Photo: Kuvatoimisto Rodeo Oy

3 Greenhouse gas inventory information, including the national system and the national registry

This chapter describes Finnish greenhouse gas emissions and their development in 1990–2020 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.

3 Greenhouse gas inventory information, including the national system and the national registry

3.1 Total greenhouse gas emissions and trends

In 2020, Finland's greenhouse gas emissions totalled 47.8 million tonnes of carbon dioxide equivalent (million tonnes CO_2 eq.). The total emissions in 2020 were approximately 33 per cent (23.4 million tonnes) below the 1990 emissions level. Compared to 2019, the emissions were approximately 9 per cent, i.e. 5.0 million tonnes, lower. Finland's annual greenhouse gas emissions varied considerably from 1990 to 2020 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.

The emission trends by sector are presented in Figure 3.1 and described in detail in Section 3.2. Please see Annex 1 of this communication and Finland's latest National Inventory Report (2022) for more information.

The energy sector is the most significant source of greenhouse gas emissions in Finland and is therefore the key driver behind the trend in emissions. 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 2020, the energy sector accounted for 72 per cent of Finland's total greenhouse gas emissions (Figure 3.2). The second largest source of emissions was agriculture sector, with a share of approximately 14 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 greenhouse gas emissions is small, about 0.1 per cent of total greenhouse gas emissions in Finland.

The land use, land-use change, and forestry (LULUCF) sector in Finland was a net sink throughout the 1990 to 2020 reporting period, because greenhouse gas removals in the sector exceeded emissions. The net sink has varied from approximately 13 to 49 per cent of the annual sum of emissions from other sectors, i.e. the total emissions without LULUCF between 1990 and 2020. The most important components of the forest sink are the tree biomass growth and biomass removed from forests due to felling. Based on the National Forest Inventory (NFI), the increment of growing stock has increased since 1990 from 78 million m^3 to 103 million m^3. There is less fluctuation between years in the estimated tree biomass growth, contrary to the harvest rates. In 2020, the total drain was 83 million m^3.

For the LULUCF sector, the most recent results on a decline in tree growth were not yet available when the latest annual greenhouse gas inventory submission and the WM projection for the LULUCF sector were prepared. Results from the first three years (2019–2021) of the current, ongoing 13th national forest inventory showed that the annual increment of the growing stock, i.e. tree growth, has declined compared to the previous, 12th national forest inventory (2014–2018). A lower tree growth indicates lower removals in the forest land, and may also mean a smaller carbon sink in the LULUCF sector. Estimates of carbon removals in the LULUCF sector will be re-evaluated in future.

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

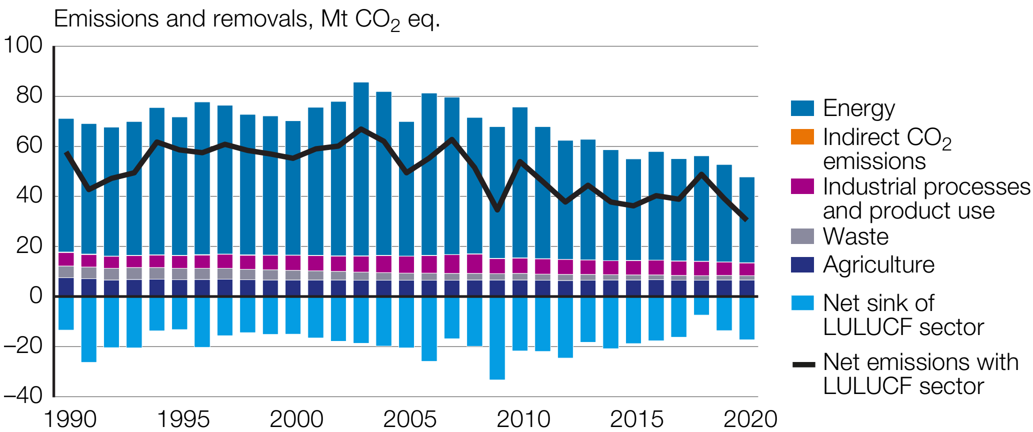
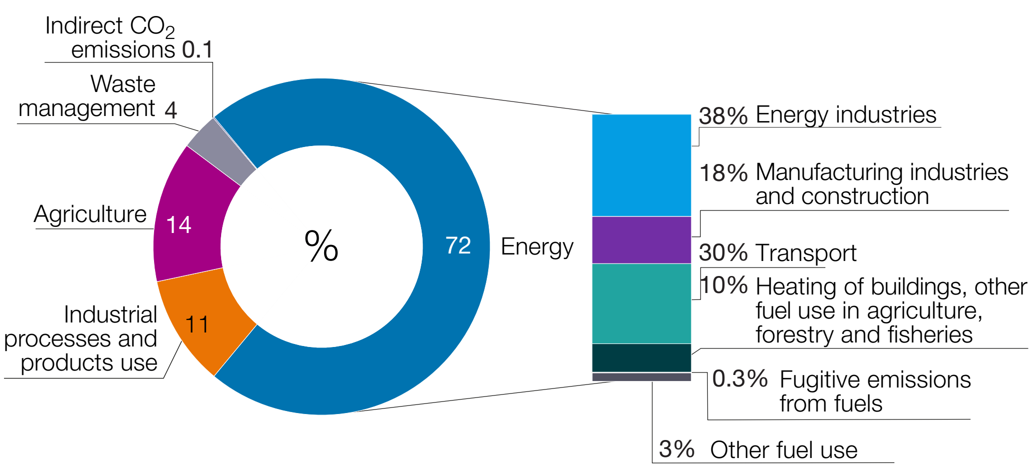


Figure 3.2
The composition of Finnish greenhouse gas emissions in 2020 (LULUCF sector excluded).*



* The sums do not add up because of independent rounding.

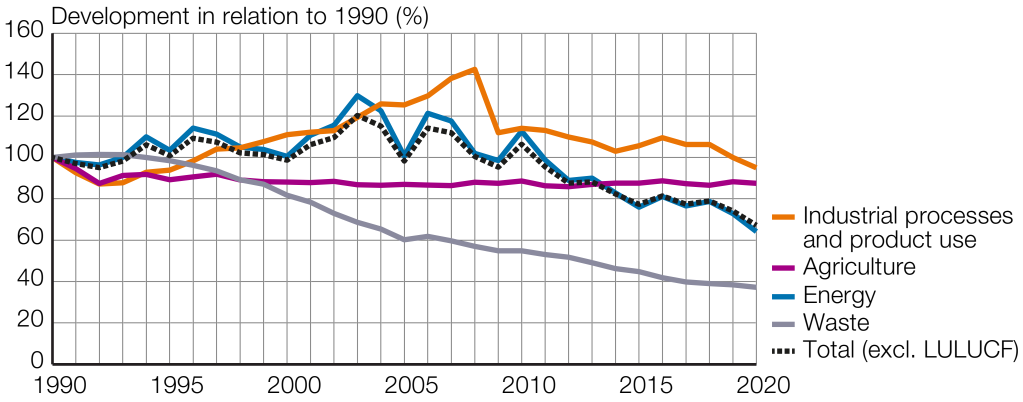
The most important greenhouse gas in Finland is carbon dioxide. The share of CO_2 emissions in total greenhouse gas emissions has varied from 79 per cent to 85 per cent. In absolute terms, CO_2 emissions are 19.4 million tonnes (i.e. 34 per cent) smaller than in 1990. The majority (89 per cent) of the CO_2 emissions originates from energy production based on the combustion of fossil fuels and peat. The CO_2 emissions from wood combustion are reported as a memo item in the CTF tables but are not included in the total national emissions, because they are reported as a loss from woody biomass stock in the LULUCF sector. The amount of energy-related CO_2 emissions has fluctuated greatly according to the economic trend, the energy supply structure (including electricity imports and exports) and climate conditions (Figure 3.3).

Methane emissions (CH_4) have decreased by 43 per cent from the 1990 level. This is mainly due to the improvements in the waste sector and reduced emissions from animal husbandry in the agricultural sector. The majority of methane emissions originated from the waste and agricultural sectors in 2020. The production and use of energy also generate methane and nitrous oxide emissions.

Emissions of nitrous oxide (N_2O) have also decreased by 26 per cent since 1990; the greatest decline occurred in 2009, when the implementation of a N_2O abatement technology in nitric acid production significantly reduced emissions. Another reason for the decrease of N_2O emissions is the reduced nitrogen fertilisation of agricultural fields. The majority of nitrous oxide emissions originated from agriculture.

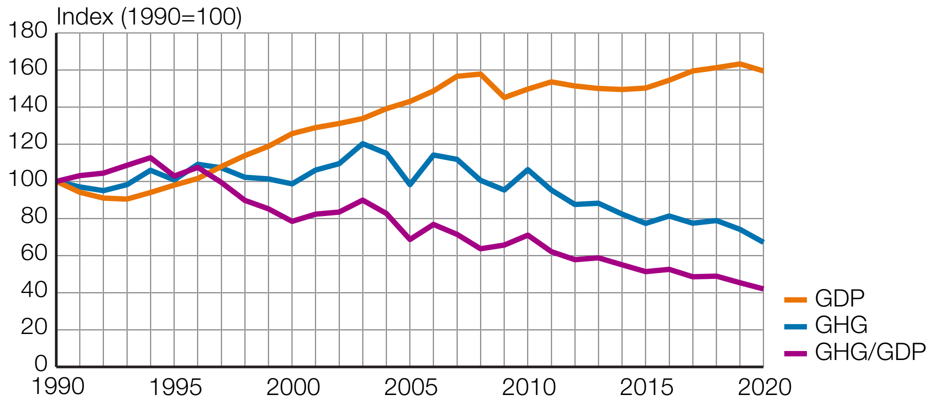
F gas emissions (HFC, PFC, SF_6) increased considerably between 1990 and 2008. A key driver of the trend was the substitution of ozone-depleting substances (ODS) by F gases in many applications. During the 2010s, F gas emissions have started to decline due to decreased leakage rates and the replacement of high-GWP HFC refrigerants with alternative low-GWP non-HFC refrigerants in many applications.

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



The overall 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 recession, which led to a steeper fall in GDP than in emissions. In 2020, the GHG/GDP ratio was almost 58 per cent below the 1990 level, indicating that the greenhouse gas intensity of the economy has decreased.

Figure 3.4
Greenhouse gas emissions relative to GDP, 1990 to 2020, excluding the LULUCF sector



More detailed information on emission trends by sector and gas can be found in the CRF Reporter Summary tables for 1990 to 2020 on emission trends included in Annex 1 of this communication and in Finland's latest National Inventory Report (2022).

3.2 Greenhouse gas emissions by sector

3.2.1 Energy

Overview of the sector

The energy sector is the main source of greenhouse gas emissions in Finland. In 2020, the sector contributed 72 per cent to total national emissions, totalling 34.6 million tonnes CO_2 eq. (Figure 3.2). Energy sector emissions can be divided into emissions resulting from fossil fuel combustion and fugitive emissions from fuels. Most of the emissions originate from fuel combustion, which reflects the high energy intensity of the Finnish industry, the extensive consumption of fuels during the long heating period, and the energy consumed for transport in this relatively large and sparsely inhabited country. Fugitive emissions make up only 0.3 per cent of the sector's total emissions.

Energy-related emissions vary greatly from year to year (Figure 3.5), mainly following the economic trend, the structure of the energy supply and climatic conditions. Compared with 1990, the emissions in the energy sector in 2020 were about 36 per cent lower. In 2020, emissions in the energy sector were about 12 per cent lower than in the previous year and approximately half the emission level in 2003, the year of the greatest emissions from the energy sector between 1990 and 2020.

The energy industries (mainly electricity and district heat production) caused approximately 38 per cent (13.1 million tonnes CO_2 eq.) of the total emissions in the energy sector in 2020. Emissions from the energy industries were 31 per cent lower in 2020 than in 1990. Manufacturing industries and construction produce a great deal of energy for their own use. Their share of energy-related emissions was around 18 per cent in 2020 (6.2 million tonnes CO_2 eq.). These emissions have declined by 53 per cent since 1990. The main reasons for this trend are the increased use of biofuels, i.e. black liquor a by-product of pulp industry, in the forest industry and the outsourcing of power plants from the manufacturing industries to energy industries. Share of biomass as a source of energy has significantly grown in the public electricity and heat production as well as in manufacturing industries and construction between 1990 and 2020 (Figure 3.6). See also Section 2.6 for trends in energy sources. Emissions from the residential sector have decreased by 67 per cent and from commercial sectors by 57 per cent compared with 1990 levels. The decrease is mainly due to the substitution of direct oil heating with district heating and electricity. The share of transport of energy-related emissions was more than 30 per cent in 2020. Emissions from transport have decreased by 14 per cent since 1990 and seven per cent since 2019. There was a decline of seven per cent in transport fuels activity data, mainly due to the Covid-19 pandemic, which explained the decrease in emissions. Since 2015, the diesel bioshare has varied annually, causing fluctuations in the annual emissions of road transport.

Figure 3.5
Greenhouse gas emissions in the energy sector, 1990 to 2020

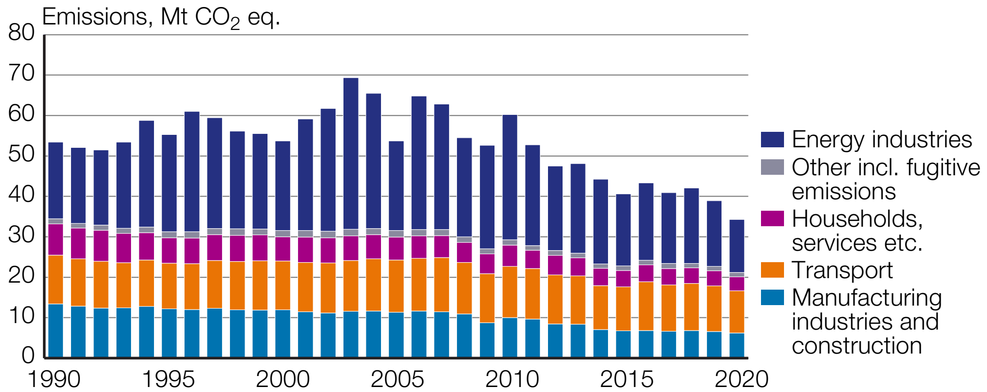
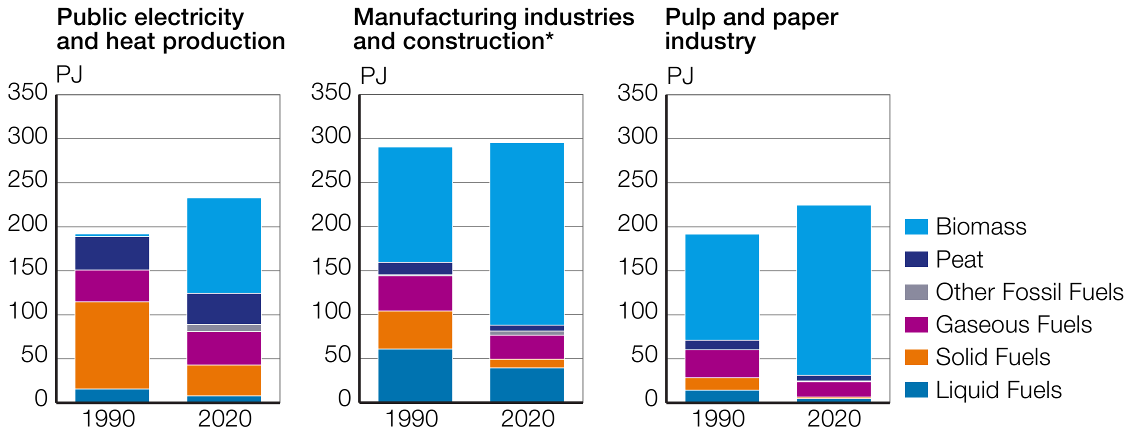


Figure 3.6
Fuel combustion in public electricity and heat production, manufacturing industries and construction, as well as in sub-sector of manufacturing industries, that is pulp and paper industry



* Fuel combustion in the pulp and paper industry is included in the manufacturing industry too.

Description and interpretation of energy emission trends

The important drivers in the energy sector's greenhouse emissions trend have been the changes in the amount of imported electricity and in the production of energy with fossil-fuel-based condensing power, as well as growth in the consumption of renewable energy (Figures 3.7 and 3.8). The availability of hydropower in the Nordic electricity market has significantly influenced the electricity supply structure and hence the emissions from fuel combustion during the time series. If the annual precipitation in the Nordic countries is lower than usual, hydropower will be in short supply and Finland's net imports of electricity will decrease. During such years, Finland has generated additional electricity using coal- and peat-fired power plants, resulting in higher CO_2 emissions from corresponding years. During recent years, the share of conventional condensing power in electricity generation has declined as the share of wind power has grown. In addition, the allowance price in EU ETS has risen, which is accelerating the replacement of fossil fuels with renewable energy.

Total energy consumption in 2020 amounted to 1.28 million terajoules (TJ). The trends in the energy sector driving greenhouse gas emissions are described in Section 2.6. In 2020, the energy sector's emissions were about 36 per cent below the 1990 level and half the emission level in 2003, which was the year of the greatest emissions from the energy sector between 1990 and 2020. At the end of the 1990s, total energy consumption increased, but emissions changed very little. The reasons for this were the increased use of wood fuels, nuclear energy, and net imports of electricity, which reduced the condensing power production and thus emissions. Net imports of electricity declined at the beginning of the 2000s, and energy sector emissions were at their peak in 2003. In 1990, the share of renewable energy in total energy consumption was just 18 per cent, since when it has grown steadily. The share of renewable energy sources from the final energy consumption grew to 44.6 per cent in 2020. In addition, the net import of electricity has been at a high level since 2012 (Figures 3.7 and 3.8). The increased use of renewable energy sources compared to the situation in 1990 has increasingly replaced fossil fuels and is the main reason for the decreased emissions despite the growth in energy consumption.

The ban on the use of hard coal for energy production, which will enter into force in 2029, is already decreasing coal consumption. For example, the total consumption of coal, which in addition to hard coal, includes coke and blast furnace and coke oven gas used by manufacturing, decreased by 23 per cent between 2019 and 2020. See Section 2.6 for further information on trends in energy.

Figure 3.7
Development of total energy consumption by energy source (PJ) and energy sector greenhouse gas emissions (million tonnes CO_2 eq.) in Finland, 1990 to 2020[1]

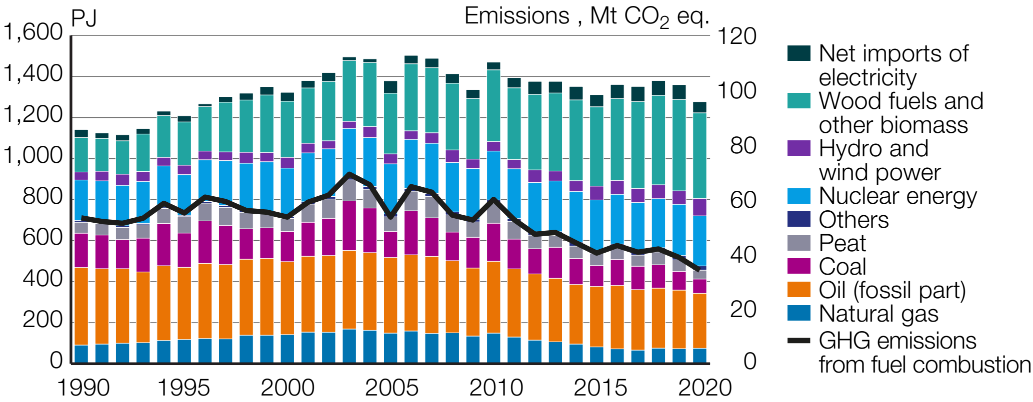
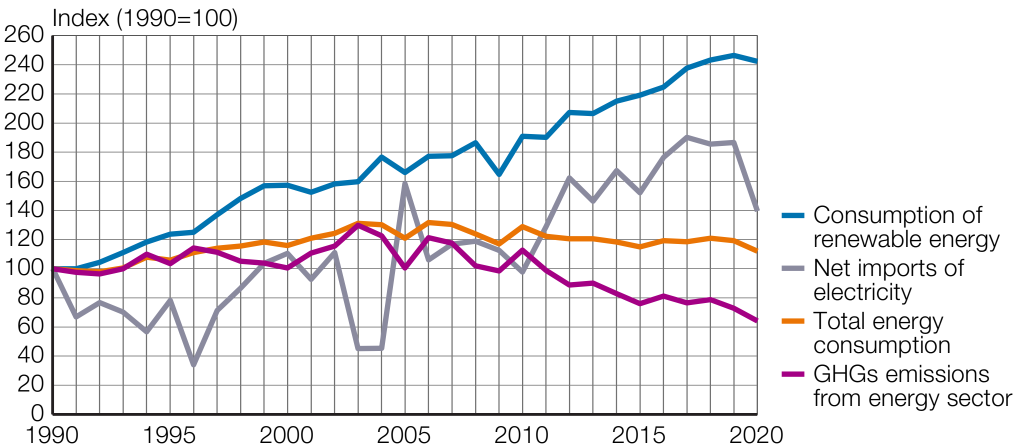


Figure 3.8
Development of the energy sector's emissions, net imports of electricity, and total and renewable energy consumption, 1990 to 2020



Transport

In 2020, the greenhouse gas emissions from transport amounted to 10.4 million tonnes CO_2 equivalent. Compared to 2019, emissions decreased by seven per cent in 2020. A decline of seven per cent in transport fuels activity data, due mainly to the Covid-19 pandemic, explains the decrease in emissions. The share

1 Coal includes hard coal and coke, blast furnace gas, coke oven gas, and until 1994, town gas.

of the transport sector of the total greenhouse gas emissions was approximately 17 per cent (12.1 million tonnes CO_2) in 1990 and 22 per cent (10.4 million tonnes CO_2) in 2020. Road transport is the most important emission source in the transport category (Figure 3.9). Road transport emissions were 9.9 million tonnes (CO_2 eq.) in 2020; this was 95 per cent of the transport emissions and 21 per cent of the total emissions.

CO_2 emissions from transport decreased considerably in the early 1990s due to the economic depression. Since 2008, emissions have fluctuated due to many simultaneous different factors, both societal and legislative. The Covid-19 pandemic since 2020 have decreased kilometrage and thus emissions as well (Figure 3.10). The fuel consumption of cars has been decreasing due to the CO_2 limits set for car manufacturers by the EU. A tax reform for cars in Finland caused a dramatic transition from petrol to diesel cars, which decreased CO_2 emissions in 2009. In the 2010s, the bioshare of diesel oil has varied annually and caused fluctuations in annual emissions. Finland's biofuel legislation allows the distributors to fulfil the bioshare obligation flexibly in advance.

Figure 3.9
Emissions from transport by subcategory (million tonnes CO_2 eq.), 1990 to 2020

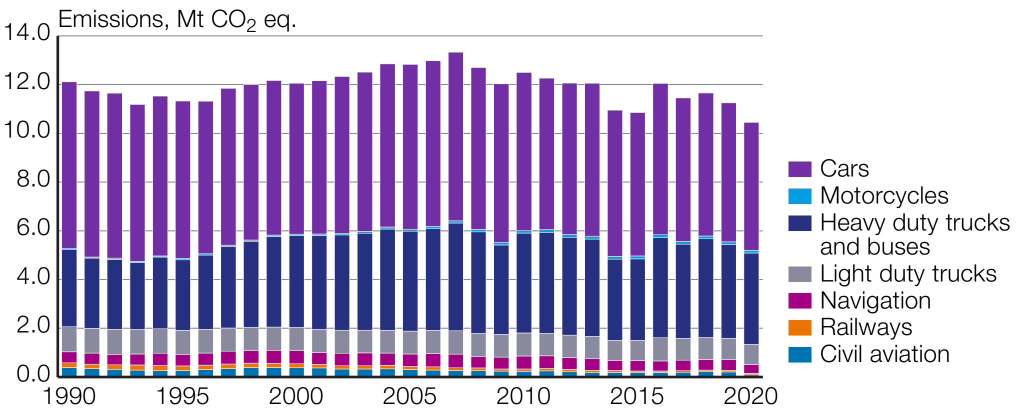
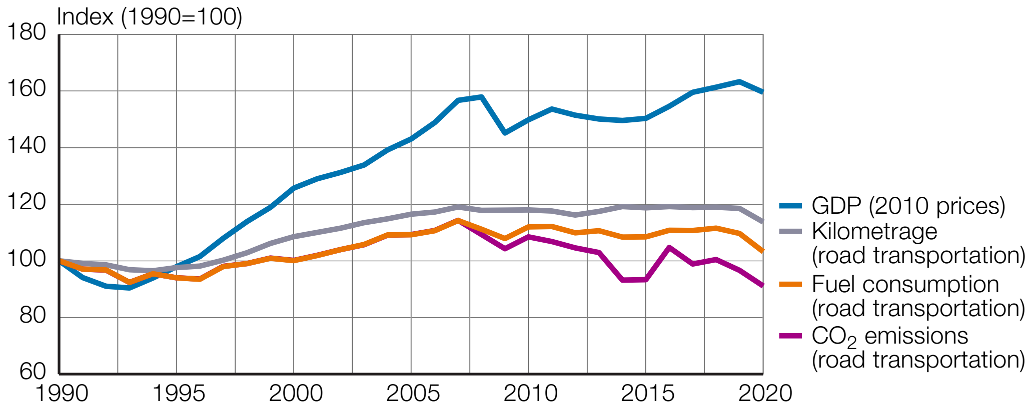


Figure 3.10
Development of GDP and fuel consumption, kilometrage and CO_2 emissions in road transport, 1990 to 2020

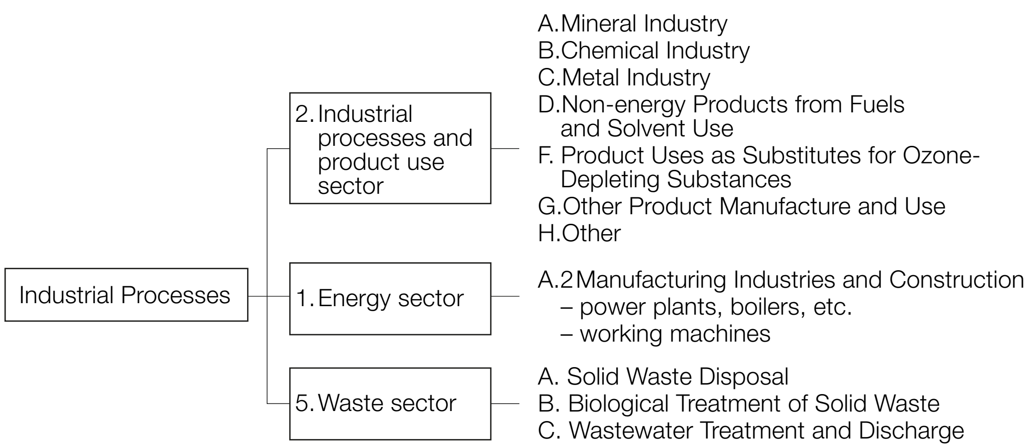


3.2.2 Industrial processes and product use

Greenhouse gas emissions from industrial processes and product use contributed 11 per cent to the total greenhouse gas emissions in Finland in 2020, totalling 5.1 million tonnes CO_2 eq. The most important greenhouse gas emission sources of industrial processes and product use in 2020 were CO_2 eq. emissions from iron and steel, hydrogen and cement production with 3.6, 1.9, and 1.2 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 in coke production in the iron and steel industry, in ethylene production (fugitive emissions) and from lubricant use. 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 as aggregated in national totals.

Fluorinated greenhouse gases, or F gases, are reported under industrial processes. They are used to replace ozone-depleting substances (ODS) in refrigeration and cooling devices, as well as in air conditioning devices and aerosols, and they accounted for 2.1 per cent of total national greenhouse gas emissions and 19 per cent of the greenhouse gas emissions of industrial processes and other product use in 2020. The reporting categories of emissions from the sources of industrial processes in the national greenhouse gas inventory are presented in Figure 3.11.

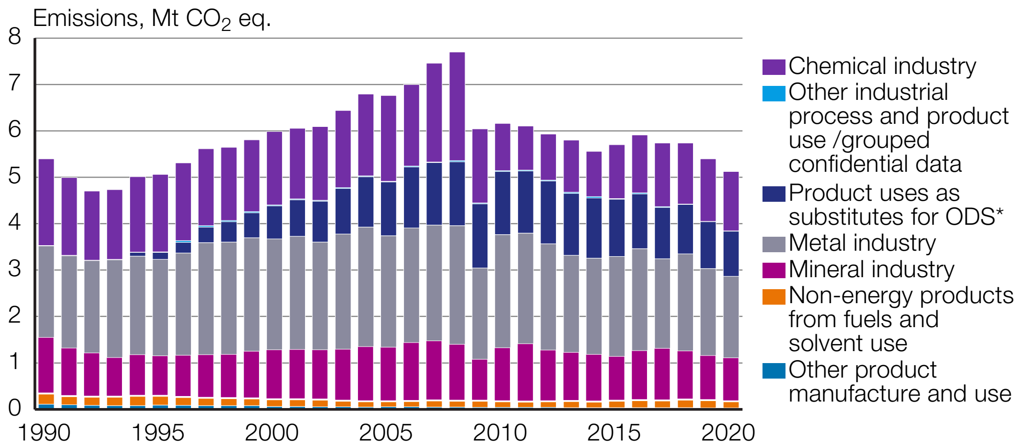
Figure 3.11
Reporting categories of emissions from industrial process sources in the national greenhouse gas inventory



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, but the implementation of technical abatement measures in nitric acid production in 2008 resulted in a significant reduction in emissions (Figure 3.12). In the period from 1990 to 2020, the largest relative change occurred in F gas emissions, which at first increased rapidly but have now begun to decrease (Figure 3.13) due to decreased leakage rates and the replacement of high-GWP HFC refrigerants with alternative low-GWP non-HFC refrigerants in many applications.

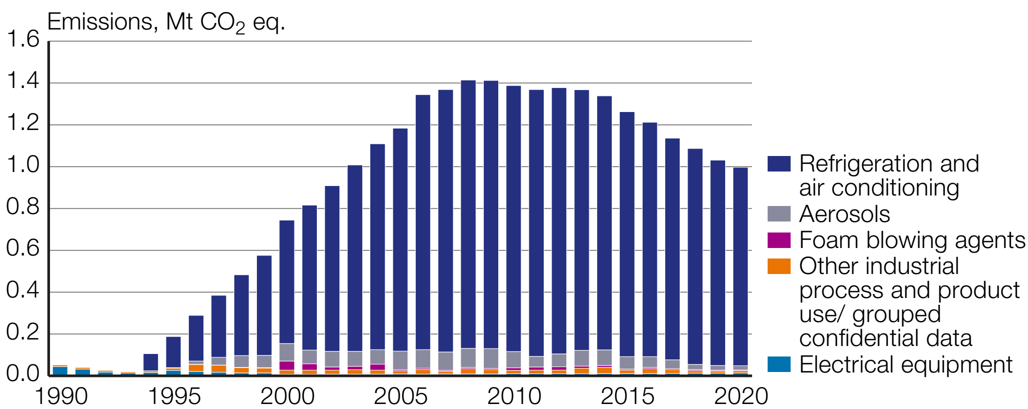
Total emissions of industrial processes and product use were five per cent (0.3 million tonnes CO_2 eq.) smaller in 2020 than in 1990. At the beginning of the time series, some production plants were closed and this caused a rapid decrease in emissions. After this, the production outputs and emissions increased and reached the level of 1990 in 1996. The increase in emissions continued until 2009, when they decreased rapidly due to the economic downturn as the demand for industrial products diminished. The implementation of N_2O abatement technology happened at the same time, which is why the emissions stayed at a lower level, even though production started to increase after the recession in 2010.

Figure 3.12
Greenhouse gas emissions from industrial processes, 1990 to 2020



* ODS= ozone-deleting substances (i.e. F gases replacing ODS)

Figure 3.13
F gas emissions, 1990 to 2020



CO_2 emissions were five per cent greater in 2020 than in 1990. The reasons are the increased production of steel and hydrogen and the use of limestone and dolomite. Methane emissions were 74 per cent lower in 2020 than in

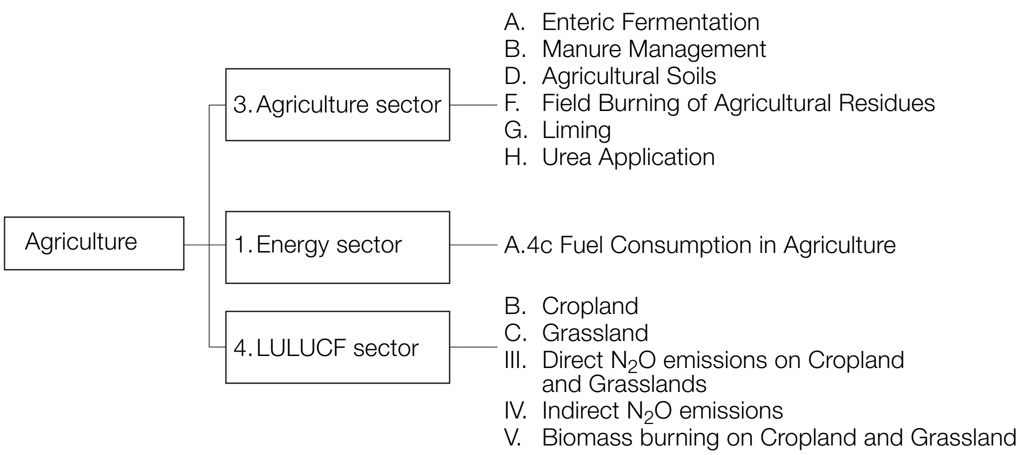
1990. Nitrous oxide emissions fluctuated between 1990 and 2020: first, there was a rapid decrease due to the closing of a nitric acid production plan; then a slow increase of emissions. The second rapid decrease that started in 2009 originated from the implementation of a new N_2O abatement technology in nitric acid production and the decreased demand of fertilisers. Since 1990, nitrous oxide emissions have decreased by 1.4 million tonnes CO_2 eq. (85 per cent). F gas emissions in 2020 were 19-fold compared to 1990.

3.2.3 Agriculture

Emissions from the agriculture sector were approximately 6.6 million tonnes CO_2 eq. in 2020. Agricultural emissions reported in the agricultural sector include methane (CH_4) emissions from the enteric fermentation of domestic livestock, manure management and crop residue burning, and nitrous oxide (N_2O) emissions from manure management and direct and indirect N_2O emissions from agricultural soils and crop residue burning. CO_2 emissions from liming and urea fertilisation are also included. Emissions from the agricultural activity are also reported in the energy and LULUCF sectors in the greenhouse gas inventory (Figure 3.14).

The agricultural sector accounted for approximately 14 per cent of Finland's total greenhouse gas emissions in 2020. In 2020, methane emissions from enteric fermentation were 32 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 54 per cent of total agricultural emissions. Liming and the application of urea comprise three per cent of emissions; the share of field burning of agricultural crop residues totals 0.03 per cent.

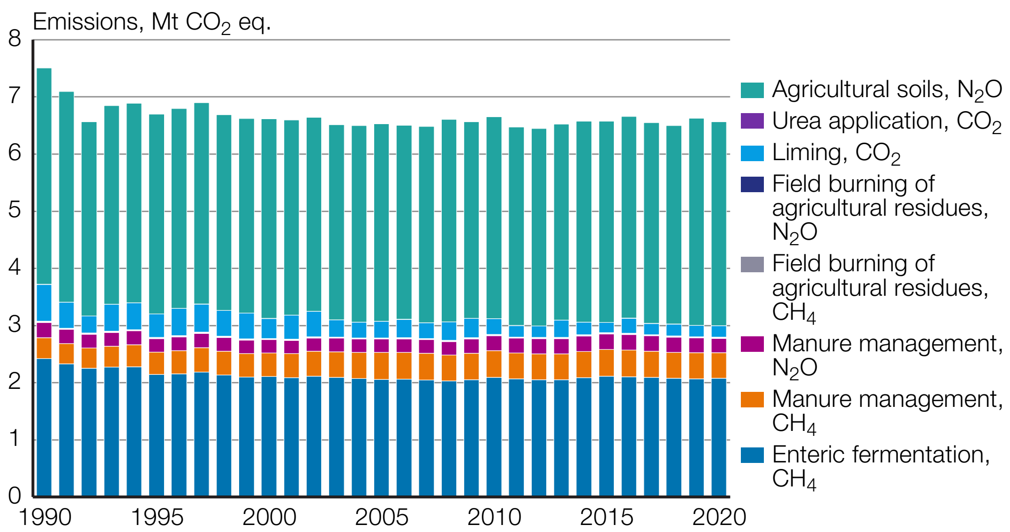
Figure 3.14
Agricultural sources of emissions and their reporting in the CRF categories in the national greenhouse gas inventory



Cattle generate most of the CH_4 emissions from enteric fermentation, 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 decreased by about 13 per cent during the 1990 to 2020 period (Figure 3.15). The most important factor behind the decrease is a reduction in the use of synthetic nitrogen fertilisers of 39 per cent between 1990 and 2020, which significantly reduced greenhouse gas emissions. Total N_2O emissions from agricultural soils were six per cent lower in 2020 than the 1990 level. The area of cultivated organic soils increased during the 1990 to 2020 period, which has also seen increased nitrous oxide emissions from agricultural soils. The decrease in CO_2 emissions from liming due to reduced use of lime is also significant.

Figure 3.15
Greenhouse gas emissions from agriculture, 1990 to 2020*



* Field burning of agricultural residues and urea application are not discernible, because their emissions range from 0.001 to 0.005 million tonnes each.

Since 1995, EU membership has resulted in changes in the economic structure of agriculture in Finland. The number of farms has decreased, average farm size has increased, and livestock numbers have decreased. For example, the number of cattle declined by more than a third between 1995 and 2020. The decline has slowed down over the last ten years. The decrease in cattle numbers over the time series has been counterbalanced by an increase in emission factors for enteric fermentation due to increased animal weights, growth and milk production. Emissions from enteric fermentation were 14 per cent lower in 2020 than in 1990.

Total emissions from manure management increased by 10 per cent between 1990 and 2020. The fluctuation in the emissions from manure management is related to both changes in animal numbers, which depend largely on agricultural policy, and changes in the distribution of the manure management systems. Direct nitrous oxide emissions from manure management first decreased and then increased in the time series. Cattle numbers have decreased, which explains the decreasing trend in manure management. However, nitrogen excretion figures increased over time for many animals, including cattle. The share of cattle slurry with a crust has also increased over time, increasing direct emissions from slurry. Methane emissions from manure management have increased by 21 per cent since 1990. This is due to an increase in the number of animals kept in slurry-based systems.

Some inter-annual variability can be detected in agricultural sector emissions. This is mainly caused by fluctuations in activity data between years due to changes in animal numbers and in the manufacture and import of lime for agriculture. Changes in animal numbers are largely affected by agricultural policy and subsidies, and they particularly affect methane and nitrous oxide emissions from manure management. Emissions from manure management are also affected by the distribution of manure managed in different manure management systems, which varies depending on the animal species. Nitrous oxide emissions from managed soils are affected by the quantity of synthetic fertilisers used annually, animal numbers and crop yields of cultivated crops, for example, which may have a large variation between years.

3.2.4 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 various sources are reported in this sector, including 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 fertilisation of forest land and N_2O emissions resulting from loss of soil organic matter. Emissions and removals are not reported for unmanaged wetlands and other land.

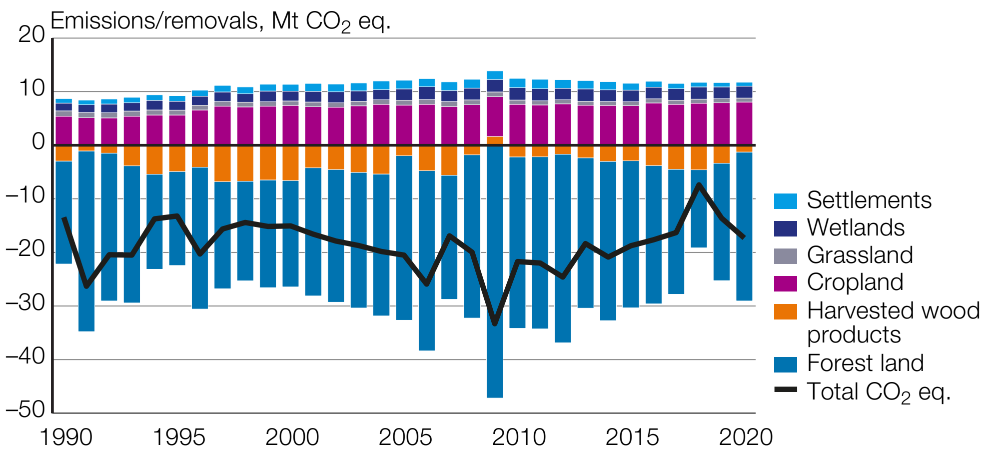
In 2020, the LULUCF sector as a whole acted as a CO_2 sink for –17.3 million tonnes CO_2 eq. This sum of removals and emissions, i.e. carbon stock changes and greenhouse gas emissions, in 2020 was 29 per cent larger than it was in 1990. For forest land, the largest sink was tree biomass, with –27.8 million tonnes CO_2 of net removals in 2020. Mineral soils on forest land were a sink of –5.2 million tonnes of CO_2, whereas organic forest soils were a source of 3.8 million tonnes of CO_2. Other emission sources in the forest land category are methane and nitrogen oxide emission from drained organic forest lands (2.6 million tonnes CO_2 eq.), nitrogen fertilisation (0.04 million tonnes CO_2

eq.) and biomass burning in forest fires and in controlled burning (0.004 million tonnes CO_2 eq. in 2020).

The high fluctuation in net biomass removals in the forest land category during the 1990 to 2020 period is mainly caused by the changes in the international market for forest industry products, which affects the amount of domestic commercial roundwood felling. In 2018, total roundwood removals reached 78 million m^3, the highest in statistical history. Roundwood removals in 2020, 69 million m^3, remained at a high level compared to the historical levels. The other significant factor affecting the trend in forest land sink is the increase in the annual volume increment. Forest growth has increased steadily since 1990 because of factors such as the large proportion of young forest at a strong growth phase and silvicultural measures. The annual growing stock increment was 77.7 million m^3, based on the 8th National Forest Inventory (NFI) (measured 1986 to 1994) and 107.8 million m^3, based on the NFI12 (2014 to 2018). The rapid increase in the increment in the 1980s and 1990s has levelled out according to the last inventory measurements. (See Section 3.1 on the latest results from the national forest inventory).

Although the LULUCF sector has been a significant net carbon sink, it 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 fertilisation of forests. The trend in emissions and removals from the different land-use categories and Harvested Wood Products pool reported in the LULUCF sector is presented in Figure 3.16.

Figure 3.16
Net emissions and removals in the LULUCF sector by land-use category and harvested wood products pool, million tonnes CO_2 eq.



Harvested wood products

The Harvested Wood Products (HWP) pool was a net sink of 1.3 million tonnes of CO_2 in 2020. HWP has been a net sink for the whole reported time series, except in 2009. The annual fluctuations in the time series are generally due to changes in the economic situation and the demand for wood products. Factors behind the HWP carbon stock changes in 2020, such as strikes, the closure of some paper machines and decreased demand for harvested wood products because of the Covid-19 pandemic are described in more detail in Finland's National Inventory Report 2022 to the UNFCCC.

HWP is reported as a carbon stock change in production-based HWP stocks originating from wood harvested in Finland divided into two categories: HWP produced and consumed domestically; and HWP produced and exported. HWP comprises 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 purposes other than paper and paperboard started mainly in 2012. The annual change of HWP in domestic solid waste disposal sites (SWDS) is not calculated.

3.2.5 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 afforestation/reforestation (AR) and deforestation (D) activities, and under Article 3, paragraph 4, from forest management (FM). The 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 for the second commitment period, as was the case in the first commitment period.

Net emissions from Article 3.3 activities, i.e. afforestation, reforestation, and deforestation, were 2.8 million tonnes of CO_2 eq. in 2020. Afforestation and reforestation resulted in a net removal of 0.6 million tonnes of CO_2 eq., while deforestation produced a net emission of 3.4 million tonnes of CO_2 eq. The area subject to AR was approximately 212,000 ha at the end of 2020. The area deforested was approximately 473,000 ha, of which 2,300 ha has been reforested.

Net removals as a result of forest management under Article 3.4 were 34.8 million tonnes of CO_2 eq. in 2020, 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.

Table 3.1

Summary of emissions (+) and removals (–) in tonnes CO_2 eq for 2013 to 2020 relevant for accounting under the second commitment period of the Kyoto Protocol*

	2013	2014	2015	2016	2017	2018	2019	2020	2013–2020
Finland's assigned amount for the second commitment period	**240,544,599**								
Total national emissions	62,784,046	58,602,565	55,025,810	57,923,441	55,109,448	56,178,737	52,788,022	47,782,251	
ETS emissions without aviation	31,365,840	28,653,801	25,371,154	27,147,677	25,058,970	26,169,997	23,241,865	19,576,138	
CO_2 emissions from aviation	180,143	181,754	178,920	181,827	189,505	210,353	205,701	86,017	
Non-ETS emissions[1)]	**31,238,063**	**29,767,010**	**29,475,736**	**30,593,937**	**29,860,973**	**29,798,387**	**29,340,456**	**28,120,096**	
Non-ETS emissions as cumulative percentage of the assigned amount	**13%**	**25%**	**38%**	**50%**	**63%**	**75%**	**87%**	**99%**	
Sum of Non-ETS emissions 2013–2019									**238,194,658**
Article 3.3 net emissions to be subtracted from the assigned amount[2)]	**3,587,485**	**3,337,762**	**3,359,836**	**3,210,995**	**3,065,656**	**3,018,433**	**3,474,088**	**2,809,177**	
Sum of Article 3.3 net emissions 2013–2019, to be subtracted from the assigned amount									**25,863,432**
Article 3.4 net removals (Forest Management, FM)	–47,335,049	–46,089,720	–41,400,742	–38,782,812	–35,735,041	–26,169,406	–31,938,319	–34,799,603	
Finland's FMRL[3)] (annual reference)	–20,466,000	–20,466,000	–20,466,000	–20,466,000	–20,466,000	–20,466,000	–20,466,000	–20,466,000	
Technical correction to the FMRL	–9,198,000	–9,198,000	–9,198,000	–9,198,000	–9,198,000	–9,198,000	–9,198,000	–9,198,000	
FM net removals minus FMRL and its technical correction	–17,671,049	–16,425,720	–11,736,742	–9,118,812	–6,071,041	3,494,594	–2,274,319	–5,135,603	
Sum of FM net removals minus FMRL and its technical correction 2013–2019									–64,938,691
FM cap[4)]									–19,978,041
Estimate of net addition to the assigned amount from Article 3.4[2)] for the entire commitment period									**19,978,041**

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) FMRL= Forest Management Reference Level

4) FM cap is –19,978,041 tonnes CO_2 eq for the whole second commitment period.

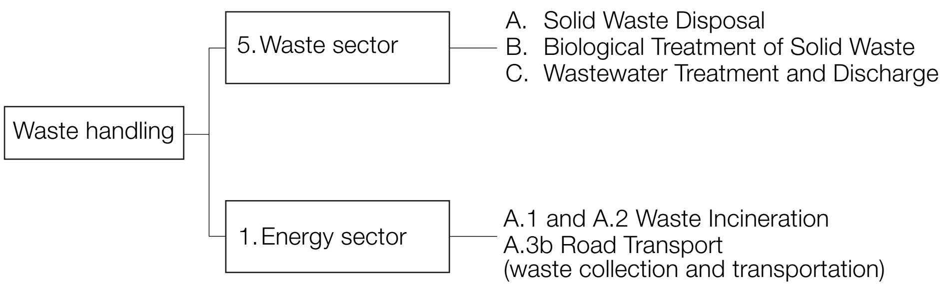
* Table does not include AAU units from the previous commitment period or CER and ERU units from the use of market-based Kyoto mechanisms that could be used to fulfill the commitment for the second commitment period.

The emissions and removals from ARD land vary between 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 felling, which has a direct impact on the quantity of the biomass sink. In addition, the changes in soil carbon stock vary according to the variation in the carbon stocks of living biomass, as well as in the amount of carbon in logging residue inputs.

3.2.6 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 3.17). 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 1.7 million tonnes CO_2 eq. in 2020, which accounts for approximately four per cent of Finland's total emissions.

Figure 3.17
Reporting categories of emissions from waste handling in the national greenhouse gas inventory

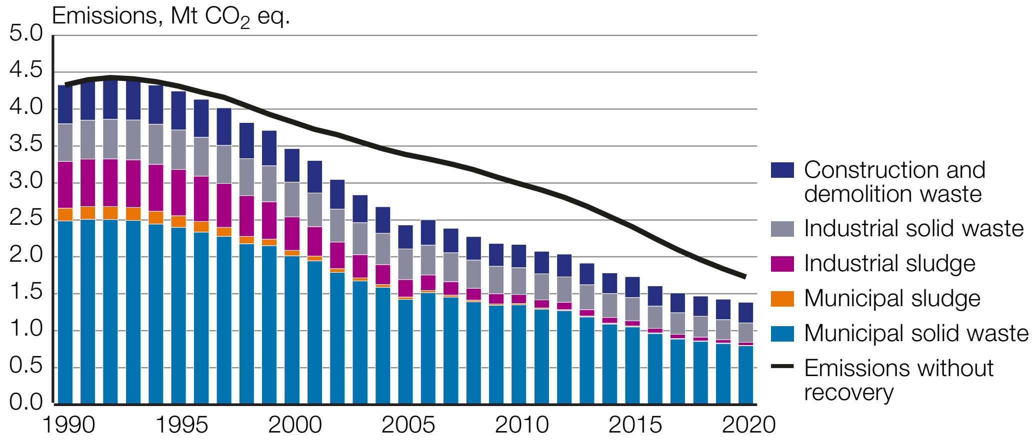


CH_4 emissions from landfills are the most important greenhouse gas emissions in the waste sector. Solid waste disposal on land contributes 80 per cent, wastewater treatment about 14 per cent and biological treatment (composting and anaerobic digestion) seven per cent of the sector's total emissions. Compared to 2019, emissions decreased by three per cent in 2020, and since 1990, these emissions have decreased by 63 per cent. A new Waste Act[2] entered into force in 1994, which has led to a reduction in methane emissions from landfill sites (Figure 3.18). The Waste Act has reduced the volume of waste deposited at landfills by promoting recycling and reuse, as well as the energy use of waste materials. The great increase in the amounts of recovered methane at the beginning of 2000 is a result of the regulations of landfill gas recovery (Council of State Decree on Landfills[3]). The amount of recovered methane in recent years has decreased due to the great decrease in the waste amounts to landfills after the ban of organic waste deposits at landfills. The recession of the early 1990s also reduced consumption and waste volumes.

2 1072/1993

3 861/1997

Figure 3.18
Methane emissions from solid waste disposal on land. The figure also shows the amount of methane generated (emission without recovery) at solid waste disposal sites



Emissions from wastewater treatment have also been successfully reduced by 20 per cent compared with 1990. For example, the reduction in emissions has been affected by the increasingly efficient treatment of wastewater (also in sparsely populated areas), as well as a lower nitrogen burden released from industrial wastewaters into waterbodies. Emissions from composting have more than doubled since 1990, being six per cent of the waste sector's emissions in 2020. The reason is the 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 for the same reason as the increase in emissions from composting. Yet this emission source is very small, being 0.6 per cent of the waste sector's emissions in 2020.

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.[4]

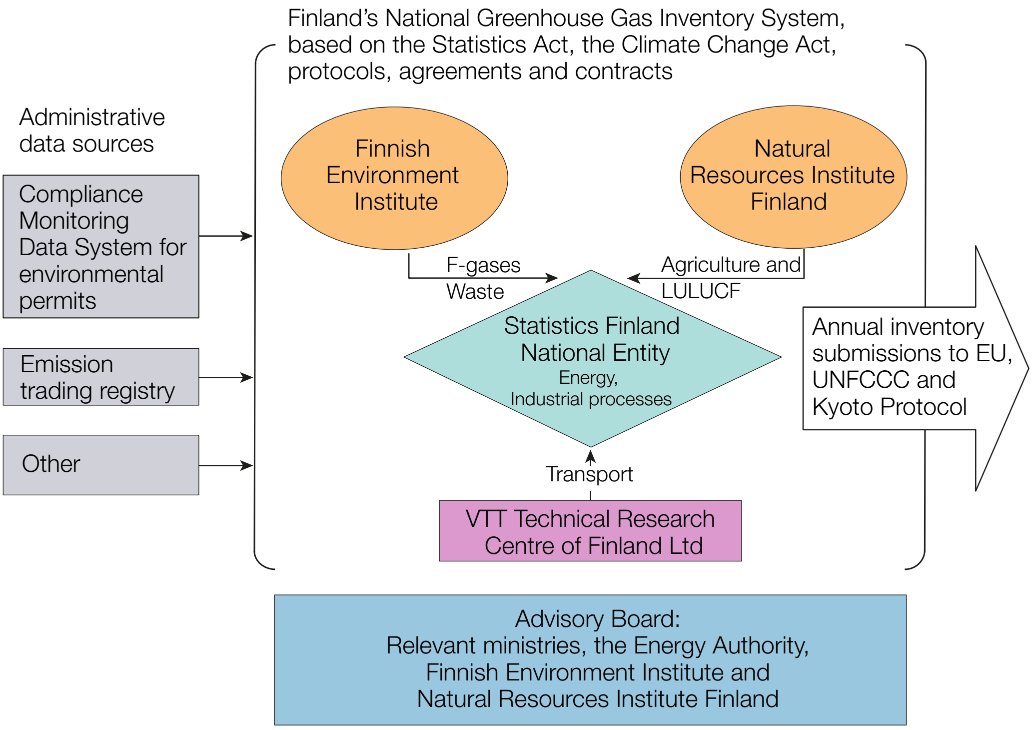
In Finland, the national system is established on a permanent footing, and it guides the development of emissions calculation in the manner required by the Kyoto Protocol. The national system is based on laws and regulations concerning Statistics Finland, agreements between the inventory unit and

4 609/2015 and 423/2022

expert organisations on the production of emission and removal estimates and related documentation. Statistics Finland also has agreements on cooperation and support for 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 3.19.

The contact person for the national entity and its designated representative with overall responsibility for the national inventory at Statistics Finland is Ms Pia Forsell, FI-00022 Statistics Finland, tel. +358-29-551 2937, email pia.forsell@stat.fi

Figure 3.19
The National System for the Greenhouse Gas Inventory in Finland



Statistics Finland as the national entity for the inventory

In Statistics Finland's activity as the national entity for the greenhouse gas inventory, the Statistics Finland Act[5] and the Statistics Act[6] are applied.

Statistics Finland defines the placement of the inventory functions in its working order. The advisory board of the greenhouse gas inventory established by Statistics Finland ensures collaboration and information exchange in issues

5 48/1992 and its amendment 901/2002
6 280/2004 and its amendment 361/2013

related to the reporting of greenhouse gas emissions under the UNFCCC and the Kyoto Protocol. 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 projects related to the development of the inventory and reporting. It also 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 oversees 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, the regulation on fluorinated gases, the European Pollutant Release and Transfer Register (E-PRTR) 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 E-PRTR and data collected under the regulation on fluorinated greenhouse gases play 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 comment.

Responsibilities of the expert organisations

In addition to Statistics Finland, Finland's inventory system includes the Finnish Environment Institute and Natural Resources Institute Finland (Luke) expert organisations. Statistics Finland also acquires parts of the inventory as purchased services from VTT (VTT Technical Research Centre of Finland Ltd).

Table 3.2
Responsibility areas by expert organisation

Area		Organisations
CRF 1.A.	Stationary sources 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 (SYKE)
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 (SYKE)
Indirect CO_2	Non-methane volatile organic compounds, NMVOC	Finnish Environment Institute (SYKE)
KP(LULUCF)	Activities under Article 3, paragraphs 3 and 4 of the Kyoto Protocol (ARD and FM)	Natural Resources Institute Finland (Luke)

Until 2009, Finavia (formerly the Civil Aviation Administration) provided emission data on aviation to the inventory. In 2010, Finavia's status in Finland's inventory system changed. Finavia is no longer performing the calculations. Statistics Finland has taken over 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 for estimating and reporting 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 inventory's QA/QC and verification process.

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 the data collected in the management of public administration duties in their administrative branch so that they can be used in the emission inventory.

In accordance with the Government resolution, the ministries produce the data 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 also 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 and supervises the monitoring and reporting of the emission data under the European Emissions Trading System (EU ETS) and international emissions trading under the Kyoto Protocol. Statistics Finland and the Energy Authority concluded an agreement in 2006 on collaboration between the national inventory system and registry, including a division of the responsibilities related to reporting. The most recent update to the agreement was made in 2018.

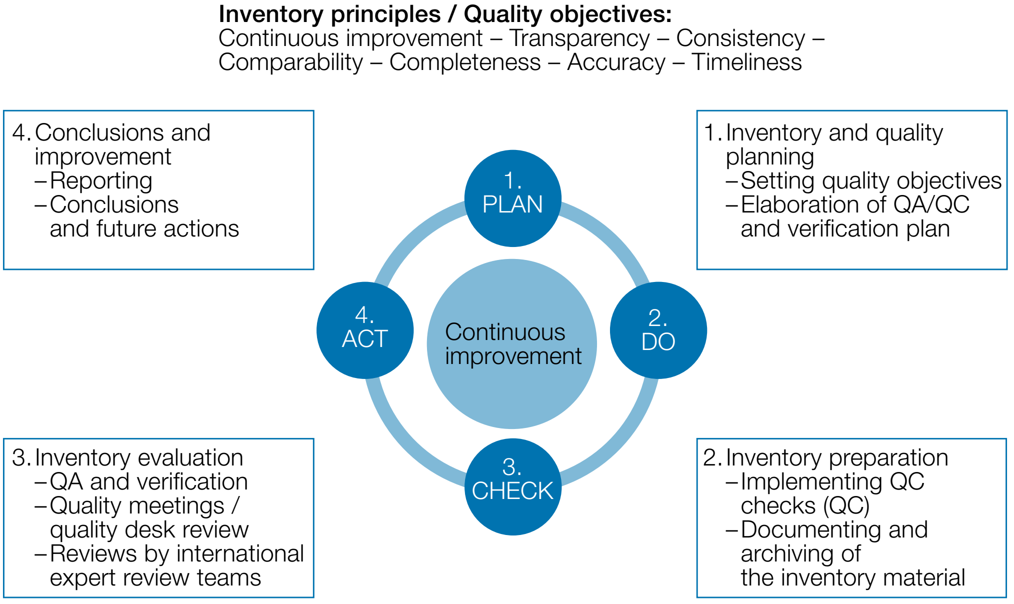
The Energy Authority provides the necessary information on emission reduction units, certified emission reductions, temporary certified emission reductions, long-term certified emission reductions and assigned amount units and removals units for annual inventory submissions in accordance with the guidelines 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 on the website of the Energy Authority.

3.3.2 Annual inventory process

The annual inventory process set out in Figure 3.20 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.

Figure 3.20
Inventory and QA/QC process of the inventory



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 are 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 YLVA, 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 conducts a Tier 2 key category analysis annually prior to submitting inventory information to the EC. The Tier 2 methodology uses category-specific uncertainty analyses. The analysis covers all the sources and sinks of the inventory.

The key category analysis functions as a screening exercise. The result is a shortlist (20+) of the subcategories that are the most important in terms of the 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 to 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 to implement methodological improvements in the inventory, including changes in activity data and emission factors, or to include new source or sink categories within the inventory or to correct identified errors, omissions, overlaps, or inconsistencies within the time series.

Greenhouse gas inventory recalculations are based on an annual evaluation of the inventory's preparation and improvement needs, 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 and approved by the inventory unit at Statistics Finland before being implemented.

Any changes made are documented in the CRF 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 articles in scientific journals and presentations at various national workshops and seminars, for example. Some of the research results have also been used by the IPCC in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the IPCC Emission Factor Database, the '2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands' and '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories', for example.

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 3.20). 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 (Plan-Do-Check-Act (PDCA) cycle) and aims for 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 its replication where necessary.

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. In addition, a schedule of the coming inventory round is prepared and presented to the expert organisations. The timetable includes deadlines for QC checks of the inventory compilation and draft meeting schedules of the inventory working group and advisory board.

The setting of quality objectives is based on the inventory principles. Quality objectives (Table 3.3) are specified statements about the quality level that is aimed at the inventory preparation regarding the inventory principles.

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 the 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 the emission sources, sinks, gases and geographic areas
6. Accuracy
6.1. Emissions and removals are not systematically over- or underestimated
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

The objectives aim to be appropriate and realistic considering 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 to attain the quality objectives and provide confidence in the Finnish national system's capability of delivering high-quality inventories. The QA/QC plan is written in Finnish and updated annually. It consists of instructions and a QA/QC form. The instructions include descriptions of 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 at each stage of the inventory preparation. Sectoral experts enter into the form the QA/QC and verification procedures performed and their results. Discussions in the bilateral quality meetings or feedback given during the quality desk reviews are based on the information documented in these forms. The QA/QC plan is available in the shared workspace of the inventory and archived according to the inventory unit's archive formation plan.

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 in which significant methodological changes or data revisions have occurred.

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 are 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 which 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 its improvement. At the improvement stage of the QA/QC process, conclusions are drawn 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 being adopted in production (see also Section 3.3.2).

3.4 National registry

This section of the National Communication summarises the national registry of Finland, which is part of the Union registry. More information is included in the National Inventory Reports of Finland.

The national registry of the EU and its Member States is maintained as a single European Union registry, operated by the European Commission, Directorate-General for Climate Action, BE-1049 Brussels, Belgium. 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 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 with the new EU registry on the basis of 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 publicly 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.

The changes to the national registry of Finland 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 7th National Communication, Chapter 3.4, remains valid. Changes to the national registry since the 7th National Communication have been reported annually in Finland's National Inventory Reports to the UNFCCC.

Table 3.4
Changes to the Union registry, including changes to Finland's national registry, since publication of the NC7

Reporting item	Description
15/CMP.1 annex II.E paragraph 32.(a) Change of name or contact	No change has occurred to the administrator of the national registry of Finland, which is: Energy Authority rekisteri@energiavirasto.fi Address and phone number are available at homepage https://energiavirasto.fi/en/contact-information1 The address of the Energy Authority changed during the reported period.
15/CMP.1 annex II.E paragraph 32.(b) Change regarding cooperation arrangement	There was a change in the cooperation arrangement during the reported period as the United Kingdom of Great Britain and Northern Ireland no longer operate their registry in a consolidated manner within the Consolidated System of EU registries.
15/CMP.1 annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	The registry has been updated to version 13.5.2. Some changes were applied to the database during the reported period. No change was required to the 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 Data Exchange Standards (DES) and are carried out prior to the relevant major release of the version to Production. 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 soft tokens for authentication and signature was introduced for the registry end users during the reported period.

Reporting item	Description
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 the Finnish registry (https://ets-registry.webgate.ec.europa.eu/euregistry/FI/public/reports/publicReports.xhtml) and via the web page of the Energy Authority (https://energiavirasto.fi:8443/en/emissions-trading-registry#public_information).
15/CMP.1 annex II.E paragraph 32.(h) Change of Internet address	The registry internet address changed during the reported period. The URL is https://unionregistry.ec.europa.eu/euregistry/FI/index.xhtml.
15/CMP.1 annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(j) Change regarding test results	No change occurred during the reported period.

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