoud.valitsus.ee/main#kSXAfDbV/. Citizens are able to express their opinions concerning the content of draft legislation and suggest proposals to the Government via the website https:// www.osale.ee/.

The MoE uses its website www.envir.ee to publish environmental information. It is also the main source of information concerning climate policy and its implementation, providing an overview of climate change-related issues and the implementation of the United Nations Framework Convention on Climate Change and the Kyoto Protocol by means of National Communications and National Greenhouse Gas (GHG) Inventories. The website includes a list of Estonian legislation related to climate change and information concerning Joint Implementation projects and the European Union Emission Trading Scheme (EU ETS). The website also contains the informative booklet *Climate change and us* prepared by the Environmental Committee of the Riigikogu for the general public.

The website www.keskkonnainfo.ee of the **Estonian Environment Agency** is a source of environmental data that encompasses various indicators, analyses and reports. The website publishes reports relating to air quality, environmental monitoring, nature conservation, water quality and the status of the environment. Information concerning environmental data can be electronically accessed in the Environmental Register at http://register.keskkonnainfo.ee; the Register is regulated by the Environmental Register Act.

The **Environmental Board**, operating within the sphere of government of the MoE, incorporates the Environmental Education Department with workers in all counties. The objective of the department is to introduce nature and environment conservation and to shape the values of society so that they become more environmentally friendly. The teaching aids on the Environmental Board's **environmental education bus**, which drives around northern Estonia, provide information on the use of solar power, reasonable consumption of water and electricity, noise, energy-efficient buildings and mineral resources.

Within the programme of developing environmental education, the web portal www.keskkonnaharidus.ee is being developed to serve as web-based support for the cooperation network. The portal will provide access to study programmes and materials related to environmental education. The programme aims to bring environmental education-related experience to Estonia from countries that have purposefully dealt with environmental education for decades, thereby reducing inequality in the development of Estonia and countries that are more advanced in the field of environmental education.

The **Ice Age Nature Study and Visiting Centre** in Tartu County combines the popular science approach to the ice age with entertainment. Since its opening in July 2012 it has been visited by over 75,000 people. The role of the centre is to introduce the development of Estonian nature and to promote environmental education among students and adults. The objective of the exhibitions is to provide visitors with an overview of the causes and impact of ice ages, the development history of Estonian nature and human habitat since the last ice age and the causes of and research into climate change. The **Tartu Environmental Education Centre** also integrates environmental education into daily life and curricula by imparting knowledge and skills that are necessary for sustainable development.

9.6.1. Media

The majority of people receive information via the media, especially television. In order to raise the awareness of the general public, the Ministry of Education and Research cooperates with Estonian Public Broadcasting to produce scientific programmes and show quality films (including documentaries) related to climate and geography to a wider audience. The radio programs *Ökoskoop* and *Keskkonnatelk* and the TV show *Osoon* are broadcast every week. The series *Mõistlik või mõttetu* is an environment-related family series dedicated to reducing the carbon footprint of citizens where regular Estonian families discuss their daily consumption habits with professionals from the field.

Daily newspapers report on climate change via topical articles. The environment and climate change are handled in various environment-related periodicals such as *Eesti Loodus*, *Keskkonnatehnika* and *Horisont*. The websites www.bioneer.ee and www.greengate.ee specialise in publishing environmental information originating from other media. Both contribute to raising the awareness of the general public and publishing environmental information. The public are also able to use web portals dedicated to energy conservation: www.kokkuhoid.energia.ee and http://www.energiaaudit.ee. Given the Estonian context in particular, the University of Tartu (with the support of the Environmental Investment Centre) has created a carbon footprint calculator which is available in both Estonian and Russian at http://www.ut.ee/mobility/jalajalg/.

9.7. Involvement of the public and non-governmental (NGO) organizations

A number of NGOs operate in Estonia that help raise awareness of climate change in society by means of campaigns, surveys and events. They often serve as cooperation partners on international projects. The undertakings of certain organisations in recent years are described below.

The **Archimedes Foundation** was established as an independent institution in 1997 to conduct international educational and research cooperation programmes in Estonia. Today, Archimedes has become the structure that intermediates education and science between Estonia and the European Union and is the organiser of higher education accreditation. From 2008-2011, with the support of the Comenius Programme, it organised various international projects related to the topics of nature and the environment. Estonian schools and nursery schools have been the partners or coordinators in such projects, which have produced interesting teaching aids and provided useful experience.

The **Baltic Environmental Forum** (BEF) is a partner in the international project 'Increasing the Proportion of Cycling in City Transport in Small and Medium-sized Cities in Central and Eastern Europe by 2020 (mobile2020)' will is being implemented from 2011-2013 with the objective of helping local stakeholders inspire citizens to use bikes as their daily means of transport instead of cars and so as to raise the proportion of cycling in general city transport to 20 per cent by 2020. Seminars, training events and visits are held for this purpose, background materials are prepared (a CO_2 calculator) and interest groups in the field are brought together. The activities of the project are being implemented in 11 Central and Eastern European countries, including Estonia, Germany and the Netherlands.

The **Estonian Environmental Law Center** (EELC) was founded in 2007 by an environmental NGO Estonian Fund for Nature (ELF) and three public interest environmental lawyers. The aim of the organization is to create, collect, disseminate and use expert knowledge on environmental and also climate related law in order to enhance development of environmental law and quality of environmental decisions of different levels as well as environmental legislation. In 2012 EELC compiled a case study on 'Climate change aspects within Strategic Environmental Assessment (SEA) proceedings.

SEA of the National Energy Sector Development Plan / Estonia' and a case study on 'Climate change aspects within Environmental Impact Assesment (EIA) proceedings. Raudsaare Peat Extraction Site / Estonia'. There is also a section dedicated to climate on EELC' webpage where corresponding legislative news are published.

Founded in 1988 , the **Estonian Green Movement** (EGM) is a non-profit NGO that deals with protection of the environment. In 2009 it was one of the initiators of the 'More bicycles in Estonia!' movement. The objective of the movement is to make getting to work/school and conducting other everyday affairs by bike more convenient, secure and natural so as to make cycling one of the most preferred means of transport in Estonia's towns and cities. There are already good examples of settlements and places (including establishments and institutions of higher education) where bicycles are being heavily used.

The **Estonian Fund for Nature** (ELF) is a non-governmental environmental protection organisation that is politically and economically independent. During a project to increase awareness of global environmental issues that was conducted in 2010 and 2011, the ELF prepared and published information pertaining to global environmental issues, including climate change. The climate-related documents prepared in the course of the project were published on the organisation's website and in the mass media. Several programmes are also related to climate change issues: observing forestry policy, preservation and restoration of wetlands and promotion of sustainable agriculture. In 2012, the ELF analysed options for the restoration of 10 Estonian bogs in relation to CO_2 binding and also participated in a project of the network of Central and Eastern European NGOs (CEEweb) to disseminate recommendations related to climate change in Eastern Europe. In 2013 ELF participated in the European Commission campaign 'A world you like. With a climate you like' as a partner responsible for spreading information.

The **Estonian Renewable Energy Association** (EREA) is an NGO that was founded in 2011. It draws together Estonian organisations related to renewable energy through associations and producing members. The objective of the association is to assist in shaping a long-term, stable and predictable legal environment that promotes the development of renewable energy in Estonia. The long-term aim of the association is a total transition to renewable energy sources in the energy economy. The EREA has prepared the 'TE100' project, sketching a development direction for the Estonian energy sector that allows a complete transition to renewable energy in the electricity and heat economy by 2030, which was also discussed in a public forum.

The **Estonian Wind Power Association** (EWPA) connects companies, organisations and individuals interested in the potential of wind power. Its mission is to create conditions for the development and competitiveness of wind energy and its technology to ensure the preservation of a clean physical and social environment by means of wider exploitation of renewable energy. Global Wind Day is celebrated in Estonia 15 June every year. Extensive information concerning wind power and the importance thereof is communicated during the event.

The **Tallinn Centre of the Stockholm Environment Institute** (SEIT) has participated in numerous local, national and international climate-related projects for over fifteen years via its climate and

energy programmes. The 'Network for Green Office Standardisation in the EU – NeGOSE' project financed by the EU Leonardo da Vinci Programme started in 2011. The project will last for three years and be managed in Estonia by SEI Tallinn. The goal of the project is to contribute to making offices more environmentally friendly and usable and to raise the knowledge and skills of workers to a new level.

The **Tartu Regional Energy Agency** was founded in 2009 by Tartu City Government and Tartu Science Park with the aim of promoting sustainable energetics and energy management in the region. It focuses on promoting energy management and key issues in modern energetics such as energy efficiency, sustainable transport and renewable energy.

9.8. Participation in international activities

The potential consequences of climate change are a headache for humanity as a whole and rapid success in developing technology and cooperating internationally in the field of regulating environmental processes must be achieved. Estonia has participated in several educational cooperation projects (described above) in addition to the projects noted below.

In 2012, the Ministry of the Environment supported one of the fastest-growing civic initiatives in Estonia – "**Let's Do It!**". The movement was launched in 2008 when 50,000 people came together to collect 10,000 tons of illegal garbage from roadsides, forests and towns, cleaning the entire country in five hours. The "Let's Do It!" team thereafter prepared the activity programme 'World Clean-up 2012' in which hundreds of volunteers, NGOs and other organisations met in order to initiate a global voluntary world clean-up campaign. Numerous local, national and regional clean-up events were held during the year, with more than 3 million volunteers in over 65 countries participating, resulting in the collection of over 100,000 tons of waste. Regional meetings were held at the same time to exchange experience and plan subsequent activities. Information materials were prepared and a virtual waste map software solution was created with a view to assisting the activities and supporting capacity-building in the field.

As the reduction in energy consumption, re-use and the minimisation of waste are essential measures in combating climate change, by promoting voluntary action and raising awareness of the importance of a clean and safe environment the clean-up campaign is a prominent example of the introduction of the principles of sustainable development.

9.8.1. Fast start finance projects

The Copenhagen Accord notes developed countries' commitment to providing developing countries with fast start finance approaching EUR 22 billion from 2010-2012, for enhanced action on

mitigation (including 'Reducing Emissions from Deforestation and Forest Degradation, REDD'), adaptation, technology development and transfer and capacity-building. Fast start finance supports immediate action on climate change and kick starts mitigation and adaptation efforts in developing countries.

In 2011, Estonia provided EUR 796,972 in co-financing for the 'Global Climate Change Alliance – Climate Change Adaptation in the Renewable Natural Resources Sector' programme. The overall objective of the programme is to enhance the resilience of Bhutan's rural households to the effects of climate change. The specific objective is to ensure the climate change readiness of the Renewable Natural Resources sector in Bhutan by mainstreaming climate change in the sector and ensuring that steps are taken to increasingly address climate change adaptation at the multi-sectoral level.

The MoE has also allocated EUR 1.6 million for the United Nations Environment Programme (UNEP) entitled 'Strengthening Climate Change Adaptation in Rural Communities, for Agriculture and Environmental Management in Afghanistan' as part of the UNEP project 'Environmental Co-operation for Peace-building – Phase III' from 2012-2015. The project will build national capacity to plan for community resilience to climate change-based threats in the country.

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Web Pages:

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Baltic Environmental Forum: http://www.bef.ee/

ELMO Programme: http://elmo.ee/home/

Estonian Environmental Law Centre: http://www.k6k.ee/

Estonian Green Movement: http://www.roheline.ee/content/view/18/45/lang,et

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Estonian Renewable Energy Association: http://www.taastuvenergeetika.ee/

Estonian Wind Power Association: http://www.tuuleenergia.ee/

European Shared Treasure: http://www.europeansharedtreasure.eu/

Environmental Board: http://www.keskkonnaamet.ee/

Environmental Investment Centre: http://www.kik.ee/et/keskkonnateadlikkus/keskkonnateadlikkus

The Ice Age Centre: http://www.jaaaeg.ee/

Let's Do It! campaign: http://www.letsdoitworld.org/

Ministry of Education and Research: http://www.hm.ee/index.php?1510026

Stockholm Environment Institute Tallinn Centre: http://www.seit.ee/index.php

Tartu Regional Energy Agency: http://trea.ee/

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals	**14,563.07**	**45.60**	**3.26**	**NA,NE,NO**	**159.38**	**NA,NE,NO**	**NA,NO**	**NA,NE,NO**	**0.00**	**33.84**	**136.90**	**31.06**	**72.68**
1. Energy	**18,366.41**	**9.31**	**0.32**							**33.73**	**136.50**	**20.84**	**71.29**
A. Fuel Combustion — Reference Approach[2]	18,688.27												
Sectoral Approach[2]	18,366.41	5.73	0.32							33.73	136.50	20.82	71.29
1. Energy Industries	14,829.11	0.64	0.11							18.38	23.01	8.12	66.85
2. Manufacturing Industries and Construction	784.01	0.10	0.01							1.45	1.06	0.24	2.16
3. Transport	2,236.96	0.21	0.06							11.50	18.83	2.62	0.24
4. Other Sectors	496.52	4.78	0.14							2.19	93.28	9.77	2.04
5. Other	19.82	0.00	0.00							0.21	0.33	0.06	0.00
B. Fugitive Emissions from Fuels	NO	3.58	NO							NO	NO	0.02	NO
1. Solid Fuels	NO	NO	NO							NO	NO	NO	NO
2. Oil and Natural Gas	NO	3.58	NO							NO	NO	0.02	NO
2. Industrial Processes	**452.62**	**NA,NO**	**NA,NO**	**NA,NE,NO**	**159.38**	**NA,NE,NO**	**NA,NO**	**NA,NE,NO**	**0.00**	**0.11**	**0.40**	**3.88**	**1.39**
A. Mineral Products	452.62	NO	NO							NE,NO	NE,NO	0.02	0.23
B. Chemical Industry	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA,NO	NA,NO	NA,NO	NA,NO
C. Metal Production	NA,NO	NA,NO	NA				NA,NO		NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production[3]	NO									0.11	0.40	3.86	1.16
E. Production of Halocarbons and SF_6					NA,NO		NA,NO		NO				
F. Consumption of Halocarbons and SF_6				NE,NO	159.38	NE,NO	NA,NO	NE,NO	0.00				
G. Other	NO	NO	NO	NO	NA,NO	NO	NA,NO	NO	NO	NO	NO	NO	NO

Note: **A** = Actual emissions based on Tier 2 approach of the IPCC Guidelines.
P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

Note: All footnotes for this table are given at the end of the table on sheet 3.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 2 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs [1]		PFCs [1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
3. Solvent and Other Product Use	**13.95**		**0.02**							**NO**	**NO**	**6.34**	**NO**
4. Agriculture		**21.72**	**2.63**							**NA,NO**	**NA,NO**	**NA,NE,NO**	**NA**
A. Enteric Fermentation		19.56											
B. Manure Management		2.16	0.34									NE	
C. Rice Cultivation		NO										NO	
D. Agricultural Soils [4]		NO	2.29									NE,NO	
E. Prescribed Burning of Savannas		NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues		NO	NO							NO	NO	NO	
G. Other		NA	NA							NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	[5] **-4,269.92**	**0.01**	**0.02**							**NE,NO**	**NE,NO**	**NE,NO**	**NO**
A. Forest Land	[5] -5,184.22	0.00	0.00							NE	NE	NE	
B. Cropland	[5] 175.83	NO	0.02							NE	NE	NE	
C. Grassland	[5] 282.29	0.00	0.00							NE	NE	NE	
D. Wetlands	[5] 129.35	0.00	0.01							NE	NE	NE	
E. Settlements	[5] 262.01	NE	NE							NE	NE	NE	
F. Other Land	[5] 64.82	NE,NO	NE,NO							NE	NE	NE	
G. Other	[5] IE	IE	NE							NO	NO	NO	NO
6. Waste	**NO**	**14.57**	**0.27**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NE,NO**
A. Solid Waste Disposal on Land	[6] NO	12.11								NE,NO	NE,NO	NE,NO	
B. Waste-water Handling		0.28	0.11							NA,NE	NA,NE	NA,NE	
C. Waste Incineration	[6] NO	NO	NO							NE	NE	NE	NE
D. Other	NO	2.17	0.16							NE	NE	NE	NE,NO
7. Other *(please specify)* [7]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Other non-specified	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: All footnotes for this table are given at the end of the table on sheet 3

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 3 of 3)

Inventory 2011
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Memo Items:[8]													
International Bunkers	**701.03**	**0.04**	**0.01**							**12.16**	**7.98**	**1.59**	**1.14**
Aviation	104.06	0.00	0.00							0.40	0.14	0.02	0.03
Marine	596.97	0.04	0.00							11.76	7.84	1.57	1.11
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**3,599.05**												

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

(2) For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in the documentation box to Table 1.A.(c). For estimating national total emissions, the results from the Sectoral approach should be used, where possible.

(3) Other Production includes Pulp and Paper and Food and Drink Production.

(4) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(5) For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(6) CO_2 from source categories Solid Waste Disposal on Land and Waste Incineration should only be included if it stems from non-biogenic or inorganic waste streams. Only emissions from Waste Incineration Without Energy Recovery are to be reported in the Waste sector, whereas emissions from Incineration With Energy Recovery are to be reported in the Energy sector.

(7) If reporting any country-specific source category under sector "7. Other", detailed explanations should be provided in Chapter 9: Other (CRF sector 7) of the NIR.

(8) Countries are asked to report emissions from international aviation and marine bunkers and multilateral operations, as well as CO_2 emissions from biomass, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**14,563.07**	**957.54**	**1,010.97**	**159.38**	**NA,NE,NO**	**1.82**	**16,692.77**
1. Energy	**18,366.41**	**195.44**	**99.78**				**18,661.63**
A. Fuel Combustion (Sectoral Approach)	18,366.41	120.30	99.78				18,586.49
1. Energy Industries	14,829.11	13.53	32.99				14,875.63
2. Manufacturing Industries and Construction	784.01	2.08	4.13				790.22
3. Transport	2,236.96	4.38	18.53				2,259.87
4. Other Sectors	496.52	100.28	43.80				640.59
5. Other	19.82	0.02	0.33				20.18
B. Fugitive Emissions from Fuels	NO	75.14	NO				75.14
1. Solid Fuels	NO	NO	NO				NO
2. Oil and Natural Gas	NO	75.14	NO				75.14
2. Industrial Processes	**452.62**	**NA,NO**	**NA,NO**	**159.38**	**NA,NE,NO**	**1.82**	**613.82**
A. Mineral Products	452.62	NO	NO				452.62
B. Chemical Industry	NO	NO	NO	NA	NA	NA	NA,NO
C. Metal Production	NA,NO	NA,NO	NA	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production	NO						NO
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				159.38	NA,NE,NO	1.82	161.19
G. Other	NO	NO	NO	NA,NO	NA,NO	NO	NA,NO
3. Solvent and Other Product Use	**13.95**		**4.90**				**18.86**
4. Agriculture		**456.10**	**814.42**				**1,270.52**
A. Enteric Fermentation		410.67					410.67
B. Manure Management		45.43	104.68				150.10
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NO	709.74				709.74
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		NO	NO				NO
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry [1]	**-4,269.92**	**0.11**	**7.00**				**-4,262.81**
A. Forest Land	-5,184.22	0.05	0.01				-5,184.16
B. Cropland	175.83	NO	5.36				181.19
C. Grassland	282.29	0.00	0.00				282.30
D. Wetlands	129.35	0.06	1.63				131.03
E. Settlements	262.01	NE	NE				262.01
F. Other Land	64.82	NE,NO	NE,NO				64.82
G. Other	IE	IE	NE				IE,NE
6. Waste	**NO**	**305.89**	**84.87**				**390.76**
A. Solid Waste Disposal on Land	NO	254.31					254.31
B. Waste-water Handling		5.98	34.40				40.38
C. Waste Incineration	NO	NO	NO				NO
D. Other	NO	45.60	50.47				96.07
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	701.03	0.85	2.48				704.36
Aviation	104.06	0.03	1.02				105.11
Marine	596.97	0.82	1.46				599.26
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**3,599.05**						**3,599.05**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	20,955.58
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	16,692.77

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

TABLE 10 EMISSION TRENDS
CO_2
(Part 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**35,565.96**	**32,585.73**	**23,576.37**	**18,428.92**	**19,011.55**	**17,314.04**	**18,017.54**	**17,534.17**	**15,928.44**	**14,836.41**
A. Fuel Combustion (Sectoral Approach)	35,565.96	32,585.73	23,576.37	18,428.92	19,011.55	17,314.04	18,017.54	17,534.17	15,928.44	14,836.41
1. Energy Industries	28,748.11	26,240.22	19,857.25	15,626.10	15,888.78	14,371.02	14,887.82	14,467.07	12,893.82	12,323.74
2. Manufacturing Industries and Construction	2,477.52	2,336.78	1,570.67	742.85	1,044.58	880.22	958.08	877.98	822.85	474.59
3. Transport	2,418.18	2,200.67	1,136.83	1,257.06	1,573.90	1,539.55	1,599.14	1,706.12	1,765.10	1,642.66
4. Other Sectors	1,878.61	1,754.69	977.37	792.11	493.29	494.46	556.24	469.32	429.46	378.23
5. Other	43.54	53.37	34.24	10.81	10.99	28.79	16.26	13.69	17.20	17.19
B. Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes	**1,048.23**	**1,026.73**	**587.44**	**325.35**	**609.65**	**646.95**	**648.81**	**680.14**	**705.22**	**649.03**
A. Mineral Products	628.18	636.02	387.16	246.48	350.39	366.98	379.79	416.11	438.40	391.11
B. Chemical Industry	420.05	390.71	200.28	78.87	259.27	279.97	269.01	264.03	266.83	257.92
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	20.77	22.09	17.04	16.04	17.76	20.44	21.67	22.14	23.74	22.90
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry[2]	**-8,850.65**	**-8,852.89**	**-9,294.37**	**-9,843.58**	**-10,347.66**	**-10,598.43**	**-10,399.39**	**-9,472.12**	**-7,603.81**	**-4,636.76**
A. Forest Land	-9,212.15	-9,156.33	-9,492.22	-9,998.61	-10,463.64	-10,672.16	-10,406.88	-9,449.50	-7,582.29	-4,582.64
B. Cropland	125.37	100.81	40.69	14.84	-1.92	-6.05	-14.58	-7.48	35.19	47.06
C. Grassland	106.89	80.54	41.36	31.89	9.30	-29.74	-90.52	-129.95	-167.61	-214.03
D. Wetlands	129.24	122.09	115.81	102.60	102.60	102.60	102.60	102.60	102.60	102.60
E. Settlements	NE,NO	NE,NO	NE,NO	5.69	6.00	6.91	9.98	12.22	8.30	10.25
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
6. Waste	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.02**	**0.01**	**0.03**	**0.06**	**0.04**
A. Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Waste-water Handling										
C. Waste Incineration	0.03	0.03	0.03	0.03	0.03	0.02	0.01	0.03	0.06	0.04
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**27,784.35**	**24,781.69**	**14,886.51**	**8,926.77**	**9,291.34**	**7,383.03**	**8,288.64**	**8,764.37**	**9,053.65**	**10,871.63**
Total CO_2 emissions excluding net CO_2 from LULUCF	**36,635.00**	**33,634.58**	**24,180.88**	**18,770.35**	**19,639.00**	**17,981.46**	**18,688.03**	**18,236.49**	**16,657.46**	**15,508.39**
Memo Items:										
International Bunkers	**682.06**	**703.88**	**427.39**	**529.64**	**445.96**	**331.57**	**338.57**	**379.57**	**379.40**	**416.96**
Aviation	107.70	107.70	35.90	54.00	44.88	53.85	48.15	67.41	47.15	66.77
Marine	574.36	596.18	391.48	475.64	401.08	277.72	290.42	312.16	332.25	350.20
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	927.21	910.13	871.56	830.41	1,345.91	2,181.45	2,605.56	2,659.18	2,265.19	2,279.44

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CO_2
(Part 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**14,490.57**	**14,820.85**	**14,528.06**	**16,301.62**	**16,404.21**	**15,711.61**	**15,086.67**	**17,944.61**	**16,422.21**	**13,832.39**
A. Fuel Combustion (Sectoral Approach)	14,490.57	14,820.85	14,528.06	16,301.62	16,404.21	15,711.61	15,086.67	17,944.61	16,422.21	13,832.39
1. Energy Industries	11,892.21	11,705.03	11,425.98	13,224.50	13,144.25	12,360.55	11,629.43	13,875.70	12,575.99	10,656.87
2. Manufacturing Industries and Construction	572.29	696.81	482.06	551.26	659.32	714.24	709.68	1,175.05	1,070.37	586.81
3. Transport	1,627.45	1,936.92	2,067.74	1,986.29	2,033.48	2,104.92	2,269.26	2,394.47	2,277.72	2,100.24
4. Other Sectors	381.75	463.57	537.60	520.57	539.39	497.06	446.65	468.76	487.35	459.34
5. Other	16.87	18.52	14.68	18.99	27.76	34.84	31.65	30.62	10.78	29.13
B. Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes	**633.65**	**659.18**	**457.40**	**512.14**	**658.98**	**687.87**	**734.93**	**908.99**	**918.43**	**311.45**
A. Mineral Products	402.32	410.70	393.87	375.56	408.26	415.74	463.32	648.93	647.74	281.80
B. Chemical Industry	231.33	248.48	63.53	136.58	250.71	272.13	271.61	260.05	270.69	29.66
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	19.01	17.69	18.78	18.62	18.89	20.00	21.00	19.77	17.07	14.05
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry[(2)]	**1,096.24**	**4,574.43**	**3,335.73**	**655.03**	**-2,390.12**	**-5,041.08**	**-7,003.74**	**-8,117.90**	**-8,133.06**	**-7,349.07**
A. Forest Land	1,149.42	4,617.78	3,649.43	1,317.60	-1,576.92	-4,406.33	-6,695.80	-8,132.81	-8,596.93	-8,108.58
B. Cropland	46.91	65.07	81.60	95.79	117.11	146.85	179.25	192.85	203.73	185.46
C. Grassland	-269.75	-314.99	-684.02	-1,093.93	-1,350.62	-1,374.88	-1,180.07	-860.14	-486.89	-124.59
D. Wetlands	102.60	102.60	109.21	109.19	124.56	148.22	155.93	151.18	178.40	165.29
E. Settlements	67.06	103.97	179.51	226.39	278.67	346.50	416.51	391.52	421.82	397.27
F. Other Land	NO	NO	NO	NO	17.07	98.56	120.43	139.49	146.80	136.08
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
6. Waste	**0.06**	**0.04**	**0.02**	**0.01**	**0.01**	**0.01**	**0.00**	**NO**	**NO**	**NO**
A. Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Waste-water Handling										
C. Waste Incineration	0.06	0.04	0.02	0.01	0.01	0.01	0.00	NO	NO	NO
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**16,239.54**	**20,072.21**	**18,339.99**	**17,487.43**	**14,691.96**	**11,378.41**	**8,838.86**	**10,755.46**	**9,224.65**	**6,808.82**
Total CO_2 emissions excluding net CO_2 from LULUCF	**15,143.30**	**15,497.77**	**15,004.26**	**16,832.39**	**17,082.08**	**16,419.49**	**15,842.60**	**18,873.36**	**17,357.71**	**14,157.89**
Memo Items:										
International Bunkers	**395.44**	**363.23**	**428.61**	**410.17**	**560.84**	**523.64**	**767.15**	**930.04**	**877.45**	**809.82**
Aviation	64.81	48.60	55.84	55.48	89.10	146.63	97.50	153.54	85.37	100.89
Marine	330.63	314.63	372.77	354.69	471.74	377.01	669.66	776.50	792.07	708.93
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	2,298.29	2,418.95	2,451.88	2,582.86	2,681.81	2,625.34	2,358.71	2,667.04	2,868.35	3,148.01

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CO_2
(Part 3 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	**17,449.42**	**18,366.41**	**-48.36**
A. Fuel Combustion (Sectoral Approach)	17,449.42	18,366.41	-48.36
1. Energy Industries	14,194.43	14,829.11	-48.42
2. Manufacturing Industries and Construction	505.98	784.01	-68.36
3. Transport	2,221.90	2,236.96	-7.49
4. Other Sectors	486.26	496.52	-73.57
5. Other	40.86	19.82	-54.47
B. Fugitive Emissions from Fuels	NO	NO	0.00
1. Solid Fuels	NO	NO	0.00
2. Oil and Natural Gas	NO	NO	0.00
2. Industrial Processes	**339.49**	**452.62**	**-56.82**
A. Mineral Products	339.49	452.62	-27.95
B. Chemical Industry	NO	NO	-100.00
C. Metal Production	NA,NO	NA,NO	0.00
D. Other Production	NO	NO	0.00
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NO	NO	0.00
3. Solvent and Other Product Use	12.58	13.95	-32.83
4. Agriculture			
A. Enteric Fermentation			
B. Manure Management			
C. Rice Cultivation			
D. Agricultural Soils			
E. Prescribed Burning of Savannas			
F. Field Burning of Agricultural Residues			
G. Other			
5. Land Use, Land-Use Change and Forestry(2)	**-5,948.72**	**-4,269.92**	**-51.76**
A. Forest Land	-6,850.70	-5,184.22	-43.72
B. Cropland	193.47	175.83	40.25
C. Grassland	160.57	282.29	164.09
D. Wetlands	155.10	129.35	0.09
E. Settlements	323.84	262.01	100.00
F. Other Land	68.98	64.82	100.00
G. Other	IE	IE	0.00
6. Waste	**NO**	**NO**	**-100.00**
A. Solid Waste Disposal on Land	NO	NO	0.00
B. Waste-water Handling			
C. Waste Incineration	NO	NO	-100.00
D. Other	NO	NO	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0.00**
Total CO_2 emissions including net CO_2 from LULUCF	**11,852.77**	**14,563.07**	**-47.59**
Total CO_2 emissions excluding net CO_2 from LULUCF	**17,801.49**	**18,832.99**	**-48.59**
Memo Items:			
International Bunkers	**809.10**	**701.03**	**2.78**
Aviation	113.97	104.06	-3.38
Marine	695.13	596.97	3.94
Multilateral Operations	NO	NO	0.00
CO_2 Emissions from Biomass	3,725.36	3,599.05	288.16

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CH_4
(Part 1 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	13.33	13.14	8.03	5.24	7.13	9.85	11.21	11.36	9.67	9.53
A. Fuel Combustion (Sectoral Approach)	4.70	4.52	3.00	2.70	3.50	5.74	6.70	6.95	5.48	5.45
1. Energy Industries	0.36	0.33	0.23	0.22	0.27	0.30	0.35	0.33	0.33	0.33
2. Manufacturing Industries and Construction	0.15	0.14	0.10	0.05	0.07	0.06	0.07	0.06	0.07	0.04
3. Transport	0.92	0.86	0.41	0.44	0.53	0.50	0.50	0.57	0.43	0.51
4. Other Sectors	3.27	3.19	2.25	1.99	2.63	4.88	5.78	5.99	4.65	4.57
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	8.62	8.62	5.03	2.54	3.63	4.11	4.52	4.41	4.19	4.08
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	8.62	8.62	5.03	2.54	3.63	4.11	4.52	4.41	4.19	4.08
2. Industrial Processes	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use										
4. Agriculture	**52.29**	**48.89**	**41.98**	**33.27**	**30.17**	**26.78**	**25.18**	**24.97**	**24.23**	**20.88**
A. Enteric Fermentation	48.43	45.38	39.46	31.18	28.15	24.88	23.64	23.39	22.65	19.53
B. Manure Management	3.60	3.25	2.35	1.88	1.88	1.76	1.36	1.40	1.43	1.24
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.26	0.25	0.17	0.21	0.14	0.14	0.17	0.18	0.15	0.11
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.02**	**0.01**	**0.16**	**0.06**	**0.04**	**0.02**	**0.06**	**0.11**	**0.01**	**0.06**
A. Forest Land	0.02	0.00	0.15	0.06	0.04	0.02	0.05	0.11	0.01	0.06
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
6. Waste	**14.05**	**13.90**	**13.07**	**11.58**	**11.33**	**10.11**	**11.02**	**14.02**	**15.94**	**16.37**
A. Solid Waste Disposal on Land	8.56	9.10	9.59	10.52	10.94	9.54	10.26	12.99	15.12	15.45
B. Waste-water Handling	5.47	4.77	3.44	1.03	0.36	0.53	0.64	0.78	0.80	0.87
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	0.03	0.03	0.03	0.03	0.03	0.04	0.13	0.26	0.03	0.04
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**79.69**	**75.93**	**63.23**	**50.15**	**48.67**	**46.76**	**47.47**	**50.46**	**49.85**	**46.84**
Total CH_4 emissions excluding CH_4 from LULUCF	**79.68**	**75.92**	**63.07**	**50.09**	**48.63**	**46.74**	**47.41**	**50.35**	**49.85**	**46.78**
Memo Items:										
International Bunkers	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CH_4
(Part 2 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	9.99	10.42	9.55	10.13	11.06	10.60	10.48	11.48	11.34	9.91
A. Fuel Combustion (Sectoral Approach)	5.37	5.42	5.38	5.50	5.64	5.02	4.82	5.83	5.93	6.22
1. Energy Industries	0.31	0.36	0.38	0.38	0.40	0.44	0.37	0.35	0.40	0.46
2. Manufacturing Industries and Construction	0.05	0.07	0.05	0.07	0.08	0.08	0.09	0.15	0.13	0.07
3. Transport	0.46	0.53	0.47	0.42	0.38	0.37	0.37	0.36	0.36	0.36
4. Other Sectors	4.54	4.45	4.47	4.64	4.78	4.12	3.99	4.98	5.05	5.33
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	4.63	5.00	4.17	4.63	5.41	5.58	5.66	5.65	5.40	3.70
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	4.63	5.00	4.17	4.63	5.41	5.58	5.66	5.65	5.40	3.70
2. Industrial Processes	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use										
4. Agriculture	**20.64**	**21.43**	**20.27**	**20.96**	**21.20**	**21.44**	**21.51**	**21.18**	**21.24**	**21.02**
A. Enteric Fermentation	19.21	19.90	18.77	19.12	19.35	19.49	19.55	19.23	19.27	18.99
B. Manure Management	1.25	1.38	1.37	1.70	1.70	1.76	1.81	1.95	1.97	2.03
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Buming of Agricultural Residues	0.19	0.15	0.14	0.13	0.15	0.19	0.15	NO	NO	NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.08**	**0.01**	**0.17**	**0.02**	**0.05**	**0.01**	**0.39**	**0.01**	**0.06**	**0.01**
A. Forest Land	0.08	0.01	0.16	0.02	0.05	0.01	0.39	0.01	0.05	0.01
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
6. Waste	**18.18**	**18.47**	**18.01**	**18.35**	**18.79**	**17.67**	**18.22**	**17.95**	**17.60**	**15.94**
A. Solid Waste Disposal on Land	17.17	17.61	16.85	16.60	16.89	15.45	15.23	14.58	14.58	13.02
B. Waste-water Handling	0.90	0.72	0.76	0.56	0.29	0.30	0.30	0.29	0.28	0.25
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	0.11	0.14	0.40	1.19	1.61	1.92	2.68	3.08	2.74	2.67
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**48.89**	**50.33**	**47.99**	**49.46**	**51.10**	**49.73**	**50.61**	**50.62**	**50.24**	**46.89**
Total CH_4 emissions excluding CH_4 from LULUCF	**48.81**	**50.32**	**47.82**	**49.44**	**51.05**	**49.71**	**50.22**	**50.61**	**50.18**	**46.88**
Memo Items:										
International Bunkers	0.02	0.02	0.03	0.02	0.03	0.03	0.05	0.05	0.05	0.05
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.05
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CH_4
(Part 3 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	10.48	9.31	-30.18
A. Fuel Combustion (Sectoral Approach)	6.52	5.73	21.76
1. Energy Industries	0.61	0.64	77.88
2. Manufacturing Industries and Construction	0.07	0.10	-35.07
3. Transport	0.36	0.21	-77.37
4. Other Sectors	5.48	4.78	46.20
5. Other	0.00	0.00	-54.49
B. Fugitive Emissions from Fuels	3.96	3.58	-58.51
1. Solid Fuels	NO	NO	0.00
2. Oil and Natural Gas	3.96	3.58	-58.51
2. Industrial Processes	**NA,NO**	**NA,NO**	**0.00**
A. Mineral Products	NO	NO	0.00
B. Chemical Industry	NO	NO	0.00
C. Metal Production	NA,NO	NA,NO	0.00
D. Other Production			
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NO	NO	0.00
3. Solvent and Other Product Use			
4. Agriculture	**21.55**	**21.72**	**-58.47**
A. Enteric Fermentation	19.31	19.56	-59.62
B. Manure Management	2.24	2.16	-39.96
C. Rice Cultivation	NO	NO	0.00
D. Agricultural Soils	NO	NO	0.00
E. Prescribed Burning of Savannas	NO	NO	0.00
F. Field Burning of Agricultural Residues	NO	NO	-100.00
G. Other	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.01**	**-71.43**
A. Forest Land	0.00	0.00	-84.18
B. Cropland	NO	NO	0.00
C. Grassland	0.00	0.00	-80.27
D. Wetlands	0.00	0.00	9.28
E. Settlements	NE	NE	0.00
F. Other Land	NE,NO	NE,NO	0.00
G. Other	IE	IE	0.00
6. Waste	**16.39**	**14.57**	**3.65**
A. Solid Waste Disposal on Land	12.92	12.11	41.54
B. Waste-water Handling	0.29	0.28	-94.79
C. Waste Incineration	NO	NO	0.00
D. Other	3.18	2.17	7,503.51
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0.00**
Total CH_4 emissions including CH_4 from LULUCF	**48.43**	**45.60**	**-42.79**
Total CH_4 emissions excluding CH_4 from LULUCF	**48.42**	**45.59**	**-42.78**
Memo Items:			
International Bunkers	0.05	0.04	3.70
Aviation	0.00	0.00	4.54
Marine	0.05	0.04	3.67
Multilateral Operations	NO	NO	0.00
CO_2 Emissions from Biomass			

Note: All footnotes for this table are given at the end of the table on sheet 5

TABLE 10 EMISSION TRENDS
N_2O
(Part 1 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**0.36**	**0.34**	**0.23**	**0.21**	**0.21**	**0.24**	**0.28**	**0.27**	**0.24**	**0.22**
A. Fuel Combustion (Sectoral Approach)	0.36	0.34	0.23	0.21	0.21	0.24	0.28	0.27	0.24	0.22
1. Energy Industries	0.06	0.06	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
2. Manufacturing Industries and Construction	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
3. Transport	0.07	0.07	0.03	0.04	0.07	0.08	0.10	0.09	0.08	0.08
4. Other Sectors	0.20	0.19	0.14	0.12	0.09	0.11	0.13	0.12	0.10	0.08
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
4. Agriculture	**6.67**	**6.39**	**5.49**	**4.05**	**3.45**	**2.97**	**2.73**	**2.74**	**2.95**	**2.43**
A. Enteric Fermentation										
B. Manure Management	0.99	0.93	0.78	0.63	0.58	0.51	0.47	0.47	0.45	0.39
C. Rice Cultivation										
D. Agricultural Soils	5.68	5.46	4.71	3.42	2.87	2.46	2.26	2.27	2.49	2.04
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**	**0.01**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**0.16**	**0.16**	**0.16**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.12**	**0.17**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.11	0.11	0.11
C. Waste Incineration	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.05
D. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**7.21**	**6.91**	**5.90**	**4.42**	**3.82**	**3.38**	**3.17**	**3.17**	**3.33**	**2.84**
Total N_2O emissions excluding N_2O from LULUCF	**7.21**	**6.91**	**5.89**	**4.42**	**3.81**	**3.38**	**3.17**	**3.16**	**3.33**	**2.83**
Memo Items:										
International Bunkers	**0.01**	**0.01**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
N_2O
(Part 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**0.23**	**0.29**	**0.31**	**0.26**	**0.28**	**0.28**	**0.25**	**0.27**	**0.28**	**0.29**
A. Fuel Combustion (Sectoral Approach)	0.23	0.29	0.31	0.26	0.28	0.28	0.25	0.27	0.28	0.29
1. Energy Industries	0.04	0.05	0.05	0.05	0.06	0.08	0.07	0.07	0.08	0.08
2. Manufacturing Industries and Construction	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01
3. Transport	0.10	0.16	0.15	0.08	0.08	0.08	0.06	0.06	0.06	0.06
4. Other Sectors	0.08	0.07	0.10	0.12	0.12	0.11	0.11	0.12	0.12	0.14
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
4. Agriculture	**2.48**	**2.38**	**2.22**	**2.33**	**2.42**	**2.32**	**2.31**	**2.47**	**2.85**	**2.55**
A. Enteric Fermentation										
B. Manure Management	0.39	0.40	0.38	0.36	0.36	0.35	0.34	0.33	0.34	0.33
C. Rice Cultivation										
D. Agricultural Soils	2.09	1.98	1.83	1.97	2.06	1.97	1.96	2.13	2.51	2.21
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.02**	**0.02**	**0.02**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	NA,NO	NA,NO	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**0.17**	**0.17**	**0.16**	**0.21**	**0.24**	**0.26**	**0.31**	**0.34**	**0.32**	**0.31**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.11	0.11	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.11
C. Waste Incineration	0.05	0.05	0.02	0.01	0.01	0.01	0.00	0.00	NO	0.00
D. Other	0.01	0.01	0.03	0.09	0.12	0.14	0.20	0.23	0.21	0.20
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**2.91**	**2.87**	**2.71**	**2.83**	**2.97**	**2.90**	**2.91**	**3.12**	**3.48**	**3.18**
Total N_2O emissions excluding N_2O from LULUCF	**2.91**	**2.87**	**2.71**	**2.82**	**2.96**	**2.89**	**2.89**	**3.10**	**3.46**	**3.16**
Memo Items:										
International Bunkers	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
N_2O
(Part 3 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
1. Energy	**0.32**	**0.32**	**-10.14**
A. Fuel Combustion (Sectoral Approach)	0.32	0.32	-10.14
1. Energy Industries	0.10	0.11	65.46
2. Manufacturing Industries and Construction	0.01	0.01	-32.89
3. Transport	0.06	0.06	-19.27
4. Other Sectors	0.14	0.14	-28.47
5. Other	0.00	0.00	-56.92
B. Fugitive Emissions from Fuels	NO	NO	0.00
1. Solid Fuels	NO	NO	0.00
2. Oil and Natural Gas	NO	NO	0.00
2. Industrial Processes	**NA,NO**	**NA,NO**	**0.00**
A. Mineral Products	NO	NO	0.00
B. Chemical Industry	NO	NO	0.00
C. Metal Production	NA	NA	0.00
D. Other Production			
E. Production of Halocarbons and SF_6			
F. Consumption of Halocarbons and SF_6			
G. Other	NO	NO	0.00
3. Solvent and Other Product Use	0.02	0.02	-13.51
4. Agriculture	**2.59**	**2.63**	**-60.63**
A. Enteric Fermentation			
B. Manure Management	0.33	0.34	-65.89
C. Rice Cultivation			
D. Agricultural Soils	2.26	2.29	-59.69
E. Prescribed Burning of Savannas	NO	NO	0.00
F. Field Burning of Agricultural Residues	NO	NO	-100.00
G. Other	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.02**	**0.02**	**351.20**
A. Forest Land	0.00	0.00	-84.18
B. Cropland	0.02	0.02	100.00
C. Grassland	0.00	0.00	-80.27
D. Wetlands	0.01	0.01	9.28
E. Settlements	NE	NE	0.00
F. Other Land	NE,NO	NE,NO	0.00
G. Other	NE	NE	0.00
6. Waste	**0.35**	**0.27**	**74.77**
A. Solid Waste Disposal on Land			
B. Waste-water Handling	0.11	0.11	-24.96
C. Waste Incineration	0.00	NO	-100.00
D. Other	0.24	0.16	7,502.08
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**0.00**
Total N_2O emissions including N_2O from LULUCF	**3.30**	**3.26**	**-54.78**
Total N_2O emissions excluding N_2O from LULUCF	**3.28**	**3.24**	**-55.06**
Memo Items:			
International Bunkers	**0.01**	**0.01**	**-0.53**
Aviation	0.00	0.00	-5.98
Marine	0.01	0.00	3.67
Multilateral Operations	NO	NO	0.00
CO_2 Emissions from Biomass			

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
HFCs, PFCs and SF_6
(Part 1 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
Emissions of HFCs[3] - ($Gg\ CO_2$ equivalent)	**NA,NE,NO**	**NA,NE,NO**	**15.92**	**18.06**	**20.67**	**25.37**	**30.58**	**36.38**	**45.93**	**55.65**
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	NO	NO	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03
HFC-152a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed HFCs[4] - ($Gg\ CO_2$ equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of PFCs[3] - ($Gg\ CO_2$ equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
CF_4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_2F_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed PFCs[4] - ($Gg\ CO_2$ equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of SF6[3] - ($Gg\ CO_2$ equivalent)	**NA,NE,NO**	**0.05**	**0.09**	**1.45**	**3.11**	**3.22**	**3.49**	**2.99**	**2.99**	**3.01**
SF_6	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
HFCs, PFCs and SF_6
(Part 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000 (Gg)	2001 (Gg)	2002 (Gg)	2003 (Gg)	2004 (Gg)	2005 (Gg)	2006 (Gg)	2007 (Gg)	2008 (Gg)	2009 (Gg)
Emissions of HFCs[3] - ($Gg\ CO_2$ equivalent)	**69.54**	**85.47**	**86.52**	**91.92**	**104.61**	**118.16**	**135.31**	**148.98**	**131.31**	**138.15**
HFC-23	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00
HFC-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.04	0.04
HFC-152a	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.04
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed HFCs[4] - ($Gg\ CO_2$ equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of PFCs[3] - ($Gg\ CO_2$ equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.07**	**0.06**	**0.04**	**NA,NE,NO**
CF_4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_2F_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_3F_8	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed PFCs[4] - ($Gg\ CO_2$ equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of SF6[3] - ($Gg\ CO_2$ equivalent)	**2.73**	**1.74**	**1.44**	**1.33**	**1.08**	**1.08**	**1.15**	**0.97**	**1.35**	**1.44**
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
HFCs, PFCs and SF_6
(Part 3 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	(Gg)	(Gg)	%
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**152.56**	**159.38**	**100.00**
HFC-23	0.00	0.00	100.00
HFC-32	0.00	0.00	100.00
HFC-41	NO	NO	0.00
HFC-43-10mee	NO	NO	0.00
HFC-125	0.02	0.02	100.00
HFC-134	NO	NO	0.00
HFC-134a	0.04	0.04	100.00
HFC-152a	0.03	0.04	100.00
HFC-143	NO	NO	0.00
HFC-143a	0.01	0.01	100.00
HFC-227ea	0.00	0.00	100.00
HFC-236fa	NO	NO	0.00
HFC-245ca	NO	NO	0.00
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	NO	NO	0.00
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**0.00**
CF_4	NO	NO	0.00
C_2F_6	NO	NO	0.00
C_3F_8	NO	NO	0.00
C_4F_{10}	NO	NO	0.00
c-C_4F_8	NO	NO	0.00
C_5F_{12}	NO	NO	0.00
C_6F_{14}	NO	NO	0.00
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	NO	NO	0.00
Emissions of SF6[3] - (Gg CO_2 equivalent)	**1.81**	**1.82**	**100.00**
SF_6	0.00	0.00	100.00

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS SUMMARY (Part 1 of 3)

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	27,784.35	24,781.69	14,886.51	8,926.77	9,291.34	7,383.03	8,288.64	8,764.37	9,053.65	10,871.63
CO_2 emissions excluding net CO_2 from LULUCF	36,635.00	33,634.58	24,180.88	18,770.35	19,639.00	17,981.46	18,688.03	18,236.49	16,657.46	15,508.39
CH_4 emissions including CH_4 from LULUCF	1,673.58	1,594.50	1,327.88	1,053.16	1,022.15	982.05	996.89	1,059.74	1,046.94	983.62
CH_4 emissions excluding CH_4 from LULUCF	1,673.18	1,594.34	1,324.57	1,051.91	1,021.24	981.63	995.70	1,057.41	1,046.77	982.34
N_2O emissions including N_2O from LULUCF	2,235.50	2,143.55	1,828.96	1,370.95	1,183.09	1,048.10	984.23	982.81	1,032.92	879.38
N_2O emissions excluding N_2O from LULUCF	2,233.95	2,142.04	1,826.88	1,369.24	1,181.44	1,046.55	982.54	980.90	1,031.41	877.66
HFCs	NA,NE,NO	NA,NE,NO	15.92	18.06	20.67	25.37	30.58	36.38	45.93	55.65
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
SF_6	NA,NE,NO	0.05	0.09	1.45	3.11	3.22	3.49	2.99	2.99	3.01
Total (including LULUCF)	**31,693.44**	**28,519.79**	**18,059.37**	**11,370.39**	**11,520.36**	**9,441.77**	**10,303.83**	**10,846.29**	**11,182.41**	**12,793.29**
Total (excluding LULUCF)	**40,542.14**	**37,371.02**	**27,348.34**	**21,211.01**	**21,865.46**	**20,038.23**	**20,700.34**	**20,314.17**	**18,784.55**	**17,427.04**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	35,956.90	32,967.77	23,816.15	18,603.92	19,225.41	17,596.48	18,341.04	17,857.11	16,205.29	15,103.37
2. Industrial Processes	1,048.23	1,026.78	603.45	344.86	633.43	675.54	682.88	719.51	754.13	707.69
3. Solvent and Other Product Use	26.44	28.12	21.69	20.85	23.03	26.02	27.56	28.34	30.25	30.03
4. Agriculture	3,166.84	3,007.95	2,584.47	1,954.14	1,702.42	1,483.71	1,375.32	1,372.75	1,422.66	1,190.93
5. Land Use, Land-Use Change and Forestry[5]	-8,848.70	-8,851.23	-9,288.97	-9,840.62	-10,345.10	-10,596.46	-10,396.51	-9,467.87	-7,602.14	-4,633.75
6. Waste	343.72	340.40	322.58	287.24	281.17	256.49	273.54	336.45	372.22	395.01
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[5]	**31,693.44**	**28,519.79**	**18,059.37**	**11,370.39**	**11,520.36**	**9,441.77**	**10,303.83**	**10,846.29**	**11,182.41**	**12,793.29**

[1] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[2] Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[3] Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

[4] In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

[5] Includes net CO_2, CH_4 and N_2O from LULUCF.

TABLE 10 EMISSION TRENDS SUMMARY (Part 2 of 3)

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	16,239.54	20,072.21	18,339.99	17,487.43	14,691.96	11,378.41	8,838.86	10,755.46	9,224.65	6,808.82
CO_2 emissions excluding net CO_2 from LULUCF	15,143.30	15,497.77	15,004.26	16,832.39	17,082.08	16,419.49	15,842.60	18,873.36	17,357.71	14,157.89
CH_4 emissions including CH_4 from LULUCF	1,026.63	1,056.87	1,007.86	1,038.68	1,073.03	1,044.24	1,062.85	1,063.05	1,055.08	984.69
CH_4 emissions excluding CH_4 from LULUCF	1,024.95	1,056.64	1,004.31	1,038.20	1,072.00	1,043.93	1,054.57	1,062.77	1,053.77	984.50
N_2O emissions including N_2O from LULUCF	903.44	890.45	841.19	877.18	919.32	898.33	900.83	966.23	1,079.94	986.35
N_2O emissions excluding N_2O from LULUCF	901.65	888.93	838.92	875.22	916.72	894.98	894.95	960.83	1,073.49	979.61
HFCs	69.54	85.47	86.52	91.92	104.61	118.16	135.31	148.98	131.31	138.15
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.07	0.06	0.04	NA,NE,NO
SF_6	2.73	1.74	1.44	1.33	1.08	1.08	1.15	0.97	1.35	1.44
Total (including LULUCF)	**18,241.88**	**22,106.75**	**20,276.99**	**19,496.53**	**16,790.00**	**13,440.22**	**10,939.07**	**12,934.75**	**11,492.37**	**8,919.45**
Total (excluding LULUCF)	**17,142.17**	**17,530.56**	**16,935.43**	**18,839.07**	**19,176.50**	**18,477.64**	**17,928.66**	**21,046.97**	**19,617.67**	**16,261.58**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	14,770.96	15,129.28	14,824.75	16,594.37	16,722.18	16,020.66	15,385.39	18,270.54	16,745.77	14,129.73
2. Industrial Processes	705.92	746.39	545.35	605.39	764.67	807.11	871.47	1,059.00	1,051.13	451.04
3. Solvent and Other Product Use	26.76	24.47	24.84	24.69	25.07	26.16	26.35	24.43	21.96	18.49
4. Agriculture	1,203.70	1,188.80	1,112.73	1,163.64	1,196.40	1,170.78	1,166.40	1,209.27	1,329.85	1,230.60
5. Land Use, Land-Use Change and Forestry[5]	1,099.71	4,576.19	3,341.56	657.47	-2,386.49	-5,037.42	-6,989.58	-8,112.22	-8,125.30	-7,342.13
6. Waste	434.83	441.62	427.76	450.98	468.18	452.93	479.04	483.74	468.96	431.72
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[5]	**18,241.88**	**22,106.75**	**20,276.99**	**19,496.53**	**16,790.00**	**13,440.22**	**10,939.07**	**12,934.75**	**11,492.37**	**8,919.45**

[1] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[2] Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[3] Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

[4] In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

[5] Includes net CO_2, CH_4 and N_2O from LULUCF.

TABLE 10 EMISSION TRENDS SUMMARY (Part 3 of 3)

Inventory 2011
Submission 2013 v1.5
ESTONIA

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	11,852.77	14,563.07	-47.59
CO_2 emissions excluding net CO_2 from LULUCF	17,801.49	18,832.99	-48.59
CH_4 emissions including CH_4 from LULUCF	1,016.97	957.54	-42.79
CH_4 emissions excluding CH_4 from LULUCF	1,016.84	957.42	-42.78
N_2O emissions including N_2O from LULUCF	1,023.01	1,010.97	-54.78
N_2O emissions excluding N_2O from LULUCF	1,016.05	1,003.97	-55.06
HFCs	152.56	159.38	100.00
PFCs	NA,NE,NO	NA,NE,NO	0.00
SF_6	1.81	1.82	100.00
Total (including LULUCF)	**14,047.13**	**16,692.77**	**-47.33**
Total (excluding LULUCF)	**19,988.77**	**20,955.58**	**-48.31**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	17,767.99	18,661.63	-48.10
2. Industrial Processes	493.86	613.82	-41.44
3. Solvent and Other Product Use	17.39	18.86	-28.69
4. Agriculture	1,256.59	1,270.52	-59.88
5. Land Use, Land-Use Change and Forestry[5]	-5,941.64	-4,262.81	-51.83
6. Waste	452.94	390.76	13.69
7. Other	NA	NA	0.00
Total (including LULUCF)[5]	**14,047.13**	**16,692.77**	**-47.33**

[1] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[2] Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[3] Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

[4] In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

[5] Includes net CO_2, CH_4 and N_2O from LULUCF.

Documentation box:

• Parties should provide detailed explanations on emissions trends in Chapter 2: Trends in Greenhouse Gas Emissions and, as appropriate, in the corresponding Chapters 3 - 9 of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.

• Use the documentation box to provide explanations if potential emissions are reported.

ANNEX II
Summary of reporting of supplementary information under Article 7, paragraph 2 of the Kyoto protocol in the NC6

Information reported under Article 7, paragraph 2	Chapter of the 6th National Communication
National systems in accordance with Article 5, paragraph 1	**3.3**
National registries	**3.4**
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	**5.5**
Policies and measures in accordance with Article 2	**4.2; 4.3**
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	**4.1**
Information under Article 10 Article 10a Article 10b Article 10c Article 10d Article 10e	 **3.3; 8.2.6** **4.3; 6.5** **4.2.4; 9.8** **8** **9.8**
Financial resources	**7; 9.8**