3

GREENHOUSE GAS INVENTORY INFORMATION, INCLUDING THE NATIONAL SYSTEM AND THE NATIONAL REGISTRY

This chapter describes Finnish greenhouse gas emissions and their development in 1990–2015 by sector. Thereafter, it outlines how the national greenhouse gas inventory is compiled, including a description of the national system, and how the high quality of the inventory is guaranteed. Finally, the national registry and its functioning are explained.

Photo: Archives of Jyväskylä Energy Group/ The CHP plant in Keljonlahti

3 GREENHOUSE GAS INVENTORY INFORMATION, INCLUDING THE NATIONAL SYSTEM AND THE NATIONAL REGISTRY

3.1 Total greenhouse gas emissions and trends

In 2015, Finland's greenhouse gas emissions totalled 55.6 million tonnes of carbon dioxide equivalent (million tonnes CO_2 eq.). The total emissions in 2015 were approximately 22 per cent (15.7 million tonnes) below the 1990 emissions level. Compared to 2014, the emissions decreased by approximately six per cent (3.6 million tonnes). The emission trends by sector are presented in Figure 3.1 and described in detail in Section 3.2.

Statistics Finland also published instant preliminary data on the greenhouse gas emissions for 2016 in May 2017[1]. The total emissions of greenhouse gases in 2016 corresponded with 58.8 million tonnes of CO_2 eq. Emissions grew by six per cent compared with the previous year but were still 18 per cent lower than in 1990. The instant preliminary data are calculated using rougher data and methodologies than are used for the inventory data in the last inventory submission to the UNFCCC. Therefore, the submitted inventory data (1990 to 2015) are presented and used as the basis for the documentation and conclusions in all chapters in this national communication.

The energy sector is by far the largest producer of greenhouse gas emissions in Finland. The energy sector includes emissions from fuels used to generate energy, including fuel used in transport and the fugitive emissions related to the production, distribution and consumption of fuels. In 2015, the energy sector accounted for 73 per cent of Finland's total greenhouse gas emissions (Figure 3.2). The second largest source of emissions was agriculture, with a share of approximately 12 per cent. Emissions from industrial processes and product use amounted to approximately 11 per cent. Emissions from industrial processes refer to sector emissions that result from the use of raw materials in industrial processes. Emissions from the waste sector amounted to four per cent of total emissions. The contribution of indirect CO_2 emissions from atmospheric oxidation of CH_4 and NMVOCs to the Finnish greenhouse gas emissions is small, about 0.1% of the total greenhouse gas emissions in Finland.

1 http://www.stat.fi/til/khki/2016/khki_2016_2017-05-24_tie_001_en.html

Figure 3.1
Greenhouse gas emissions and removals in Finland by reporting sector (million tonnes CO_2 eq.) and net CO_2 equivalent emissions (emissions plus removals). Emissions are positive and removals negative quantities.

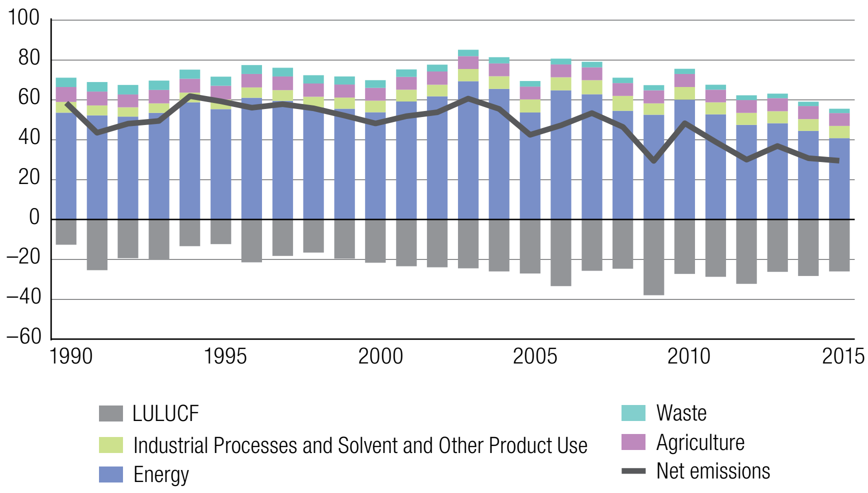
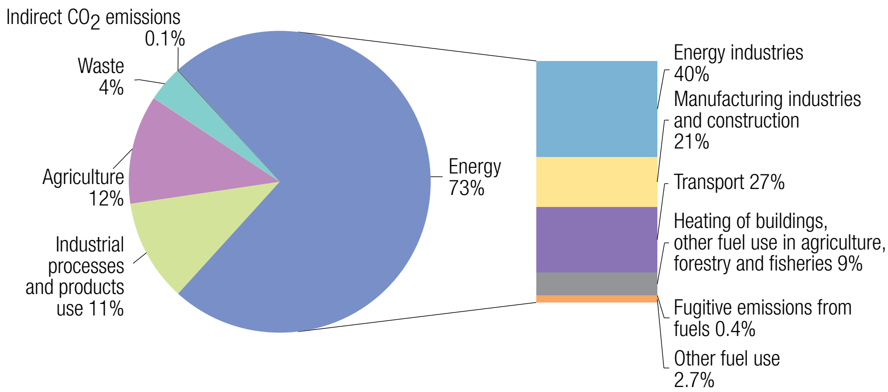


Figure 3.2
The composition of Finnish greenhouse gas emissions in 2015 (LULUCF sector excluded). Due to independent rounding, the sums do not add up.



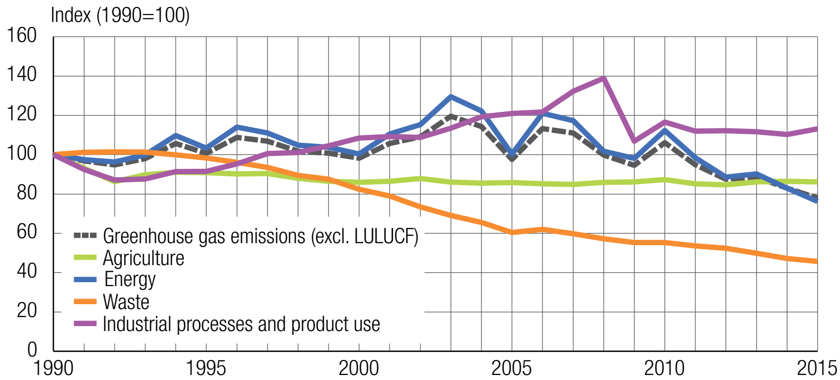
The most important greenhouse gas in Finland is carbon dioxide. The share of CO_2 emissions in total greenhouse gas emissions has varied from 80 per cent to 85 per cent. In absolute terms, CO_2 emissions have decreased by 12.7 million tonnes (i.e. 22 per cent) since 1990. Around 90 per cent of all CO_2 emissions originated from the energy sector in 2015. The amount of energy-related CO_2 emissions has fluctuated much according to the economic trend, the energy supply structure (including electricity imports and exports) and climate conditions. Methane emissions (CH_4) have decreased by 37 per cent from the 1990 level. This is mainly due to the improvements in waste sector and a contraction in animal husbandry in the agricultural sector. Correspondingly, emissions of nitrous oxide (N_2O) have also decreased by 27 per cent; the greatest decline occurred in 2009 when the implementation of a N_2O abatement technology in nitric acid production reduced emissions significantly. Another reason for the decrease of N_2O emissions is the reduced nitrogen fertilisation of agricultural fields. In 2015, the F-gas emissions (HFCs, PFCs and SF_6) were nearly 35 times higher than the emissions for 1995 (the base year for F-gas emissions[2]). A key driver behind the trend has been the substitution of ozone depleting substances (ODS) by F-gases in many applications.

The land use, land-use change and forestry (LULUCF) sector is a net sink in Finland. The net sink has varied from approximately 15 to 55 per cent of the total annual emissions from other sectors during 1990 to 2015. The most important components of the forest sink are the increment of growing stock and the harvest removals. The growth has increased since 1990 from 78 million m^3 to 105.5 million m^3. There is less fluctuation in the growth than in the harvest rates between years. In 2015, the total drain was 82 million m^3 being still at a very high level.

The majority of the CO_2 emissions originate from energy production based on the combustion of fossil fuels and peat. Peat is not a fossil fuel as such, but lifecycle studies indicate that the climate effects of peat combustion are comparable with those of fossil fuels. The CO_2 emissions from wood combustion are not included in the total national emissions but are reported separately. CO_2 emissions from combustion in energy production totalled 40 million tonnes in 2015. The production and use of energy also generate methane and nitrous oxide emissions. The majority of methane emissions originated from the waste and agricultural sectors in 2015. The majority of nitrous oxide emissions originated from agriculture. F-gas emissions originate from the consumption of halocarbons and SF_6 and are reported in the industrial prosesses and product use sector.

Finland's annual greenhouse gas emissions have varied considerably due to changes in electricity imports and the production of fossil-fuel-based condensing power. In addition, emissions are influenced each year by the economic situation in the country's energy intensive industries, weather conditions and the volumes of energy produced using renewable energy sources (see trends by sector in Figure 3.3).

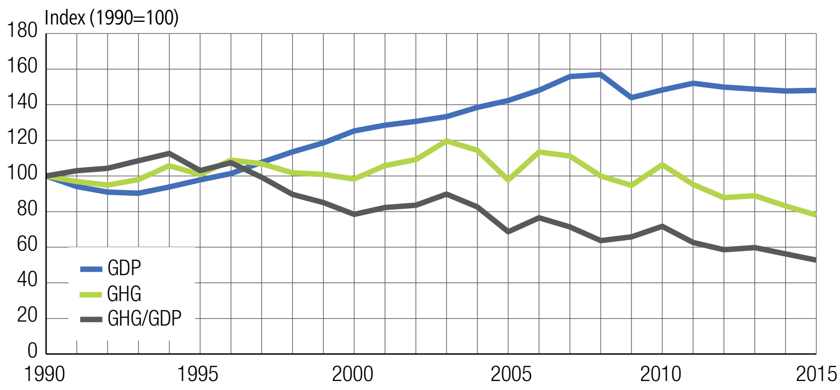
Figure 3.3
Relative development of greenhouse gas emissions by main category relative to the 1990 level (1990=100%)



The trend in greenhouse gas emissions relative to Finland's gross domestic product (GDP) has been declining (Figure 3.4), although annual variations have been large. In the early 1990s, the GHG/GDP ratio rose almost 15 per cent above the 1990 level. This was largely due to the economic recession, which led to a steeper fall in the GDP than in emissions. In 2015, the GHG /GDP ratio was more than 45 per cent below the 1990 level, indicating that the greenhouse gas intensity of the economy has decreased.

2 The base year for F-gas emissions is 1995 under the Kyoto Protocol

Figure 3.4
Greenhouse gas emissions relative to GDP, 1990 to 2015, excluding the LULUCF sector



More detailed information on emission trends by sector and gas can be found in the CRF Reporter Summary tables on emission trends included in Annex 1 of this communication.

3.2 Greenhouse gas emissions by sector

3.2.1 Energy

Similarly to other industrialised countries, Finland's biggest source of greenhouse gas emissions is the energy sector. The cold climate, long distances and energy-intensive industries are apparent in the high emissions volumes of the energy sector. In 2015, its share of total greenhouse gas emissions, including transport, was 73 per cent (40.8 million tonnes CO_2 eq.). Energy sector emissions can be divided into emissions resulting from fossil fuel combustion and fugitive emissions from fuels. The majority of the sector's emissions result from fuel combustion. Fugitive emissions make up only 0.4 per cent of the total emissions of the sector.

Energy sector emissions show strong annual variation in accordance with the amount of energy used and the proportion of imported electricity. This variation has been the principal feature of the overall trend in emissions since 1990. Emissions from the energy sector are strongly affected by the availability of hydropower on the Nordic electricity market. If the annual precipitation in the Nordic countries is lower than usual, hydropower will become scarce and Finland's net imports of electricity will decrease. During such years, Finland has generated additional electricity using coal and peat in condensing power production for its own needs and also for sale on the Nordic electricity market. This can be seen directly in the emissions of the energy sector (Figure 3.5).

In 2015, energy sector emissions were almost eight per cent lower than in 2014, and they were 24 per cent lower than the 1990 level. CO_2 emissions in the energy sector decreased more than the total use of energy (Figure 3.6). Total energy consumption in Finland amounted to 1.3 petajoules (PJ) in 2015, which was three per cent less than in 2014. The biggest reasons for decreasing emissions are the increased shares of forest-based fuels and net imports of electricity, which lowers the condensing power production.

Figure 3.5
Greenhouse gas emissions in the energy sector, 1990 to 2015

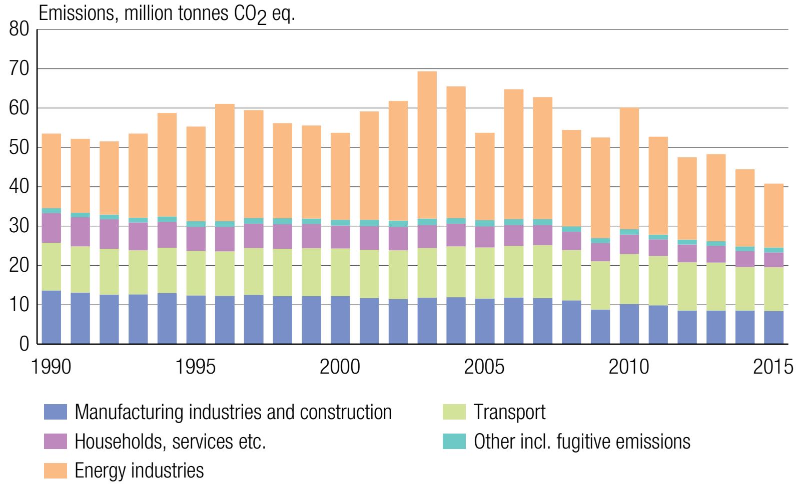
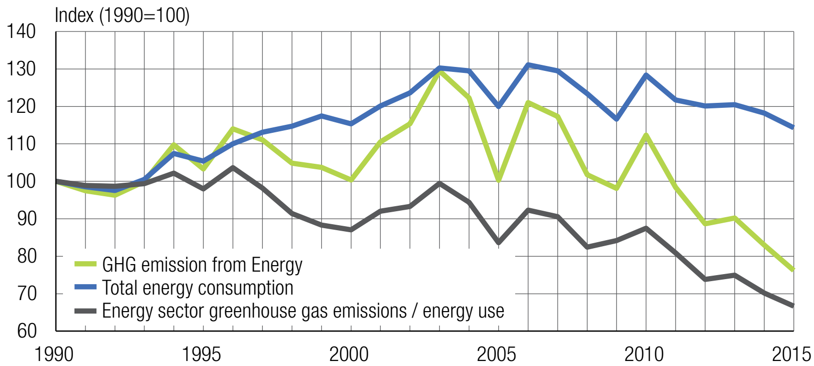


Figure 3.6
Total energy use relative to energy sector greenhouse gas emissions, 1990 to 2015



The use of renewable energy sources increased by two per cent and that of fossil fuels decreased by eight per cent. Final energy consumption in transport remained at the same level and energy consumption in space heating decreased by five per cent from the year before. Final consumption in manufacturing contracted by two per cent.

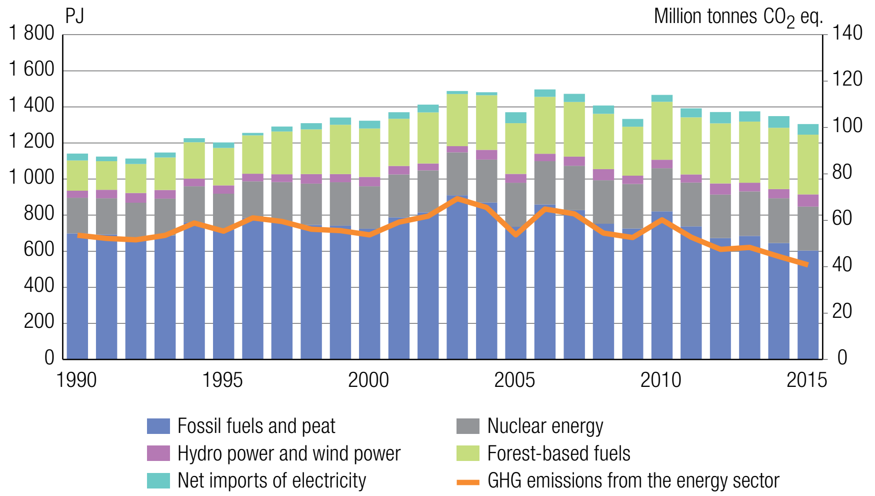
The share of renewable energy in total energy consumption grew to 35 per cent in 2015. The share of forest-based fuels in Finland's total energy consumption continued to grow and was 25 per cent. EU targets for renewable energy are calculated relative to total final energy consumption. Estimated in this manner, the share of renewable energy was over 39 per cent in Finland in 2015. Finland's target for the share of renewable energy is 38 per cent of final energy consumption in 2020, which was reached for the first time in 2014.

The use of fossil fuels went down by eight per cent from the year before. The use of natural gas fell by 14 per cent and that of peat by five per cent from the year before. The consumption of coal (including hard coal, coke, and blast furnace and coke oven gas) decreased by 20 per cent.

In 2015, the production of electricity in Finland amounted to 66.2 terawatt hours (TWh). Production went up by one per cent from the year before. In turn, total electricity consumption went down by one per cent and amounted to 82.5 TWh. Of total electricity consumption, 80 per cent was covered by domestic production and 20 per cent by net imports of electricity from the Nordic countries, Russia and Estonia. Net imports of electricity declined by nine per cent from the year before. Thirty two per cent of domestic electricity production was based on combined heat and power production.

Of all electricity production, 29.5 TWh were produced with renewable energy sources, which is the biggest amount ever. Forty five per cent of electricity production was covered with renewable energy sources, which is the largest share since the 1970s. Over one-half of the electricity produced with renewable energy sources was produced with hydro power, nearly one-tenth with wind power and almost all of the remainder with forest-based fuels. Hydro power was used for producing 16.6 TWh of electricity. More electricity than this has been produced with hydro power only in 2008 and 2012. Seventeen per cent of electricity was produced with fossil fuels, four per cent with peat and 34 per cent with nuclear power (Figure 3.7).

Figure 3.7
Total energy use by energy source (PJ) and energy sector greenhouse gas emissions (million tonnes CO_2 eq.), 1990 to 2015



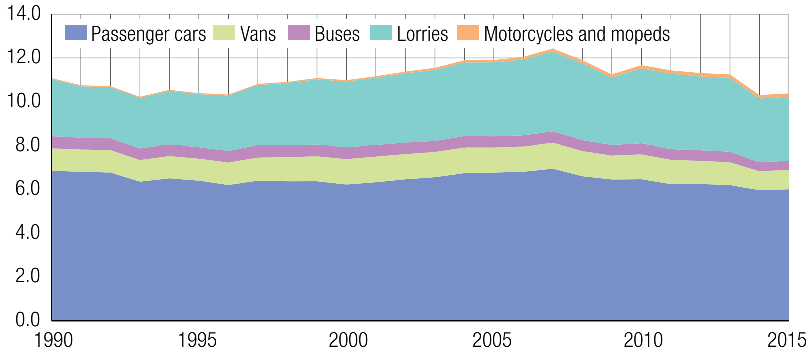
In 2015, greenhouse gas emissions from energy industries amounted to 16.2 million tonnes and manufacturing industries and construction amounted to 8.4 million tonnes CO_2 eq. The share of energy industries was 40 per cent of the energy sector's total emissions. The corresponding share was 20 per cent for manufacturing industries and construction. These two subsectors together accounted for 44 per cent of total greenhouse gas emissions of Finland. Emissions from the fuels used by different industries have fallen by 24 per cent compared with the emission levels in 1990. This is the result of increased use of biomass by the forest industry in particular.

Emissions attributable to energy use by individual households and the service sector accounted for approximately nine per cent of Finland's total emissions. These emissions are down significantly from the 1990 levels. The service sector's emissions have decreased by as much as 58 per cent, and those by households by 60 per cent. This is the result of the changeover from oil heating to district or electric heating (in which case emissions are allocated to energy production plants).

3.2.2 Transport

In 2015, greenhouse gas emissions from transportation amounted to 11.1 million tonnes CO_2 equivalent. Compared to 2014, emissions increased less than one percent in 2015. The changes in activity and in the share of biofuels were small. The emission level in the transport sector has fluctuated between 11 to 13 million tonnes CO2 eq. during 1990–2015 being eight per cent lower in 2015 than in 1990. The share of the transport sector in total greenhouse gas emissions was approximately 17 per cent (12.1 million tonnes CO_2) in 1990 and 20 per cent in 2015. Road transportation is the most important emission source in transport, covering over 94 per cent of the sector's emissions in 2015. The distribution of road transportation emissions by vehicle type 1990 to 2015 is presented in Figure 3.8.

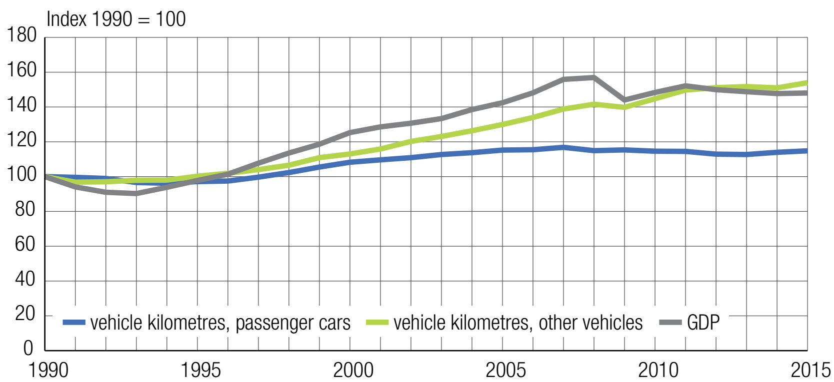
Figure 3.8
Road transport greenhouse gas emissions by vehicle type, 1990 to 2015



Source: VTT, LIPASTO model

During 1990 to 2015, road transport emissions decreased by six per cent regardless of the growth in traffic kilometrage during the same period (Figure 3.9). After the recession in the early 1990s, emissions from road transport increased until 2007 due to the increased kilometrage. In 2008, the emissions deviated from the upward trend. The worldwide economic downturn decreased the kilometrage of all transport modes. At

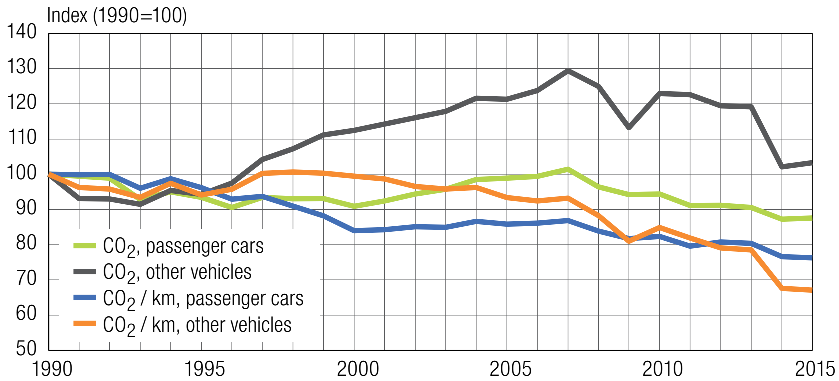
Figure 3.9
Development of traffic volume (vehicle-kilometres, passenger cars and other vehicles) and GDP, 1990 to 2015



Source of kilometreage: VTT, LIPASTO model the same time, the change in Finland to CO_2-based taxation of cars caused a transition from gasoline to diesel cars and lowered the specific fuel consumption of new cars, both gasoline and diesel. The downward trend in emissions since 2010 is due to the growing share of biofuels used in road transport and improving fuel efficiency of vehicles. However, Finland's per capita CO_2 emissions from transport are higher than in many other EU countries owing primarily to the long distances, transport-intensive industries and travel to and from free-time residences.

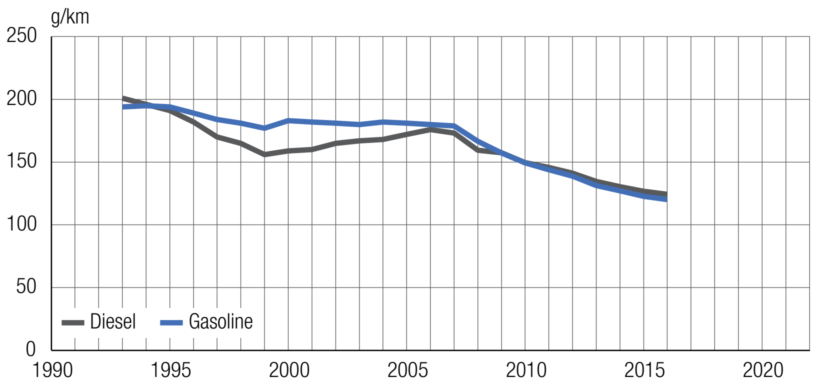
The CO_2 emissions per kilometre driven have decreased both for passenger cars and other vehicles (Figure 3.10). The energy efficiency of new registered cars began to improve in the 1990s, and during 1993 to 2015 the vehicle-specific CO_2 emissions of new registered passenger cars fell 37 per cent (Figure 3.11).

Figure 3.10
Relative development of CO_2 emissions from cars and other vehicles, 1990 to 2015 (CO_2/km=carbon dioxide emissions per vehicle-kilometre)



Source: VTT, LIPASTO model

Figure 3.11
CO_2 emissions (g/km) of new registered cars (gasoline and diesel), 1993 to 2015

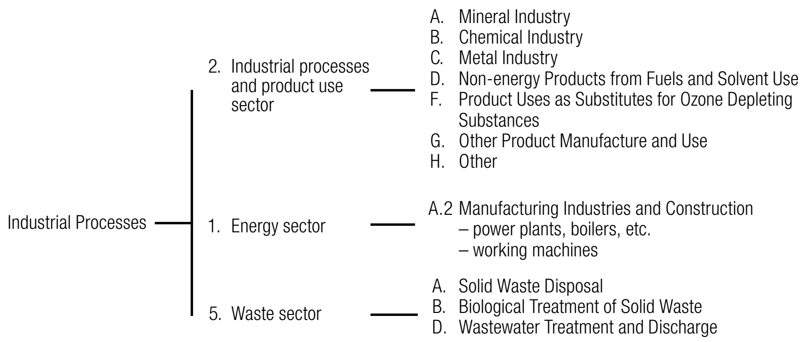


Source: Finnish Transport Safety Agency

3.2.3 Industrial processes and product use

Greenhouse gas emissions from industrial processes and product use contributed 11 per cent to the total greenhouse gas emissions in Finland in 2015, totalling 6.1 million tonnes CO_2 eq. The most important greenhouse gas emission sources of industrial pro-

Figure 3.12
Reporting categories of emissions from industrial process sources in the national greenhouse gas inventory



cesses and product use in 2015 were CO_2 eq. emissions from iron and steel, hydrogen and cement production with 3.9, 1.4 and 0.8 per cent shares of total national greenhouse gas emissions, respectively.

CO_2 emissions were also generated to produce lime, glass, phosphoric acid, zinc, copper and nickel, as well as in the use of limestone, dolomite, soda ash, lubricant, paraffin vax and urea-based catalyst. Small amounts of methane (CH_4) were generated for coke production in the iron and steel industry and nitrous oxide (N_2O) emissions were generated to produce nitric acid and from product use. Indirect CO_2 emissions from CH_4 and NMVOC (non-methane volatile organic compounds) emissions are reported aggregated in national totals.

Fluorinated greenhouse gases, or F-gases, are reported under industrial processes. They are used to replace ozone-depleting substances in refrigeration and cooling devices, as well as in air conditioning devices and as aerosols, and they accounted for 2.9 per cent of total national greenhouse gas emissions and 26 per cent of the greenhouse gas emissions of industrial processes and other product use in 2015.

The emissions resulting from industrial processes and product use are mostly affected by changes in production output, as they depend on the use of raw materials and production volumes. Emissions caused by industrial processes did not vary much during the 1990s (Figure 3.13).

Figure 3.13
Greenhouse gas emissions from industrial processes, 1990 to 2015

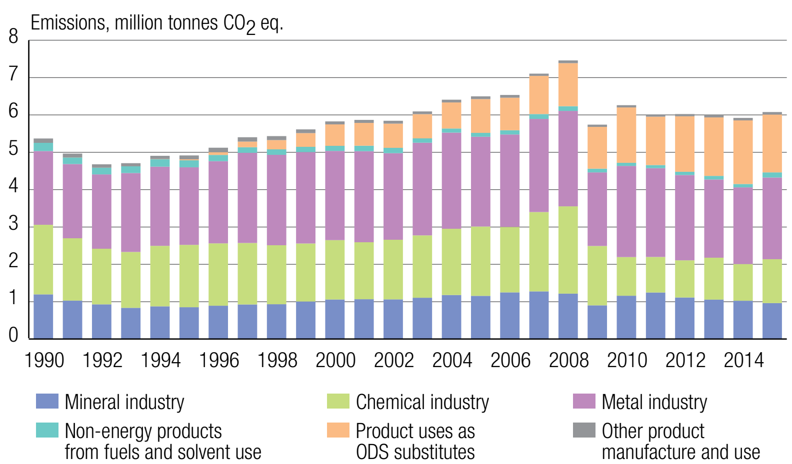
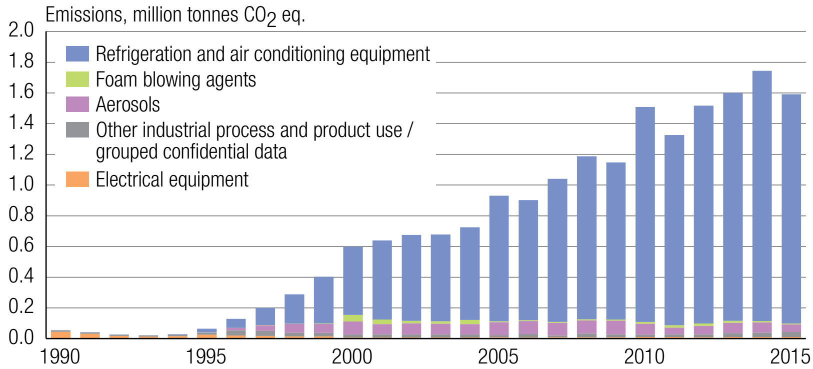


Figure 3.14
F-gas emissions, 1990 to 2015



The implementation of N_2O abatement technology in nitric acid production plants in 2009 reduced the emissions from the chemical industry significantly. In the period from 1990 to 2015, the largest relative change occurred in F-gas emissions, which increased about thirtyfold (Figure 3.14).

Emissions of industrial processes and product use have increased by 13 per cent (0.7 million tonnes CO_2 eq.) since 1990. At the beginning of the time series, some production plants were closed down and that caused a fast decrease in emissions. After this, the production outputs and emissions increased and reached the level of 1990 in 1996. Since then, the overall trend in emissions has been increasing, however. Emissions decreased rapidly in 2009 due to the economic downturn as the demand for industrial products diminished. Emissions started to grow along with production after the recession in 2010.

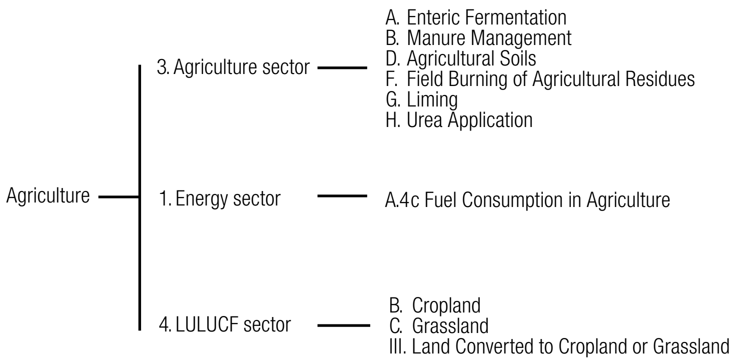
CO_2 emissions have increased by 15 per cent from 1990 to 2015. The reasons are increased production of steel, hydrogen and use of limestone and dolomite. Methane emissions have decreased by 63 per cent. Nitrous oxide emissions have fluctuated during 1990 to 2015; first a fast decrease due to the closing of a nitric acid production plant and after that a slow increase of emissions, the second fast decrease that started in 2009 originated from the implementation of a new N_2O abatement technology in nitric acid production and the decreased demand of fertilisers. Since 1990, nitrous oxide emissions have decreased by 1.3 million tonnes CO_2 eq. (83%).

3.2.4 Agriculture

Emissions from the agriculture sector were approximately 6.5 million tonnes CO_2 eq. in 2015. Agricultural emissions reported under the agricultural sector include methane (CH_4) emissions from the enteric fermentation of domestic livestock, manure management and crop residue burning, as well as nitrous oxide (N_2O) emissions from manure management and direct and indirect N_2O emissions from agricultural soils and crop residue burning. Also CO_2 emissions from liming and urea fertilization are included. Emissions from the agriculture are also reported in the energy and LULUCF sectors in the greenhouse gas inventory (Figure 3.15).

The agricultural sector accounted for approximately 12 per cent of Finland's total greenhouse gas emissions in 2015. In 2015, methane emissions from enteric fermentation were 33 per cent, methane emissions from manure management seven per cent, nitrous oxide emissions from manure management four per cent and nitrous oxide emissions from agricultural managed soils 53 per cent of total agricultural emissions. Liming and application of urea comprise three per cent of emissions, the share of field burning of agricultural crop residues totals 0.04 per cent.

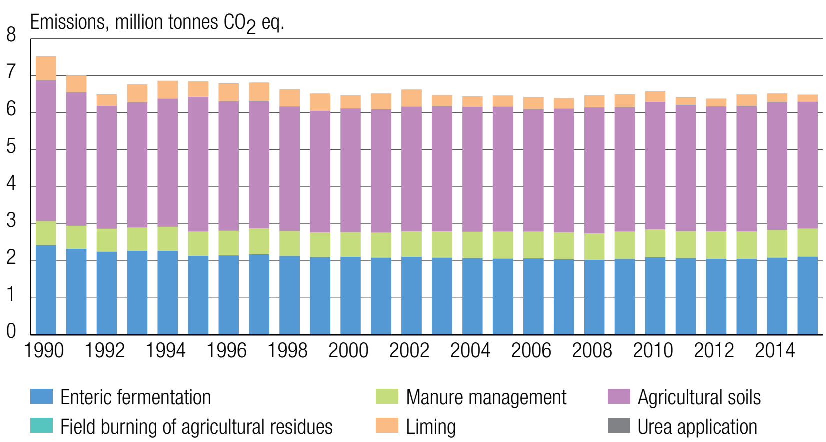
Figure 3.15
Agricultural sources of emissions and their reporting in the CRF categories in the national greenhouse gas inventory



Most of the CH_4 emissions from enteric fermentation are generated by cattle, but emissions generated by horses, pigs, sheep, goats, fur animals and reindeer are also reported. Most of the N_2O emissions from the agriculture sector are direct and indirect N_2O emissions from agricultural soils.

Emissions in the Agriculture sector have decreased by about 14 per cent over the period 1990 to 2015 (Figure 3.16). The reduced use of nitrogen fertilisers and improved manure management resulting from measures taken by farmers as part of an agri-environmental programme aiming to minimise nutrient loading to water courses have decreased emissions in the agriculture sector. The amount of mineral fertilisers used has decreased by 37 per cent from 1990 to 2015, which is the most important factor in emission reduction. The decrease in N_2O emissions from agricultural soils was 10 per cent in 2015 compared with the 1990 level. Structural changes in agriculture have resulted in an increase in farm size and a decrease in the numbers of domestic livestock. The decrease in the number of livestock is visible in the lower CH_4 emissions from enteric fermentation (Figure 3.16). The emissions have not decreased in proportion to the drop in the number of livestock, however, because milk and meat output and the emissions per animal have increased.

Figure 3.16
Greenhouse gas emissions from agriculture, 1990 to 2015*



* The CH_4 and N_2O emissions from field burning of agricultural residues, as well as CO_2 emissions from urea application are very small and, therefore, not discernible in the figure.

3.2.5 Land use, land-use change and forestry

Finland reports both greenhouse gas emissions and removals in the LULUCF sector. Removals refer to the absorption of CO_2 from the atmosphere by carbon sinks, such as plant biomass or soil.

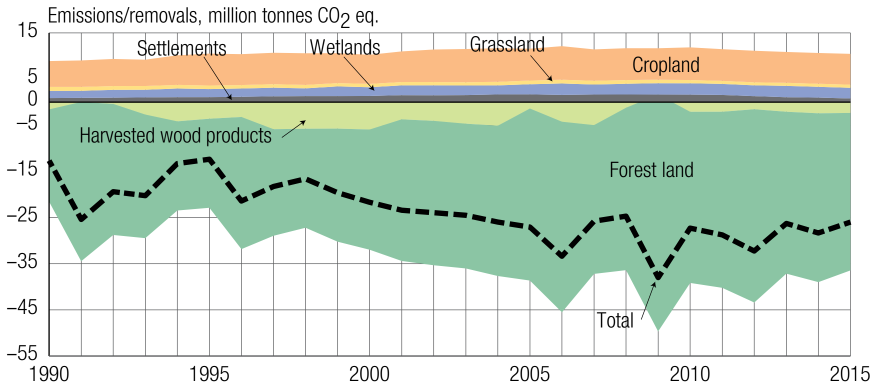
Changes in carbon stocks in six land-use categories covering the whole of Finland are reported in this sector. In accordance with the IPCC guidelines, the changes in different carbon pools, which include above and below-ground biomass, dead wood, litter and soil, are reported for each category. In addition, carbon stock changes of harvested wood products and emissions originating from other sources are reported in this sector, such as CH_4 and N_2O emissions from drained organic forest soils and managed wetlands such as peat extraction areas, emissions from the burning of biomass (forest fires and controlled burning), emissions from nitrogen fertilization of forest land and N_2O emissions resulting from land-use change. Emissions and removals are not reported for unmanaged wetlands and other land.

In 2015, the LULUCF sector as a whole acted as a CO_2 sink for –26.0 million tonnes CO_2 eq. because the total emissions resulting from the sector were smaller than the total removals. The sink in 2015 was 47 per cent of total national emissions excluding the LULUCF sector. In forest land, the largest sink in 2015 was tree biomass: –30.3 million tonnes CO_2 eq. Mineral forest soils were a sink of –12.0 million tonnes CO_2 eq., whereas organic forest soils were a source of 6.2 million tonnes CO_2 eq. Other emission sources in the forest land category are methane and nitrogen oxide emission from drained organic forest lands (2.0 million tonnes CO_2 eq.), nitrogen fertilisation (0.013 million tonnes CO_2 eq.) and biomass burning (0.002 million tonnes CO_2 eq.). Forest growth has increased steadily since 1990 owing to factors such as the large proportion of young forest at a strong growth phase and silvicultural measures. Felling volumes have varied according to the market situation and demand. In 2015, roundwood removals reached 68 million m^3 being the highest ever. In Finland, all forests are classified as managed forests. Consequently, nature reserves are also included in the reporting.

Even though the LULUCF sector has clearly been a net carbon sink, the sector also produces significant emissions. The largest emissions come from drained organic soils of forests and croplands. Other emission sources in the LULUCF sector include grasslands, peat production areas, forest fires and nitrogen fertilization of forests.

The trend in emissions and removals from the different land-use categories reported in the LULUCF sector is presented in Figure 3.17.

Figure 3.17
Greenhouse gas emissions (positive values) and removals (negative values) in the LULUCF sector, 1990 to 2015



Harvested wood products

The Harvested Wood Products (HWP) pool was a net sink of 2.3 million tonnes CO_2 in 2015. HWP has been a net sink for the whole reported time series except in 1991 and 2009.

HWP is reported as a carbon stock change in production-based HWP stocks originating from wood harvested in Finland divided in two categories: HWP produced and consumed domestically and HWP produced and exported. HWP comprise of solid wood products (sawn wood and wood panels) and paper products (wood pulp). The production quantity of pulp was used as a proxy for paper and paperboard production. In Finland, 98.7 per cent of wood pulp is used for paper and paperboard production, and 1.3 per cent (part of dissolving wood pulp) for textile and hygiene products, which are exported (percentages are for 2013). Wood pulp production for other purposes than paper and paperboard started mainly in 2012. The annual change of HWP in domestic solid waste disposal sites (SWDS) is not calculated.

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

Under Article 3, paragraph 3 of the Kyoto Protocol, Finland reports emissions and removals from activities afforestation/reforestation (AR) and deforestation (D), and under Article 3, paragraph 4, from forest management (FM). Reporting and accounting of these activities are mandatory for the second commitment period (CP) of the Kyoto Protocol. Finland had also elected forest management as a voluntary activity for the first commitment period. Finland has not elected other voluntary activities under Article 3, paragraph 4 (cropland management, grazing land management, revegetation and wetland drainage and rewetting) for the second commitment period, as was the case in the first commitment period.

Table 3.1
Accounting for the KP LULUCF activities for the second commitment period, tonnes of CO_2 eq.

	2013	2014	2015
Finland's assigned amount for the second commitment period	**240,544,599**		
Total national emissions	63,195,337	59,125,790	55,559,213
ETS emissions without aviation	31,496,743	28,765,587	25,486,758
CO_2 emissions from aviation	186,663	187,557	185,976
Non-ETS emissions[1)]	**31,511,931**	**30,172,646**	**29,886,479**
Non-ETS emissions as cumulative percentage of the assigned amount	**13%**	**26%**	**38%**
Article 3.3 net emissions to be subtracted from the assigned amount[2)]	**3,435,980**	**3,233,289**	**2,923,614**
Article 3.4 net removals (FM)	–56,214,409	–54,381,385	–49,312,939
Finland's FMRL (annual reference)	–20,466,000	–20,466,000	–20,466,000
Technical correction to the FMRL	–13,582,000	–13,582,000	–13,582,000
FM net removals minus FMRL and the technical correction	–22,166,409	–20,333,385	–15,264,939
FM cap[3)]	–19,978,041	–	–
Estimate of net addition to the assigned amount from Article 3.4[2)]	**19,978,041**	**0**	**0**

1) The emissions corresponding to the emission level allocated to Finland in the joint fulfilment agreement by the EU, its Member States and Iceland
2) Finland has chosen end of commitment period accounting for Articles 3.3 and 3.4 wherefore any additions or subtractions to the assigned amount will be done at the end of the commitment period
3) FM cap is –19,978,041 tonnes CO_2 eq for the whole second commitment period. In the table, for each commitment period year the value in this row presents how much of the cap is available for accounting in that year.

Net emissions from Article 3.3 activities i.e. afforestation, reforestation and deforestation were 2.9 million tonnes of CO_2 eq. in 2015. Afforestation and reforestation resulted in a net removal of 0.2 million tonnes CO_2 eq., while deforestation produced a net emission of 3.1 million tonnes of CO_2 eq. The area subject to AR was approximately 173,000 ha at the end of 2015. The area deforested since 1 January 1990 was approximately 391,000 ha, of which 1,400 ha has been reforested.

Net removals as a result of forest management under Article 3.4 were 49.3 million tonnes CO_2 eq. in 2015, including the carbon stock change in the Harvested Wood Products pool. Accounting for the KP LULUCF activities for the second commitment period is presented in Table 3.1.

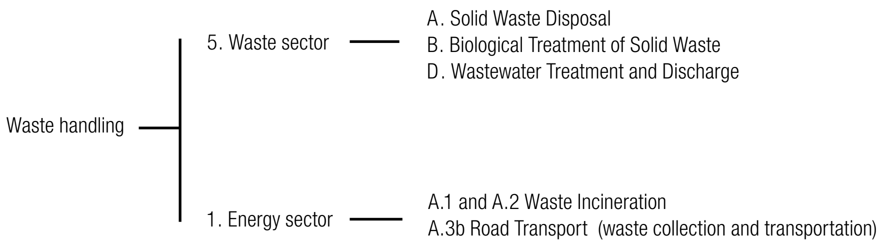
The emissions and removals from ARD lands vary between the years depending on the timing and quantity of the land-use changes, which vary depending on the economy.

Interannual variation in the total CO_2 removals from FM is mainly due to variations in the amount of logging, which have a direct impact on the quantity of the biomass sink. In addition, the changes in soil carbon vary according to the variation in the carbon stocks of living biomass, as well as in the amount of carbon in logging residue inputs, but the changes occur at a slower rate than they do for biomass.

3.2.7 Waste

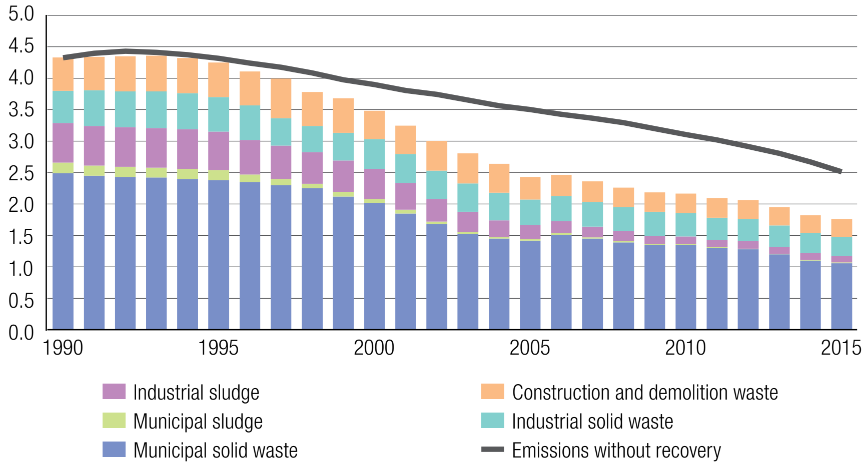
Methane (CH_4) emissions from landfills and CH_4 and N_2O emissions from composting and wastewater treatment are reported under the waste sector (Figure 3.18). Greenhouse gas emissions from the combustion of waste are reported fully in the energy sector, as waste incineration without energy recovery is almost non-existent. Waste sector emissions amounted to 2.1 million tonnes CO_2 eq. in 2015, which accounts for approximately four per cent of Finland's total emissions.

Figure 3.18
Reporting categories of emissions from waste handling in the national greenhouse gas inventory



CH_4 emissions from landfills are the most important greenhouse gas emissions in the waste sector. Solid waste disposal on land contributes nearly 83 per cent, wastewater treatment about 12 per cent and biological treatment (composting and anaerobic digestion) five per cent of the sector's total emissions. Compared to 2014, emissions decreased by three per cent in 2015 and since 1990, these emissions have decreased by 54 per cent. A new Waste Act entered into force in 1994, which has led to a reduction in methane emissions from landfill sites (Figure 3.19). The Waste Act has cut back on the volume of waste deposited at landfills by promoting recycling and reuse, as well as energy use of waste materials. The recovery of landfill gas has also increased significantly since 1990. Currently, nearly one-third of the methane generated at landfills is recovered. The economic recession of the early 1990s also reduced consumption and waste volumes

Figure 3.19
Methane emissions from solid waste disposal on land, 1990 to 2015



during that period. CH4 emissions from landfills are expected to decrease further due to the implementation of EU and national policies and measures (see Section 4.5.7).

Emissions from wastewater treatment have also been successfully reduced by 15 per cent compared with the situation in 1990. The reduction in emissions has been affected by, for example, increasingly efficient treatment of wastewater (also in sparsely populated areas), as well as a lower nitrogen burden released from industrial wastewaters into bodies of water. Emissions from composting have more than doubled since 1990, being five per cent of the waste sector's emissions in 2015. The reason for this is increased composting of waste, especially in semi-urban areas, due to separate collection of organic waste. Emissions from anaerobic digestion have also increased significantly in recent years due to the same reason as the increase in emissions from composting. Yet, this emission source is very small being 0.3 per cent of the waste sector's emissions in 2015.

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

3.3.1 Institutional, legal and procedural arrangements

According to the Government resolution of 30 January 2003 on the organisation of climate policy activities of Government authorities, Statistics Finland assumed the responsibilities of the national entity for Finland's greenhouse gas inventory from the beginning of 2005. In 2015, the role of Statistics Finland as the national entity was enforced through the adoption of the Climate Change Act[3].

In Finland, the national system is established on a permanent footing and it guides the development of emission calculation in the manner required by the UNFCCC and the Kyoto Protocol. The national system is based on laws and regulations concerning Statistics Finland, on agreements between the inventory unit and expert organisations on the production of emission and removal estimates, as well as related documentation. Statistics Finland

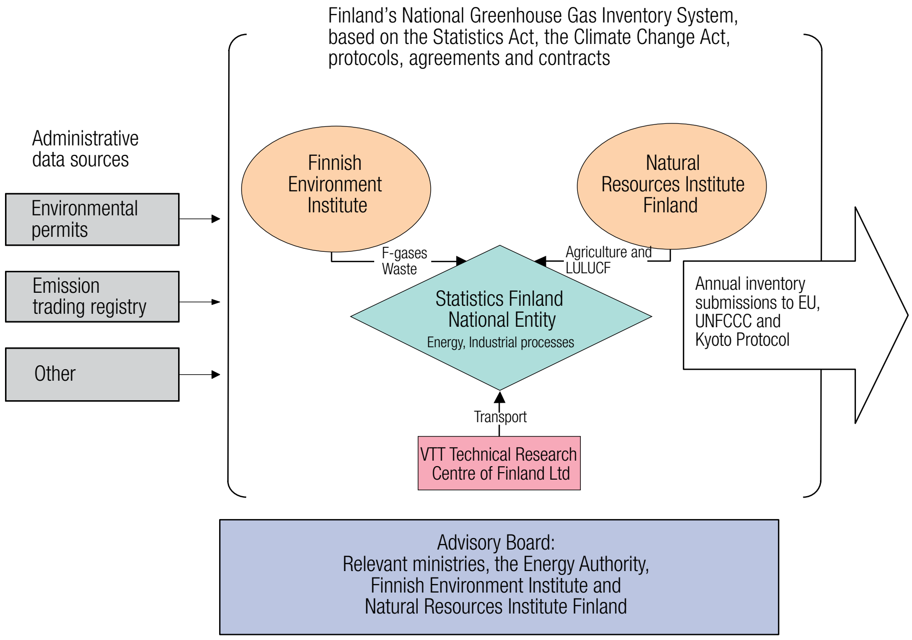
3 609/2015

also has agreements on cooperation and support to the expert organisations participating in Finland's national system with relevant ministries. The national system is designed and operated to ensure the transparency, consistency, comparability, completeness, accuracy and timeliness of greenhouse gas emission inventories. The quality requirements are fulfilled by consistently implementing the inventory quality management procedures. The national system for the greenhouse gas inventory in Finland is presented in Figure 3.20.

The contact person for the national entity and its designated representative with overall responsibility for the national inventory at Statistics Finland is:

Dr Riitta Pipatti,
POB 6 A, FI-00022 Statistics Finland
Tel: + 358 29 551 3543
Email: riitta.pipatti@stat.fi

Figure 3.20
National system for the greenhouse gas inventory in Finland



Statistics Finland as the national entity for the inventory

In its activity as the national entity for the greenhouse gas inventory, the Statistics Finland Act[4] and its amendment[5], and the Statistics Act[6] and its amendment[7] are applied.

Statistics Finland defines the placement of the inventory functions in its working order. The advisory board of the greenhouse gas inventory set up by Statistics Finland ensures collaboration and information exchange in issues related to the reporting of greenhouse gas emissions under the UNFCCC, the Kyoto Protocol and the EU. The advisory board reviews planned and implemented changes in the inventory and the achieved quality. It approves changes to the division of tasks between the expert organisations preparing the inventory. In addition, the advisory board promotes research and review

4 48/1992
5 901/2002
6 280/2004
7 361/2013

projects related to the development of the inventory and reporting, as well as gives recommendations on participation in international cooperation in this area (UNFCCC, IPCC and EU). The advisory board is composed of representatives from the expert organisations and the responsible Government ministries.

Statistics Finland is in charge of the compilation of the national emission inventory and its quality management in the manner intended in the Kyoto Protocol. In addition, Statistics Finland calculates the estimates for the energy and industrial processes (except for F-gases: HFCs, PFCs and SF_6) sectors. As the national entity, Statistics Finland also bears the responsibility for the general administration of the inventory and communication with the UNFCCC and the EU Commission, coordinates the review of the inventory, and publishes and archives the inventory results.

Statistics Finland has access to data collected for administrative purposes. Hence by law, Statistics Finland has access to data collected under the EU ETS, regulation on fluorinated gases, the European EPRTR registry and energy statistics regulation. Access to EU ETS data is also ensured through the agreement between Statistics Finland and the Energy Authority. The EU ETS data and data collected under the energy statistics regulation are significant data sources and used both directly and/or for verification in inventory compilation. The use of the EPRTR and data collected under the regulation on fluorinated greenhouse gases have a much more limited role in the inventory preparation.

Statistics Finland approves the inventory before the submissions to the UNFCCC and EU. The draft inventory submission to the EU on 15 January is presented to the advisory board, and before submitting the final inventory to UNFCCC on 15 April, the national inventory report is sent to the inter-ministerial network on climate policy issues for comments.

Responsibilities of the expert organisations

Finland's inventory system includes, in addition to Statistics Finland, the expert organisations the Finnish Environment Institute and the Natural Resources Institute Finland

Table 3.2
Responsibility areas (Common Reporting Format category) and organisation

Area		Organisations
CRF 1.A.	Stationary sources, including fuel combustion in point sources, such as power plants, heating boilers, industrial combustion plants and processes	Statistics Finland
CRF 1.A.	Mobile sources (transport and off-road machinery)	Statistics Finland, VTT Technical Research Centre of Finland Ltd (as a purchased service), Finavia (inventory years 1990 to 2010)
CRF 1.A.	Other fuel combustion (agriculture, households, services, public sector, etc.)	Statistics Finland
CRF 1.B.	Fugitive emissions from energy production and distribution	Statistics Finland
CRF 2.	Emissions from industrial processes and product use	Statistics Finland
CRF 2.	Emissions of F-gases	Finnish Environment Institute
CRF 3.	Emissions from agriculture	Natural Resources Institute Finland (Luke)
CRF 4.	Emissions from land use, land-use change and forestry	Natural Resources Institute Finland (Luke)
CRF 5.	Emissions from waste	Finnish Environment Institute
Indirect CO_2	Non-methane volatile organic compounds, NMVOC	Finnish Environment Institute
KP	Activities under Article 3, paragraphs 3 and 4 of the Kyoto Protocol (ARD and FM)	Natural Resources Institute Finland (Luke)

(Luke). Statistics Finland also acquires parts of the inventory as purchased services from VTT (VTT Technical Research Centre of Finland Ltd).

Up to 2009, Finavia (former Civil Aviation Administration) provided emission data on aviation to the inventory. In 2010, Finavia's status in Finland's inventory system changed. Finavia no longer performs the calculations and is not responsible for the related calculations. Statistics Finland has overtaken this task and has been responsible for the calculations since 2010. Finavia continues to support Statistics Finland in the task by providing Statistics Finland with expert advice.

The agreements between Statistics Finland and the expert organisations define the division of responsibilities (sectors/categories covered) and tasks related to uncertainty and key category analyses, QA/QC and reviews. They also specify the procedures and schedules for the annual inventory process coordinated by Statistics Finland. The responsibilities to estimate and report emissions/removals from different sectors/categories of the different expert organisations are based on established practices for the preparation and compilation of the greenhouse gas emission inventory. The scope of these responsibilities is presented in Table 3.2.

All the participating organisations are represented in the inventory working group set up to support the process of producing annual inventories and the fulfilment of reporting requirements. The working group advances collaboration and communication between the inventory unit and the experts producing the estimates for the different reporting sectors, and ensures the implementation of the QA/QC and verification process of the inventory.

The role of responsible ministries and the Energy Authority in the national system

The resources of the national system for the participating expert organisations are channelled through the relevant ministries' performance management (Ministry of the Environment and Ministry of Agriculture and Forestry). In addition, other ministries participating in the preparation of the climate policy advance in their administrative branch that the data collected while performing public administration duties can be used in the emission inventory.

In accordance with the Government resolution, the ministries are responsible for producing the information needed for international reporting on the contents, enforcement and effects of the climate strategy. Statistics Finland assists in the technical preparation of policy reporting. Statistics Finland technically compiles the National Communications and the biennial reports under the UNFCCC. Separate agreements have been made on the division of responsibilities and cooperation between Statistics Finland and the ministries.

The Energy Authority is the National Emissions Trading Authority in Finland. It supervises the monitoring and reporting of the emissions data under the European Emission Trading Scheme (EU ETS) and international emissions trading under the Kyoto Protocol.

The Energy Authority provides the necessary information on emission reduction units, certified emission reductions, temporary certified emission reductions, long-term certified emission reductions and assigned amount units and removals units for annual inventory submissions in accordance with the guidelines for preparation of information under Article 7 of the Kyoto Protocol. This reporting is done using so-called standard electronic tables (SEF) and documentation provided in the National Inventory Report or made publicly available at the website of the Energy Authority. Statistics Finland and the Energy Authority have an agreement on the respective responsibilities.

3.3.2 Annual inventory process

The annual inventory process set out in Figure 3.21 illustrates at a general level how the inventory is produced within the national system. The quality of the output is ensured by inventory experts during compilation and reporting. The quality control and quality assurance elements are integrated into the inventory production system, which means that each stage of the inventory process includes relevant procedures for quality management (see also Section 3.3.3).

The methodologies, collection of activity data and choice of emission factors are consistent with the guidance in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the IPCC 2013 Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.

Advanced and country-specific approaches (Tier 2 and Tier 3 methods) are used wherever possible, as these are designed to produce more accurate emission estimates than the basic (Tier 1) methods. Detailed activity data is used for most categories, and the emission factors and other parameters are based on national research and other data. For large point sources within the energy and industrial processes sectors, the estimates are based on plant and process-specific data. The Compliance Monitoring Data System VAHTI, used by the Centres for Economic Development, Transport and the Environment for processing and monitoring environmental permits, is the central data source for plant and process-specific data. Detailed descriptions of the methodologies used can be found in the sector-specific chapters of the National Inventory Report.

Statistics Finland annually conducts a Tier 2 key category analysis prior to submitting inventory information to the EC. The Tier 2 methodology makes use of category-specific uncertainty analyses. The analysis covers all of the sources and sinks of the inventory.

The key category analysis functions as a screening exercise. The end result is a short list (20+) of the subcategories that are the most important in terms of level and trend of the emissions. This list forms the basis for discussions with the sectoral experts on the quality of the estimates and possible needs for improvement on the calculation methodology. The results of the key category analysis are included annually in the national inventory report and the common reporting tables. This information is archived following Statistics Finland's archival practices.

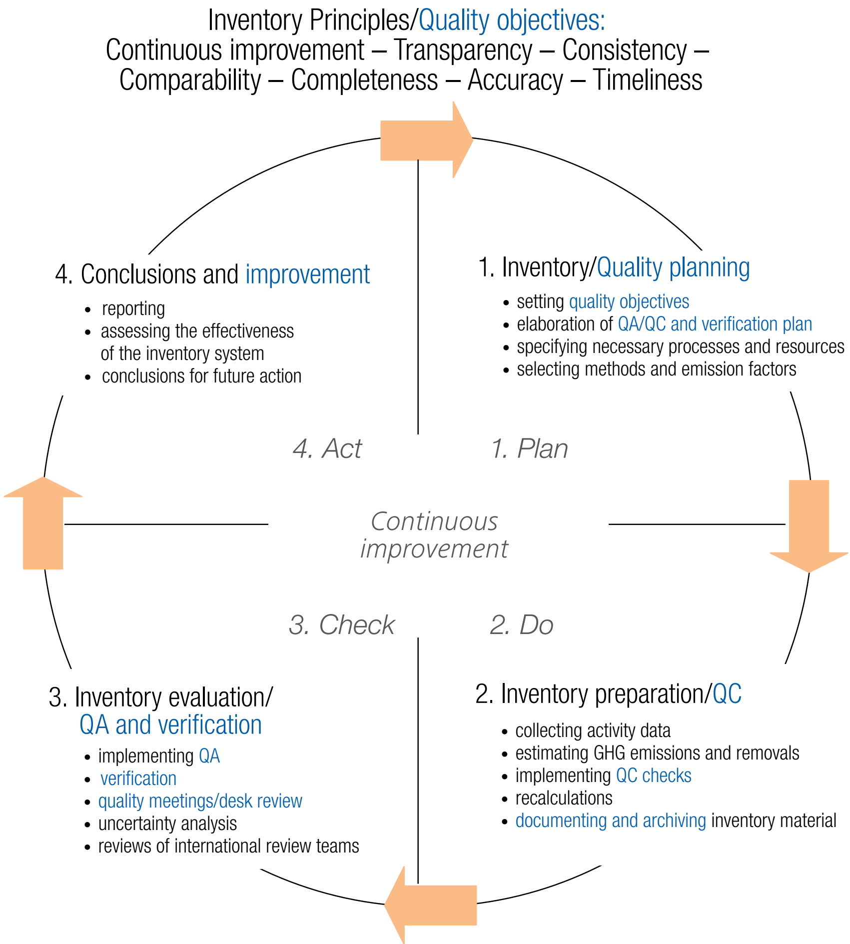
Recalculations are made for the purpose of implementing methodological improvements in the inventory, including changes in activity data collection and emission factors, or for including new source or sink categories within the inventory or for correcting identified errors, omissions, overlaps or inconsistencies within the time series.

Greenhouse gas inventory recalculations are based on an annual evaluation of the preparation and improvement needs for the inventory, including input from the QA/QC activities. The driving forces when applying the recalculations are the need to implement the guidance given in the IPCC Guidelines and the recommendations in the UNFCCC and EU inventory reviews.

Statistics Finland coordinates the development of the inventory. Each organisation participating in the inventory preparation process bears the primary responsibility for developing its own sector. The advisory board discusses and promotes the horizontal development projects and resources needed for development work.

Inventory development needs and projects that require additional resources are identified at bilateral quality meetings between the inventory unit and the participating organisations. Statistics Finland keeps a record of the development needs and planned or proposed improvement measures, and uses this information to compile an annual inventory improvement plan. Methodological changes are discussed and evaluated by the advisory board before being implemented. Any changes that are made are documented in the CRF

Figure 3.21
Inventory process and QA/QC management of the inventory



tables and in the National Inventory Report in accordance with the UNFCCC reporting guidelines. Changes in methodologies are implemented for the whole time series.

Finland has undertaken several research programmes and projects to improve the quality of the country-specific emission factors and other parameters, as well as the methods used in the greenhouse gas inventory (see also Chapter 8, Section 8.2.4). The results have been disseminated through, for example, articles in scientific journals and presentations at various national workshops and seminars. Some of the research results have also been used by the IPCC, for instance in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the IPCC Emission Factor Database and the '2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands'.

3.3.3 Quality management

The objective of Finland's GHG inventory system is to produce high-quality GHG inventories, which means that the structure of the national system (i.e. all institutional, legal and procedural arrangements) for estimating greenhouse gas emissions and removals, and the content of the inventory submissions (i.e. outputs, products) comply with the requirements and principles.

The starting point for accomplishing a high-quality GHG inventory is consideration of the expectations and requirements directed at the inventory. The quality requirements set for the annual inventories – transparency, consistency, comparability, completeness, accuracy, timeliness and continuous improvement – are fulfilled by implementing the QA/QC process consistently in conjunction with the inventory process (Figure 3.21). The quality control and quality assurance elements are integrated into the inventory production system, which means that each stage of the inventory process includes relevant procedures for quality management.

The inventory process consists of four main stages: planning, preparation, evaluation and improvement (PDCA cycle) and aims at continuous improvement. A clear set of documents is produced on the different work phases of the inventory. The documentation ensures the transparency of the inventory: it enables external evaluation of the inventory and, where necessary, its replication.

Statistics Finland has the overall responsibility for the GHG inventory in Finland, including the responsibility for coordinating the quality management measures at national level. The quality coordinator steers and facilitates the quality assurance and quality control (QA/QC) and verification process, and elaborates the QA/QC and verification plan. The expert organisations contributing to the production of emission or removal estimates are responsible for the quality of their own inventory calculations. Experts on each inventory sector implement and document the QA/QC and verification procedures.

The inventory planning stage includes the setting of quality objectives and elaboration of the QA/QC and verification plan for the coming inventory preparation, compilation and reporting work. The setting of quality objectives is based on the inventory principles. Quality objectives (Table 3.3) are specified statements about the quality level

Table 3.3
The quality objectives regarding all calculation sectors for the inventory

Quality objectives
1. Continuous improvement
1.1 Treatment of review feedback is systematic
1.2 Improvements promised in the National Inventory Report (NIR) are carried out
1.3 Improvement of the inventory is systematic
1.4 Inventory quality control (QC) procedures meet the requirements
1.5 Inventory quality assurance (QA) is appropriate and sufficient
1.6 Verification of the inventory meet the requirements
1.7 Known uncertainties of the inventory are taken into consideration when planning improvement needs
2. Transparency
2.1 Archiving of the inventory is systematic and complete
2.2 Internal documentation of calculations supports emission and removal estimates
2.3 CRF tables and the National Inventory Report (NIR) include transparent and appropriate descriptions of emission and removal estimates and of their preparation
3. Consistency
3.1 The time series are consistent
3.2 Data have been used in a consistent manner in the inventory
4. Comparability
4.1 The methodologies and formats used in the inventory meet comparability requirements
5. Completeness
5.1 The inventory covers all emission sources, sinks, gases and geographic areas
6. Accuracy
6.1 Estimates are systematically neither higher nor lower than the true emissions or removals
6.2 Calculation is correct
6.3 Inventory uncertainties are estimated
7. Timeliness
7.1 High-quality inventory reports reach their receivers (EU/UNFCCC) within the set time

that is aimed at the inventory preparation with regard to the inventory principles. The objectives aim to be appropriate and realistic while taking into account the available resources and other conditions in the operating environment.

The quality objectives and the planned general and category-specific QA/QC and verification procedures regarding all sectors are set in the QA/QC plan. This is a document that specifies the actions, schedules and responsibilities in order to attain the quality objectives and to provide confidence in the Finnish national system's capability to deliver high-quality inventories. The QA/QC plan is written in Finnish, updated annually, and consists of instructions and a QA/QC form. Instructions include descriptions of, e.g., quality objectives, general and category-specific inventory QC checks, information on quality assurance and verification, schedules, and responsible parties. The QA/QC form addresses the actions to be taken in each stage of the inventory preparation. Sectoral experts fill the QA/QC and verification procedures performed, and the results of the procedures in the form. Discussions in the bilateral quality meetings or feedback given during the quality desk reviews are based on information documented on these forms.

The general and category-specific QC procedures are performed by the experts during inventory calculation and compilation according to the QA/QC and verification plan. The QC procedures used in Finland's GHG inventory comply with the 2006 IPCC Guidelines. General inventory QC checks (2006 IPCC Guidelines, Vol 1, Chapter 6, Table 6.1) include routine checks of the integrity, correctness and completeness of the data, identification of errors and deficiencies, and documentation and archiving of the inventory data and quality control actions. Category-specific QC checks including reviews of the activity data, emission factors and methods are applied on a case-by-case basis focusing on key categories and on categories where significant methodological changes or data revisions have taken place.

The QA reviews are performed after the implementation of QC procedures concerning the finalised inventory. The QA system comprises reviews and audits to assess the quality of the inventory and the inventory preparation and reporting process, to determine the conformity of the procedures taken and to identify areas where improvements could be made. Specific QA actions differ in their viewpoints and timing. The actions include basic reviews of the draft report, quality meetings or quality desk reviews, internal and external audits, peer reviews, EU MMR comparisons and UNFCCC and EU inventory reviews. In addition, emission and activity data can be verified by comparing them with other available data compiled independently of the GHG inventory system. These include measurement and research projects and programmes initiated to support the inventory system, or for other purposes but that produce information relevant to the inventory preparation.

The ultimate aim of the QA/QC process is to ensure the quality of the inventory and to contribute to the improvement of the inventory. At the improvement stage of the QA/QC process, conclusions are made based on the realised QA/QC measures taken and their results, as well as UNFCCC and EU review feedback and uncertainty analysis where relevant. In addition, the inventory unit and experts performing the inventory calculations follow the development of the sector. When technologies and practices change, or new activity or research data become available, they evaluate the need for improvements and recalculations to improve the inventory. The methodological changes are communicated to the advisory board for evaluation, and approved by the inventory unit before adopted into production (see also Section 3.3.2).

3.4 National registry

The EU Emissions Trading Scheme (EU ETS) began in January 2005 and is mandatory for specific industries in the European Union with emissions above a certain threshold. The EU ETS aims to ensure that large industrial emitters of CO_2 make a measurable contribution to the EU's emissions targets. The EU ETS and wider international emissions trading under the Kyoto Protocol have operated parallel to one another since October 2008. Both emissions trading schemes are underpinned by a system of electronically linked national registries, which in essence are intended to keep track of national and international transactions involving EU allowances and Kyoto units.

Directive 2009/29/EC adopted in 2009, provides for the centralisation 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, the EU Member States, who are also Parties to the Kyoto Protocol (26) 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.

The consolidated platform, which implements the national registries in a consolidated manner (including the registry of the EU) is called the Union registry and was developed together with the new EU registry on the basis the following modalities:

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

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 origin identifier in its unique serial number;

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;

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;

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;

The requirements of paragraphs 44 to 48 of the Annex to Decision 13/CMP.1 concerning making non-confidential information accessible to the public is fulfilled by each Party through a publically available web page hosted by the Union registry;

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

Table 3.4
Changes to the Union registry, including changes to Finland's national registry

Reporting Item	Description
15/CMP.1 Annex II.E paragraph 32.(a) Change of name or contact	None, administrator of the Finland's registry: Energy Authority rekisteri@energiavirasto.fi Address and phone number are available at homepage http://www.energiavirasto.fi/en/web/energy-authority/home
15/CMP.1 Annex II.E paragraph 32.(b) Change regarding cooperation arrangement	No change of cooperation arrangement occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	In 2016, new tables were added to the database for the implementation of the CP2 functionality. Versions of the Union registry released after 6.1.6 (the production version at the time of the last NC submission) introduced other minor changes in the structure of the database. These changes were limited and only affected EU ETS functionality. No change was required to the database and application backup plan or to the disaster recovery plan. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(d) Change regarding conformance to technical standards	Each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and were successfully carried out prior to each release of a new version in Production. Annex H testing is carried out every year. No other change in the registry's conformance to the technical standards occurred for the reported period.
15/CMP.1 Annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(f) Change regarding security	The mandatory use of hardware tokens for authentication and signature was introduced for registry administrators.
15/CMP.1 Annex II.E paragraph 32.(g) Change to list of publicly available information	Publicly available information is provided via the Union registry homepage for Finnish registry e.g. https://ets-registry.webgate.ec.europa.eu/euregistry/FI/public/reports/publicReports.xhtml and via the web page of the Energy Authority, e.g. http://www.energiavirasto.fi/en/web/energy-authority/public-reports
15/CMP.1 Annex II.E paragraph 32.(h) Change of Internet address	No change of the registry's Internet address occurred during the reporting period.
15/CMP.1 Annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reporting period.
15/CMP.1 Annex II.E paragraph 32.(j) Change regarding test results	Both regression testing and tests on the new functionality are carried out prior to release of the new versions in Production. The site acceptance tests are carried out by quality assurance consultants on behalf of and assisted by the European Commission. Annex H testing is carried out on an annual basis.

Following the successful implementation of the Union registry, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on 20 June 2012. Croatia was migrated and consolidated as of 1 March 2013. During the go-live process, all relevant transaction and holdings data were migrated to the Union registry platform and the individual connections to and from the ITL were re-established for each Party.

The changes to the national registry, which have occurred since the last National Communication report are summarized in Table 3.4. For other parts, the description of the functions of the national registry and its conformity with the Data Exchange Standards (DES) under the Kyoto Protocol, reported in Finland's 6th National Communication, Chapter 3, Table 3.4, remains valid.

Literature

2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. & Tanabe K. (eds). Published: IGES, Japan. http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

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Internet links

Finland's annual national inventory submissions are also published on the UNFCCC's website, http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php

Finnish part of the Union Registry, https://ets-registry.webgate.ec.europa.eu/euregistry/FI/index.xhtml

Energy supply and consumption, Statistics Finland http://tilastokeskus.fi/til/ehk/index_en.html

European Union Transaction Log, http://ec.europa.eu/environment/ets/account.do?languageCode=en