Statistics Finland

Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

Finland's Fourth Biennial Report
under the UNFCCC

20 December 2019

Contents

1 Introduction

Finland's fourth biennial report (BR4) under the UNFCCC has been elaborated in accordance with the UNFCCC biennial reporting guidelines for developed country Parties contained in Decision 2/CP.17 (Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, Document: FCCC/CP/2011/9/Add.1) as adopted by the Conference of the Parties at its seventeenth session. The additional requirements for reporting of financial information in biennial reports in Decision 9/CP.21 have also been taken into account.

Information provided on greenhouse gas emissions and trends is consistent with the information in Finland's greenhouse gas inventory submission in 2019[1].

The EU and its Member States are committed to a joint quantified economy-wide emission reduction target of 20 per cent by 2020, compared to 1990 levels. Therefore, Finland and other Member States of the EU, have not submitted individual economy-wide emission reduction targets to the UNFCCC secretariat. The details of the EU joint target under the UNFCCC are clarified in the document *Additional information relating to the quantified economy-wide emission reduction targets contained in document FCCC/SB/2011/INF.1/Rev.1* (FCCC/AWGLCA/2012/MISC.1) and in the EU's fourth biennial report under the UNFCCC, which also addresses progress in meeting the joint target.

This biennial report provides information on progress made in relation to Finland's contribution to the joint EU quantified economy-wide emission reduction target, including information on the target, Finland's historical emissions and projected emissions.

Furthermore, the report includes information on Finland's provision of financial, technological and capacity-building support to Parties not included in Annex I to the Convention.

The information to be reported electronically in the Common Tabular Format (CTF) in accordance with Decision 19/CP.18 adopted by the Conference of the Parties on its eighteenth session and contained in the document FCCC/CP/2012/8/Add.3, and Decision 9/CP.21, has been submitted to the UNFCCC using the CTF application.

[1] Finland's 2019 greenhouse gas inventory submission under the UNFCCC, https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019

2 Information on greenhouse gas emissions and trends

This section of Finland's biennial report under the UNFCCC contains summary information on the national greenhouse gas emissions and emission trends in accordance with the UNFCCC Annex I reporting guidelines[2]. The information is consistent with Finland's most recent annual inventory submission to the UNFCCC where more detailed information on the greenhouse gas emissions and their estimation can be found. Information on the greenhouse gas emissions and removals in the land use, land-use change and forestry (LULUCF) sector is also provided, even if this sector is not included in the EU joint target under the Convention.

Also, summary information on the national inventory arrangements in accordance with the UNFCCC Annex I inventory reporting guidelines is included, as well as changes to these arrangements since Finland's Third Biennial Report (BR3) under the UNFCCC.

2.1 Total greenhouse gas emissions and trends

The greenhouse gas emissions trends for the period 1990 to 2017 by gas and by sector are presented in CTF Table 1. In 2017, Finland's greenhouse gas emissions totalled 55.4 million tonnes of carbon dioxide equivalent (million tonnes CO_2 eq.). The total emissions in 2017 were approximately 22 per cent (15.9 million tonnes) below the 1990 emissions level. Compared to 2016, the emissions decreased by approximately five per cent (2.7 million tonnes). The emission trends by sector are presented in Figure 2.1 and described in detail in Section 2.2.

Statistics Finland also published instant preliminary data on the greenhouse gas emissions for 2018 in May 2019[3]. The total emissions of greenhouse gases in 2018 corresponded with 56.5 million tonnes of CO_2 eq. Emissions grew by two per cent compared with the previous year but were still 21 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 2017) are presented and used as the basis for the documentation and conclusions in all chapters in this biennial report.

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 2017, the energy sector accounted for 74 per cent of Finland's total greenhouse gas emissions (Figure 2.2). 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 three 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 per cent of the total greenhouse gas emissions in Finland.

[2] 'Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories'. Decision 24/CP.19. (FCCC/CP/2013/10/Add.3).

[3] http://www.stat.fi/til/khki/2018/khki_2018_2019-05-23_tie_001_en.html

Figure 2.1 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.

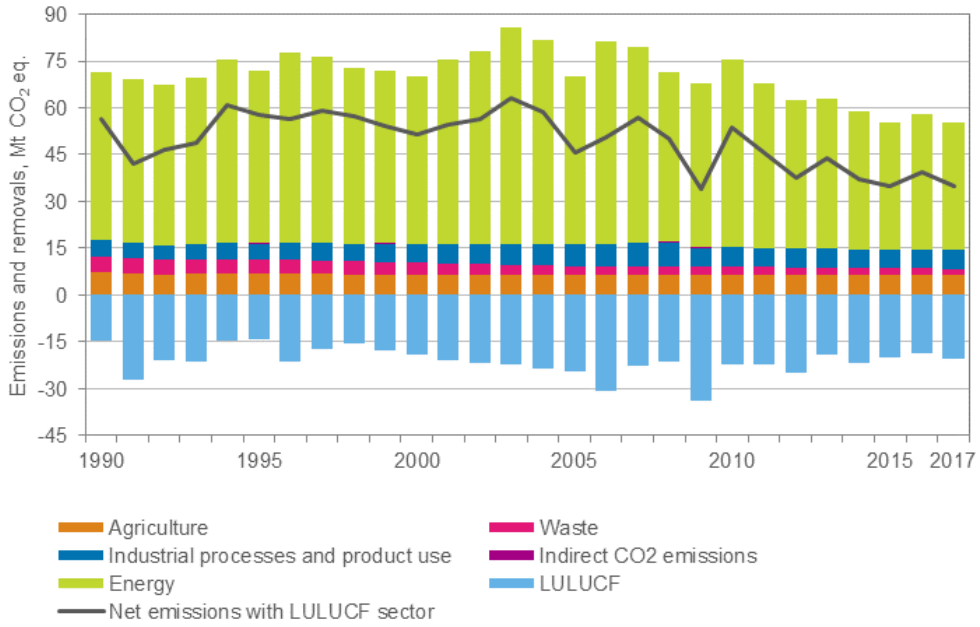
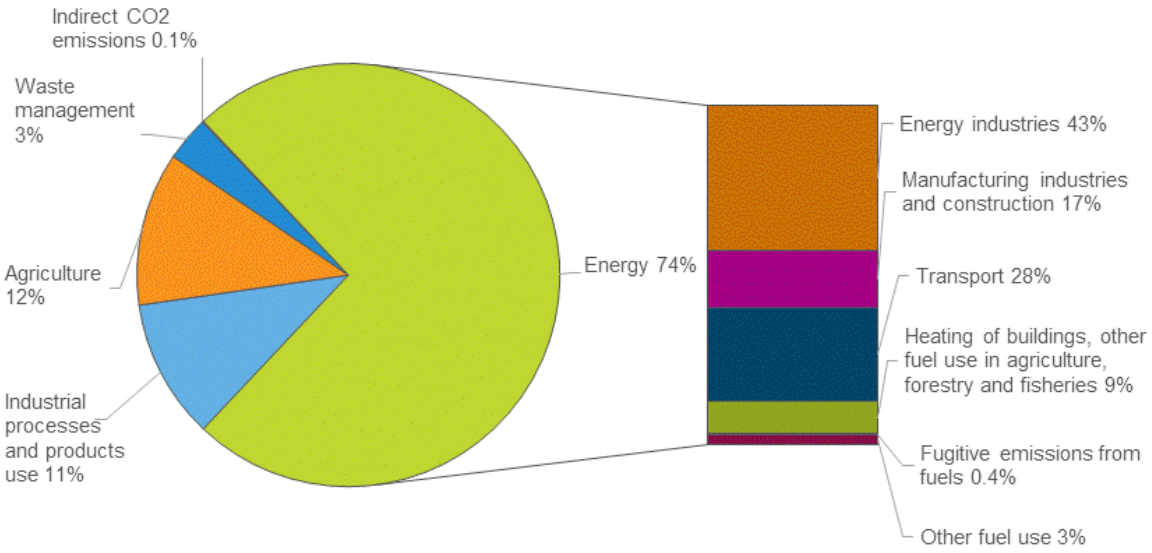


Figure 2.2 Finland's greenhouse gas emissions by sector in 2017 (LULUCF sector excluded). Due to independent rounding, the sums do not add up.



The land use, land-use change and forestry (LULUCF) sector is a net sink in Finland. The net sink has varied from approximately 19 to 50 per cent of the total annual emissions from other sectors during 1990 to 2017. Forests (trees and soil) absorb a significant proportion of Finland's carbon dioxide emissions. 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 107 million m^3. There is less fluctuation in the growth than in the harvest rates between years. In 2017, the total drain was 87 million m^3.

The most important greenhouse gas in Finland is carbon dioxide (CO_2). 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

12.4 million tonnes (i.e. 22 per cent) since 1990. Around 90 per cent of all CO_2 emissions originated from the energy sector in 2017 due to 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.

Methane emissions (CH_4) have decreased by 41 per cent from the 1990 level. This is mainly due to the improvements in the waste sector and a contraction in animal husbandry in the agricultural sector.

Correspondingly, emissions of nitrous oxide (N_2O) have also decreased by 26 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.

The emissions of F gases have increased nearly 27-fold during 1990 to 2013. A key driver behind the trend has been the substitution of ozone depleting substances (ODS) by F gases in many applications. Since then F gas emissions have started to decline due to restrictions on the use of high GWP refrigerants

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 2.3).

The trend in greenhouse gas emissions relative to Finland's gross domestic product (GDP) has been declining (Figure 2.4), although annual variations have been large. In the early 1990s, the GHG/GDP ratio rose almost 13 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 2017, the GHG /GDP ratio was more than 50 per cent below the 1990 level, indicating that the greenhouse gas intensity of the economy has decreased.

Figure 2.3 Relative development of greenhouse gas emissions by main category relative to the 1990 level (1990=100%)

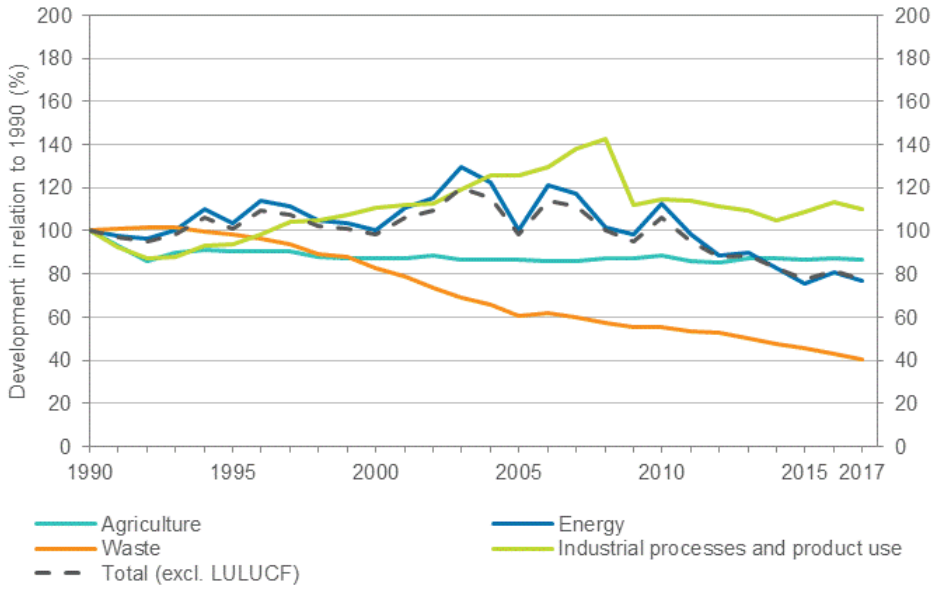
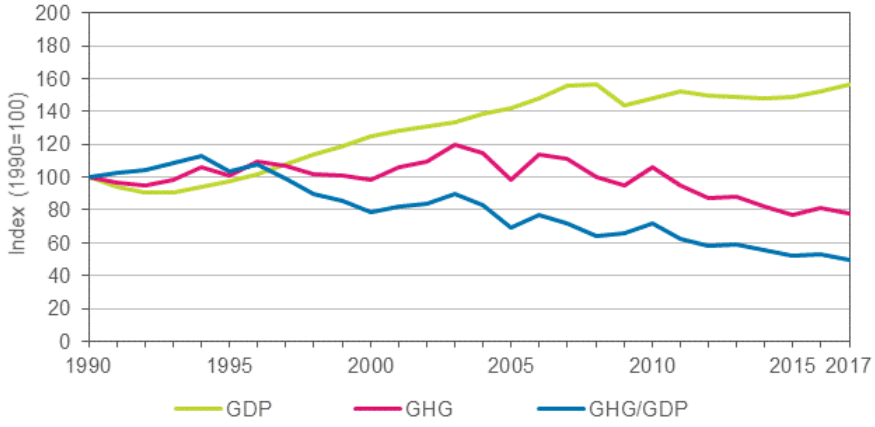


Figure 2.4 Greenhouse gas emissions relative to GDP (2010 prices), 1990 to 2017, excluding the LULUCF sector (Index, 1990 = 100)



2.2 Greenhouse gas emissions by sector

2.2.1 Energy

Similarly to other industrialised countries, Finland's main source of greenhouse gas emissions is the energy sector. In 2017, the sector (including Transport) contributed 74 per cent to total national emissions, totalling 41.0 million tonnes of carbon dioxide equivalent (Figure 2.5). 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, as well as the energy consumed for transport in this relatively large and sparsely inhabited country. Fugitive emissions make up only 0.4 per cent of the total emissions of the sector.

Energy-related emissions vary much from year to year, mainly following the economic trend, the structure of the energy supply and climatic conditions. The important drivers in the trend of the energy sector's greenhouse emissions have been the changes in the level of annually imported electricity and fossil fuel-based condensing power in annual energy production as well as the growth in the consumption of renewable energy (Figure 2.6 and Figure 2.7).

In 2017, the energy sector's emissions were about 23 per cent below the 1990 level (Figure 2.5). At the end of 1990s total energy consumption increased but emissions changed very little. The reasons for that were increased use of wood fuels, nuclear energy and net imports of electricity which lowers the condensing power production and thus emissions. In the 2010s emissions from the energy sector have a declining trend which deviates from the trend of the total energy consumption (Figure 2.6). In 1990, the share of renewable energy in total energy consumption was just 18 per cent, after which it has grown steadily, growing in the 2010s clearly faster than before and being 37 per cent in 2017 (Figure 2.7 and Figure 2.8). In addition, the net import of electricity has been at high level from 2012 on. The growth in the use of renewable energy compared to the situation in 1990 has replaced fossil fuels increasingly and is the main reason for the decreased emissions despite the growth in energy consumption in the energy sector.

Figure 2.5 Greenhouse gas emissions in the energy sector, 1990 to 2017

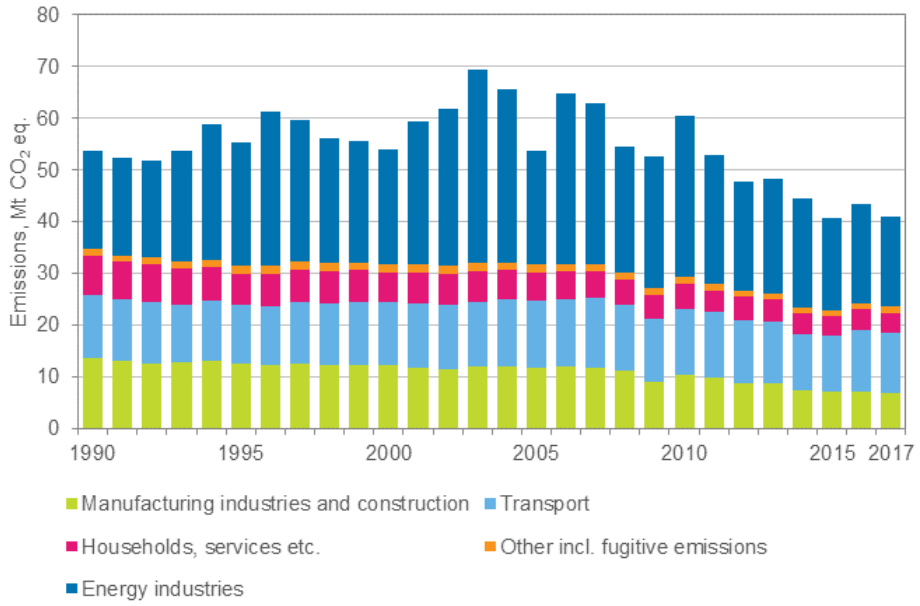
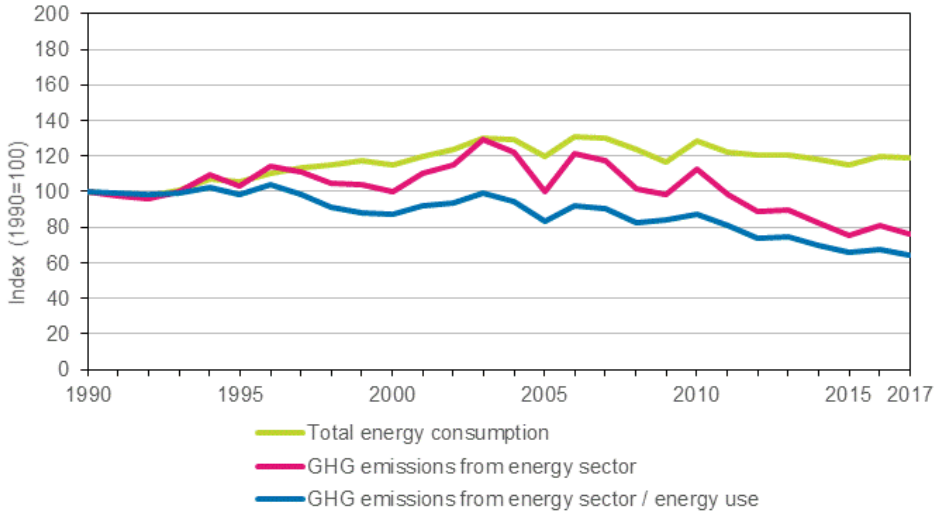


Figure 2.6 Total energy use relative to energy sector greenhouse gas emissions, 1990 to 2017



Total consumption of energy in Finland amounted to 1.35 million terajoules (TJ) in 2017, which was one percent less than in 2016 (Figure 2.7). The use of renewable energy sources grew by 6 per cent, rising to a new record level. Renewables covered 37 per cent of total energy consumption and almost 40 per cent of final energy use. Wood fuels remained the biggest energy source in Finland and their consumption has increased (Figure 2.8). The growth is based on an increase in burning by-products and wood residues, such as black liquor and bark, of the forest industry. The current consumption of roundwood by the forest industry is higher than before, meaning that more by-products are also available for energy production (Natural Resources Institute Luke 2018).

The consumption of fossil fuels declined by 6 per cent and peat by 5 per cent and their share in total energy consumption was 40 per cent. The second most used energy source after wood fuels was oil, 23 per cent of total consumption. The consumption of oil fell by 1 per cent, coal by 10 per cent and natural gas by 9 per cent from the previous year. (Energy supply and consumption, Statistics Finland).

Figure 2.7 Total energy use by energy source (PJ) and energy sector greenhouse gas emissions (million tonnes CO_2 eq.), 1990 to

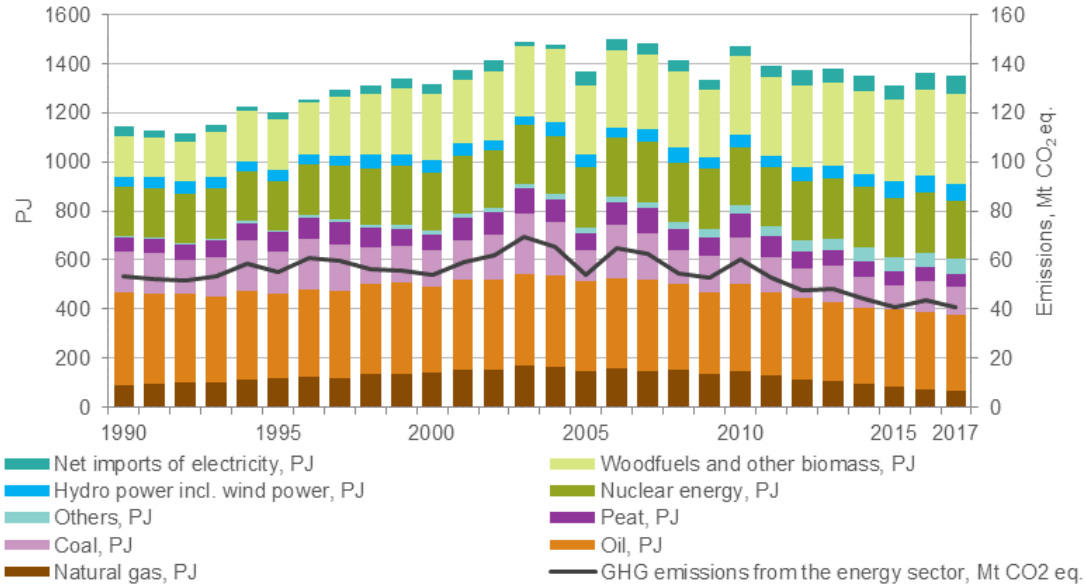
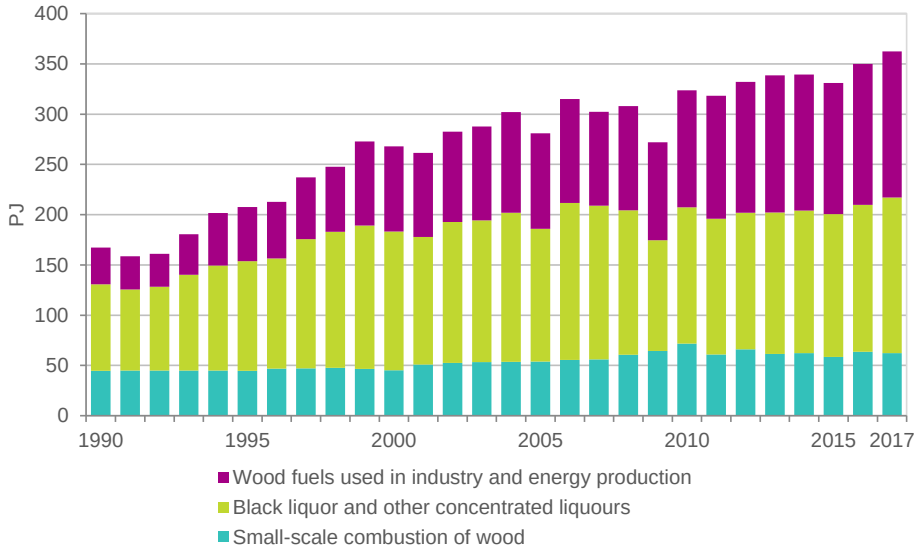


Figure 2.8 Development of energy consumption of wood fuels and other biomass in Finland (Energy Statistics)



Energy industries (mainly electricity and district heating production) caused approximately 43 per cent of the total emissions in the energy sector in 2017 (Figure 2.5). Emissions from the energy industries were 8 per cent lower in 2017 than in 2016 and 7 per cent lower than in 1990. In 2017, the production of electricity in Finland amounted to 65.0 terawatt hours (TWh), which was slightly less than in the year before. Because the consumption of electricity did not fall, reduced production was covered by net imports of electricity, which increased by 8 per cent and amounted to 20 TWh in 2017, which is more than ever before. Of total electricity consumption, 76 per cent was covered by domestic production and 24 per cent by net imports of electricity from the Nordic countries, Russia and Estonia. 32 per cent of domestic electricity production was based on combined heat and power production.

Of all electricity production, 39.7 TWh were produced with renewable energy sources. Renewable energy sources accounted for 47 per cent of electricity production. Nearly one-half of the electricity produced with renewable energy sources was produced with hydro power, 16 percent with wind power and almost all of the remainder with wood-

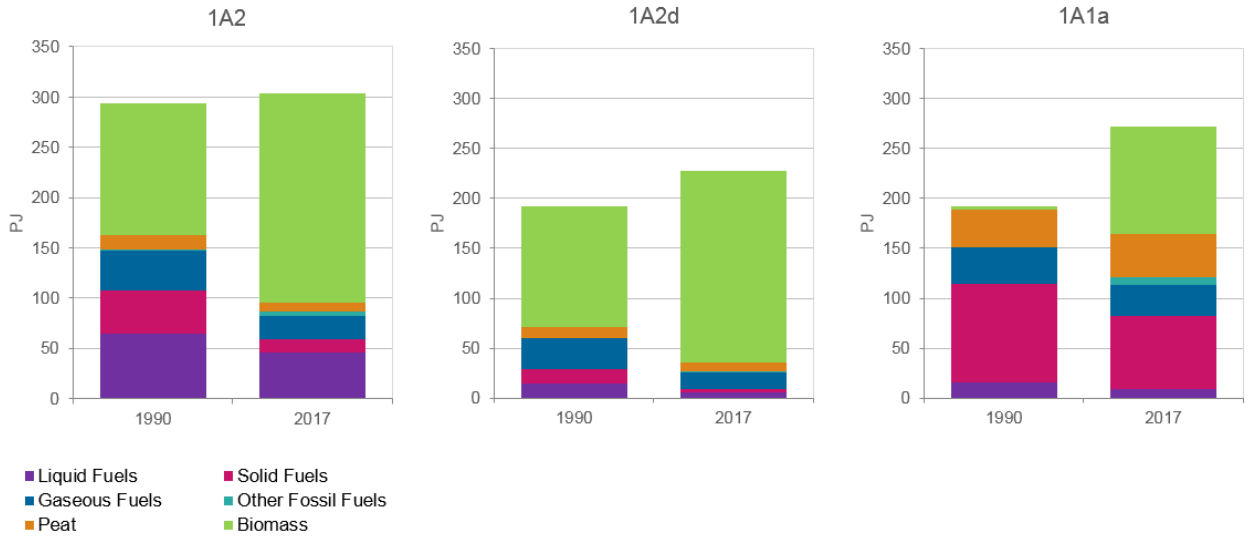
based fuels. 15 per cent of electricity was produced with fossil fuels, 4 per cent with peat and 33 per cent with nuclear power. (Production of electricity and heat, Statistics Finland).

The production of district heat totalled 38.3 TWh in 2017, being thus on level with the previous year. The use of renewable fuels in the production of district heat grew by 6 per cent from the year before. In turn, the use of fossil fuels diminished by 8 per cent. Clearly under one-half of district heat was produced with fossil fuels. Most of district heat was produced with wood fuels (33 per cent) and hard coal (23 per cent). Peat retained its position as the third most important energy source in district heat production; 14 per cent of district heat was produced with peat. Heat recovery of flue gas scrubbers has grown considerably in recent years. They produced 6 per cent of district heat in 2017.

Manufacturing industries and construction produce much energy for their own use. Their share of energy-related emissions was around 17 per cent in 2017 (Figure 2.5). Emissions from manufacturing industries and construction have declined by 50 per cent since 1990. The main reasons behind this trend are increased use of biofuels in the forest industry and outsourcing of power plants from industry to the energy sector. Fuel switch from fossil to biomass can be seen clearly in pulp and paper industry (1.A.2d) as well as in electricity and heat production (1.A.1a) (Figure 2.9).

The production of industrial heat was 53.7 TWh in 2017. The production went up slightly from the year before. One-half of heat produced for the needs of manufacturing comes from black liquor. In all, 75 percent of the production of industrial heat was based on renewable fuels. One of the biggest users of industrial heat is the forest industry, which uses its own fuels in production, like black liquor and other wood fuels (Production of electricity and heat, Statistics Finland)

Figure 2.9 Fuel combustion in manufacturing industry and construction (1.A.2), pulp and paper (1.A.2.d) and in electricity and heat production (1.A.1.a)

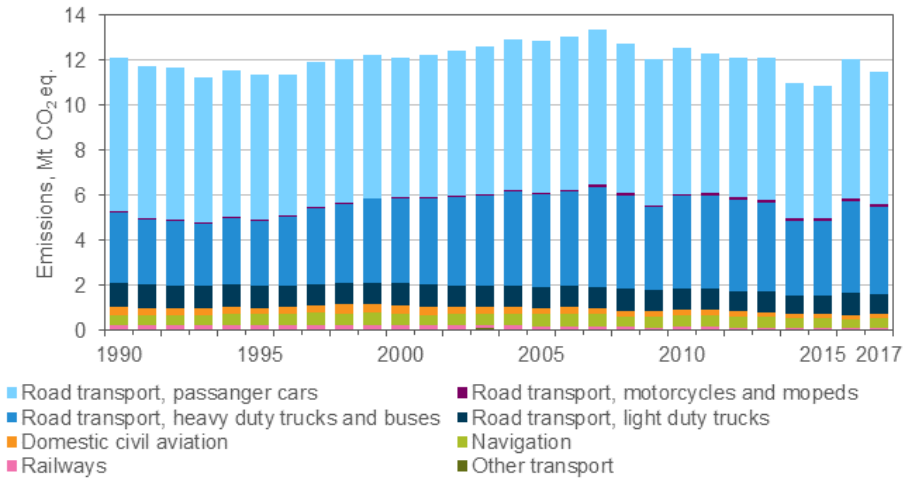


Emissions from the residential sector have decreased by 58 per cent and from commercial sectors by 54 per cent compared with the 1990 levels. The decrease is mainly due to substitution of direct oil heating with district heating and electricity.

2.2.2 Transport

In 2017, greenhouse gas emissions from transportation amounted to 11.5 million tonnes CO_2 equivalent. Compared to 2016, emissions decreased five per cent in 2017. The changes in activity data were otherwise small but the bioshare increased in road transport diesel oil, although it still did not exceed the 2014 and 2015 levels. The emission level in the transport sector has fluctuated between 11 to 13 million tonnes CO_2 eq. during 1990 to 2017 being five per cent lower in 2017 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 21 per cent in 2017. Road transportation is the most important emission source in transport, covering over 94 per cent of the sector's emissions in 2017. The emissions from transportation including distribution of road transportation emissions by vehicle type 1990 to 2017 is presented in Figure 2.10.

Figure 2.10 Greenhouse gas emissions from transportation, 1990 to 2017 (million tonnes of CO_2 eq.)



After the recession in the early 1990s, emissions from road transport increased until 2007 due to the increased kilometrage (Figure 2.11). In 2008, the emissions deviated from the upward trend. The worldwide economic downturn decreased the kilometrage of all transport modes. At the same time the increased use of biofuels has lowered the CO_2 emissions from transportation. In recent years, the bioshare in diesel oil has varied a great deal annually. 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 energy efficiency of new registered cars began to improve in the 1990s, and during the last ten years the vehicle-specific CO_2 emissions of new registered passenger cars has fallen 33 per cent (Figure 2.12).

Figure 2.11 Relative development of traffic volume (vehicle-kilometres*), GDP (2010 prices) and CO_2 emissions from road transport, 1990 to 2017

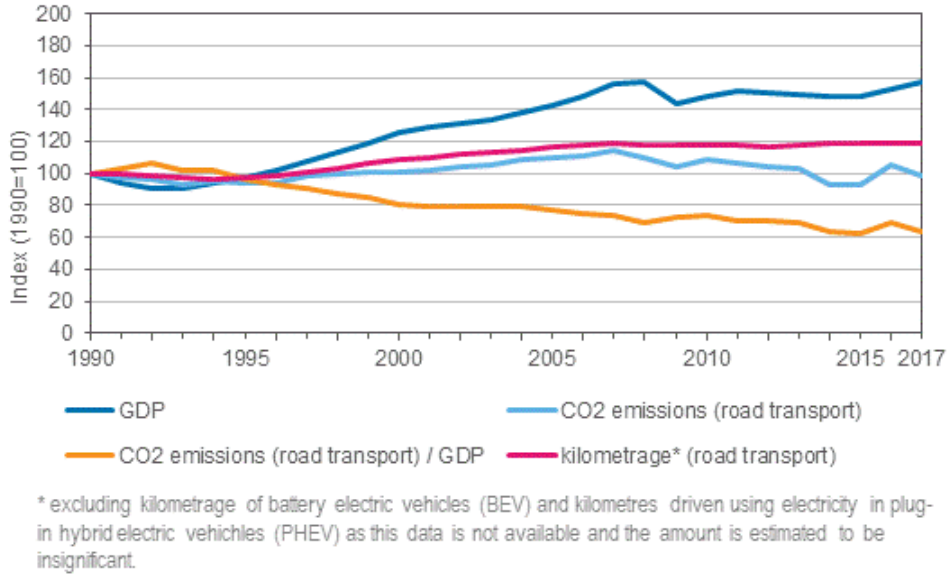
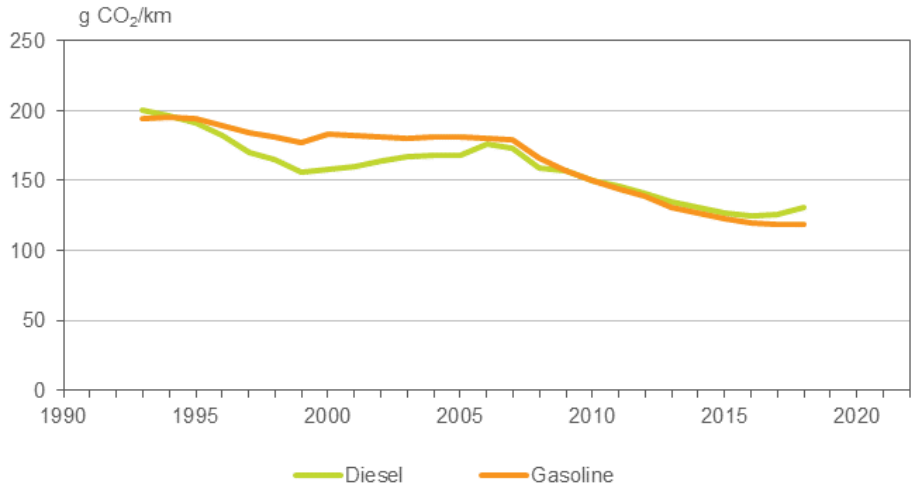


Figure 2.12 CO_2 emissions (g/km) of new registered cars (gasoline and diesel), 1993 to 2017



2.2.3 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 2017, totaling 5.9 million tonnes CO_2 eq. Emissions of industrial processes and product use have increased by 10 per cent (0.5 million tonnes CO_2 eq.) since 1990. The emissions resulting from industrial processes and product use (Figure 2.14) are mostly affected by changes in production output, as they depend on the use of raw materials and production volumes. 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 until the emissions decreased rapidly in 2009. The decrease was due to the economic downturn as the demand for industrial products diminished and also implementation of N_2O abatement technology in nitric acid production plants which reduced the emissions from the chemical industry significantly. Emissions related to industrial processes and product use are reported also under the energy and waste sectors (see Figure 2.13).

Figure 2.13 Reporting categories of emissions from industrial process sources in the national greenhouse gas inventory

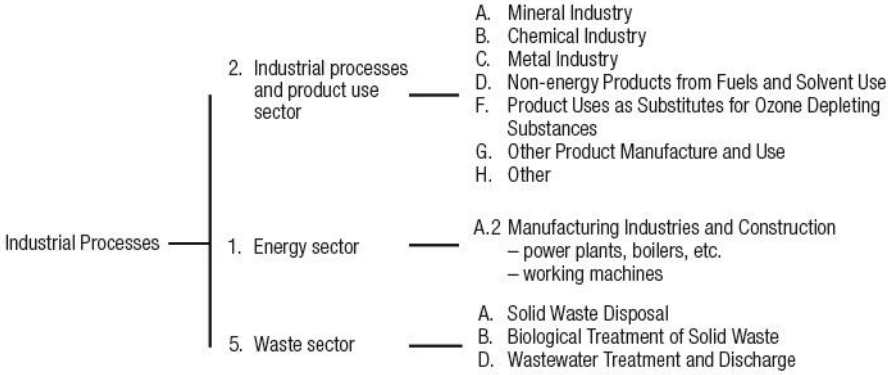
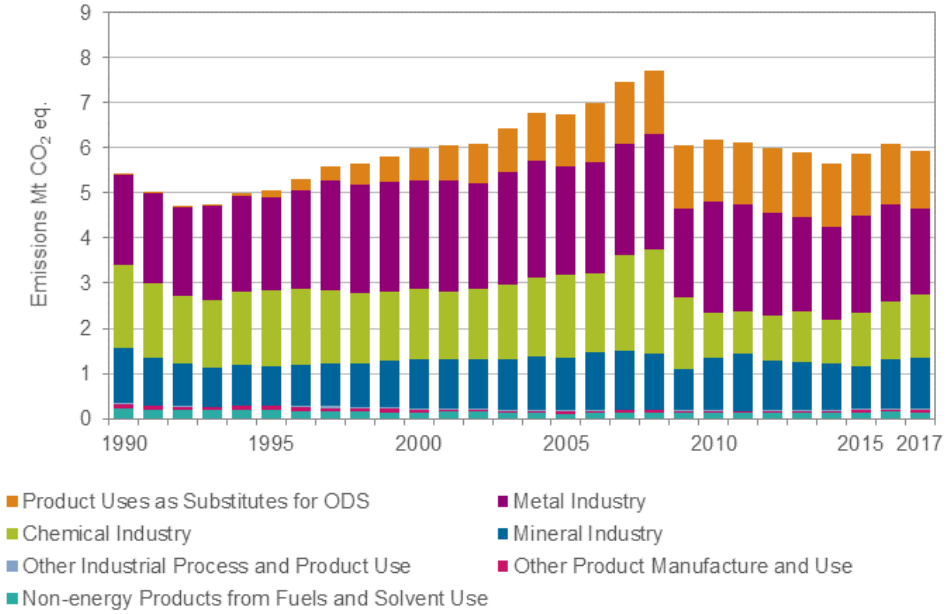


Figure 2.14 Greenhouse gas emissions from industrial processes, 1990 to 2017



The most important greenhouse gas emission sources of industrial processes and product use in 2017 were CO_2 emissions from iron and steel, hydrogen and cement production with 3.4, 1.9 and 1.1 per cent shares of total national greenhouse gas emissions, respectively. CO_2 emissions were also generated in lime, glass, phosphoric acid, zinc, copper and nickel production, as well as in the use of limestone, dolomite, soda ash, lubricant, paraffin vax and urea-based catalyst. The CO_2 emissions were 18 per cent higher in 2017 than in 1990. The reasons are increased production of steel, hydrogen and use of limestone and dolomite.

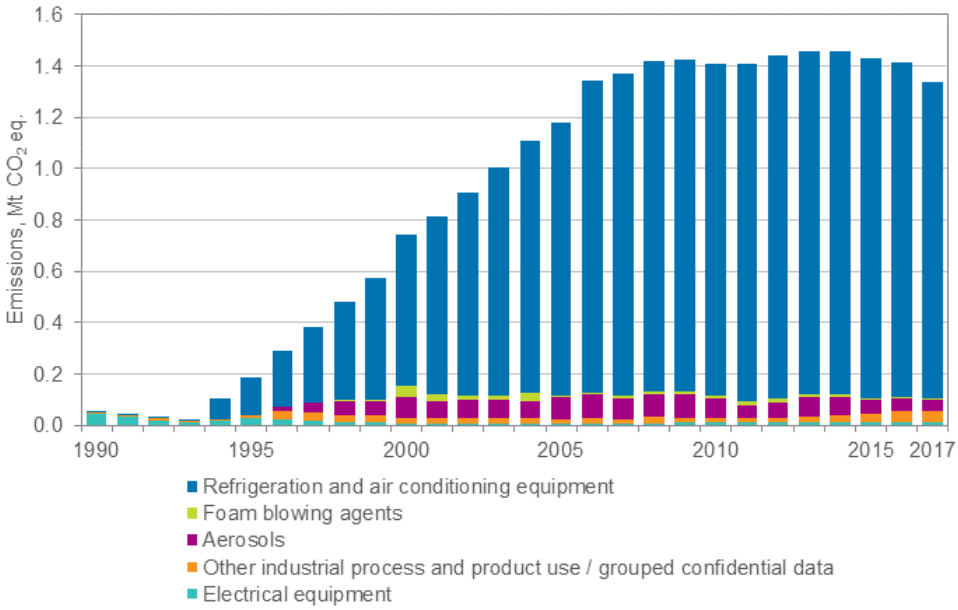
Small amounts of methane (CH_4) were generated in coke production in the iron and steel industry. Methane emissions have decreased by 48 per cent since 1990.

Nitrous oxide (N_2O) emissions were generated in nitric acid production and from product use. Nitrous oxide emissions have fluctuated during 1990 to 2017. First, a fast decrease due to the closing of a nitric acid production plant and after that a slow increase of emissions. A 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 1.4 million tonnes CO_2 eq. (84 per cent).

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 2.4 per cent of the total national greenhouse gas emissions and 23 per cent of the greenhouse gas emissions of industrial processes and other product use in 2017. In the period from 1990 to 2008 F gas emissions increased nearly thirtyfold. Since then the emission trend has stabilized and emissions have even declined during the most recent years (Figure 2.15).

Indirect CO_2 emissions from CH_4 and NMVOC (non-methane volatile organic compounds) emissions are reported aggregated in national totals.

Figure 2.15 F gas emissions, 1990 to 2017

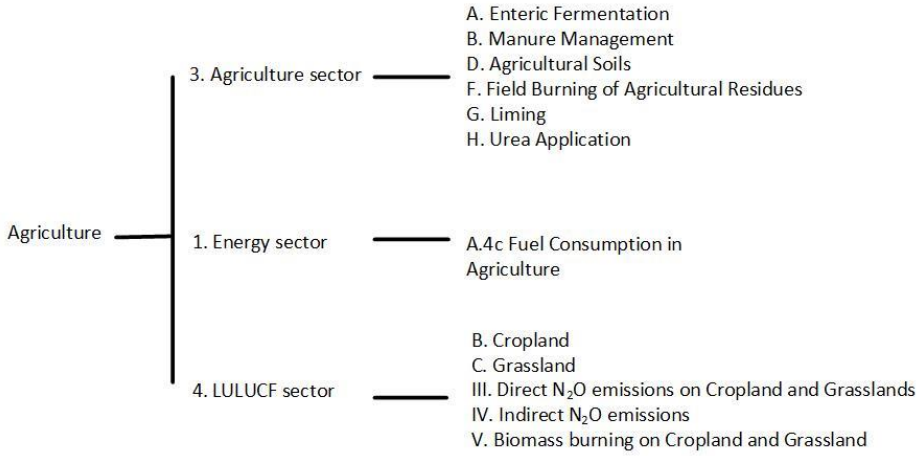


2.2.4 Agriculture

Emissions from the agriculture sector were approximately 6.5 million tonnes CO_2 eq. in 2017. Emissions reported under the agricultural sector include methane (CH_4) emissions from the enteric fermentation of domestic livestock, manure management and field burning of crop residues, 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. CO_2 emissions from liming and urea fertilization are also included.

Emissions related to agriculture are reported also in other sectors of the greenhouse gas inventory such as under the energy and LULUCF sectors (Figure 2.16).

Figure 2.16 Agricultural sources of emissions and their reporting in the CRF categories in the national greenhouse gas inventory

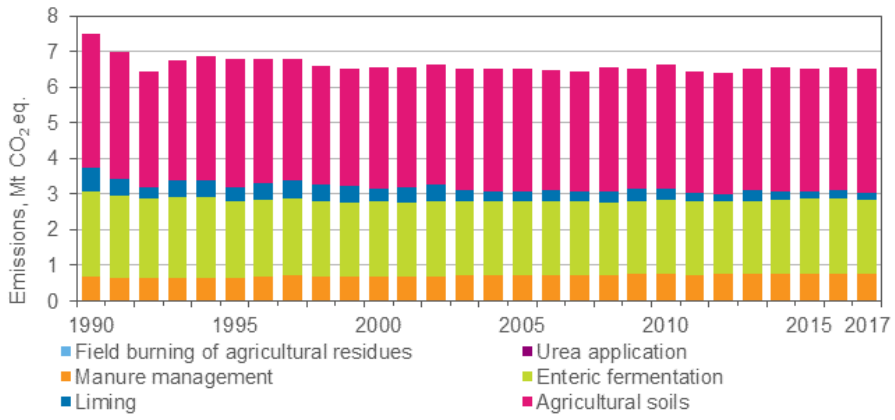


The agricultural sector accounted for approximately 12 per cent of Finland's total greenhouse gas emissions in 2017. In 2017, methane emissions from enteric fermentation were 32 per cent, methane emissions from manure management seven per cent, nitrous oxide emissions from manure management four per cent and nitrous oxide emissions from agricultural managed soils 53 per cent of total agricultural emissions. Liming comprised three per cent of emissions, the share of field burning of agricultural crop residues totalled 0.04 per cent and application of urea 0.03 per cent.

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 agricultural sector have decreased by about 13 per cent over the period 1990 to 2017 (Figure 2.17). The amount of mineral fertilisers used has decreased by 40 per cent from 1990 to 2017, which is the most important factor in the emission reduction. The decrease in N_2O emissions from agricultural soils was 8 per cent in 2017 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 2.17). The emissions have not decreased in proportion to the decrease in the number of livestock because milk and meat output and emissions per animal have increased.

Figure 2.17 Greenhouse gas emissions from agriculture, 1990 to 2017*



** 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.*

2.2.5 LULUCF

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 from mineralisation of nitrogen associated with loss of soil organic matter resulting from land-use change on mineral soils. Emissions and removals are not reported for unmanaged wetlands and other land.

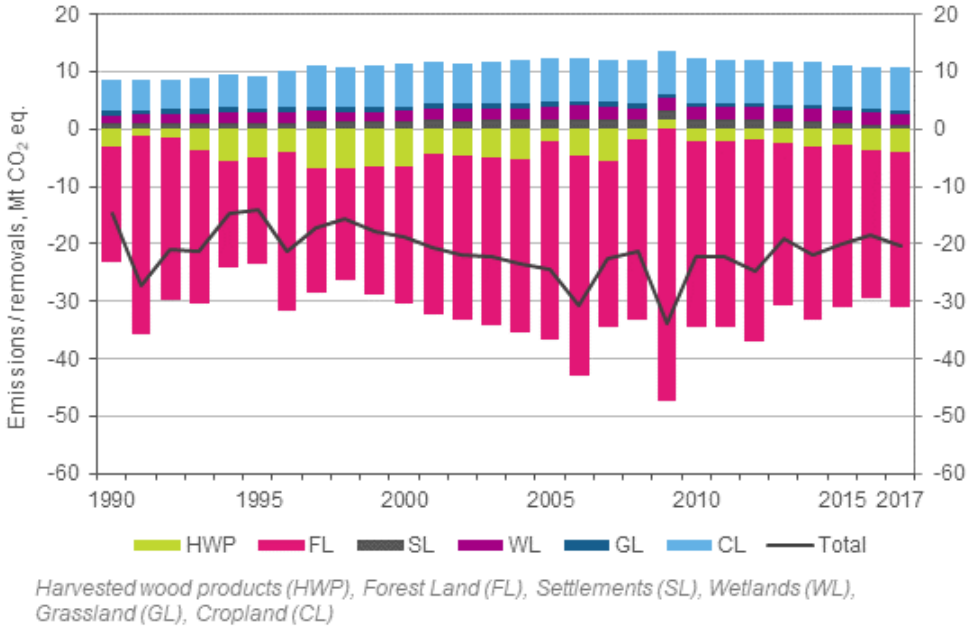
In 2017, the LULUCF sector as a whole acted as a CO_2 sink for −20.4 million tonnes CO_2 eq. because the total emissions resulting from the sector were smaller than the total removals. The sink in 2017 was 37 per cent of total national emissions excluding the LULUCF sector. In forest land, the largest sink in 2017 was tree biomass: −24.2 million tonnes CO_2 eq. Mineral forest soils were a sink of −10.0 million tonnes CO_2 eq., whereas organic forest soils were a source of 4.3 million tonnes CO_2 eq. Other emission sources in the forest land category are methane and nitrogen oxide emission from drained organic forest lands (2.8 million tonnes CO_2 eq.), nitrogen fertilisation (0.03 million tonnes CO_2 eq.) and biomass burning (0.005 million tonnes CO_2 eq.).

Forest growth has increased 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 2017, roundwood removals reached 72 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 2.18.

Figure 2.18 Greenhouse gas emissions (positive values) and removals (negative values) in the LULUCF sector, 1990 to 2017



Harvested wood products (HWP), Forest Land (FL), Settlements (SL), Wetlands (WL), Grassland (GL), Cropland (CL)

Harvested wood products

The Harvested Wood Products (HWP) pool was a net sink of −4.0 million tonnes CO_2 in 2017. HWP has been a net sink for the whole reported time series except in 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. 98.7 per cent of wood pulp produced in Finland is used for paper and paperboard production, and 1.3 per cent (dissolving wood pulp) for textile and hygiene products (percentages are for 2013).

2.2.6 Waste

Methane (CH_4) emissions from landfills and CH_4 and N_2O emissions from biological treatment of solid waste and wastewater treatment are reported under the waste sector (Figure 2.19). 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 1.9 million tonnes CO_2 eq. in 2017, which accounts for approximately three per cent of Finland's total emissions.

CH_4 emissions from landfills are the most important greenhouse gas emissions in the waste sector. Solid waste disposal on land contributes nearly 81 per cent, wastewater treatment about 13 per cent and biological treatment (composting and anaerobic digestion) six per cent to the sector's total emissions. Compared to 2016, emissions decreased by five per cent in 2017 and since 1990, these emissions have decreased by 60 per cent. A new Waste Act entered into force in 1994, which has led to a reduction in methane emissions from landfill sites (Figure 2.20). 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 during that period. CH_4 emissions from landfills are expected to decrease further due to the implementation of EU and national policies and measures (see Chapter 4).

Figure 2.19 Reporting categories of emissions from waste handling in the national greenhouse gas inventory

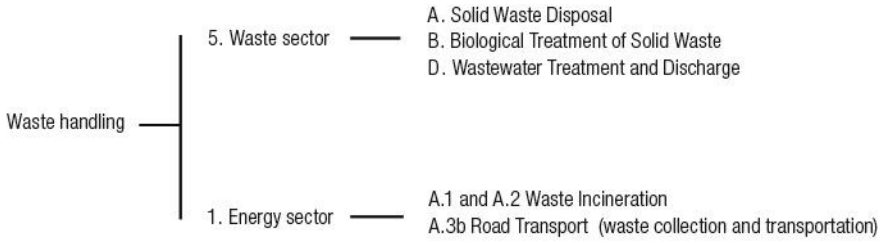
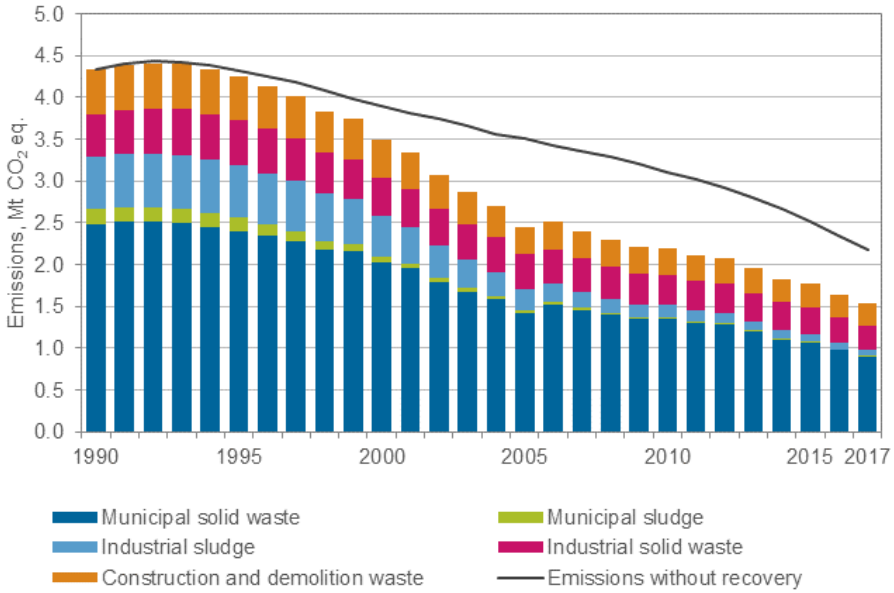


Figure 2.20 Methane emissions from solid waste disposal on land, 1990 to 2017



Emissions from wastewater treatment have also been successfully reduced by 16 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 2017. 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 0.2 per cent of the waste sector's emissions in 2017.

2.3 National inventory arrangements

2.3.1 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].

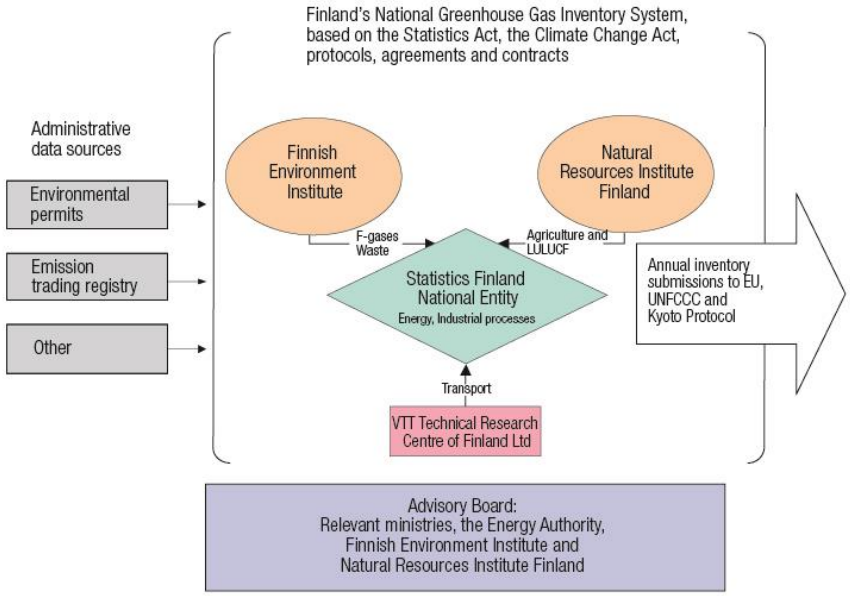
In Finland, the national system is established on a permanent footing and it guides the development of emission calculation in the manner required by the UNFCCC and the Kyoto Protocol. The national system is based on laws and regulations concerning Statistics Finland, on agreements between the inventory unit and expert organisations on the production of emission and removal estimates, as well as related documentation. Statistics Finland 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 2.21.

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

[4] 609/2015

Figure 2.21 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[5] and its amendment[6], and the Statistics Act[7] and its amendment[8] 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 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. The present advisory board was nominated on 8th January 2019 and will serve for four years until end 2020.

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 statis-

[5] 48/1992

[6] 901/2002

[7] 280/2004

[8] 361/2013

tics 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 (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 2.1.

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 nomination of the most recent working group took place 21st December 2018. The term of the working group is four years.

Table 2.1 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)

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 co-operation 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.

2.3.2 Annual inventory process

The annual inventory process set out in Figure 2.22 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 2.3.3).

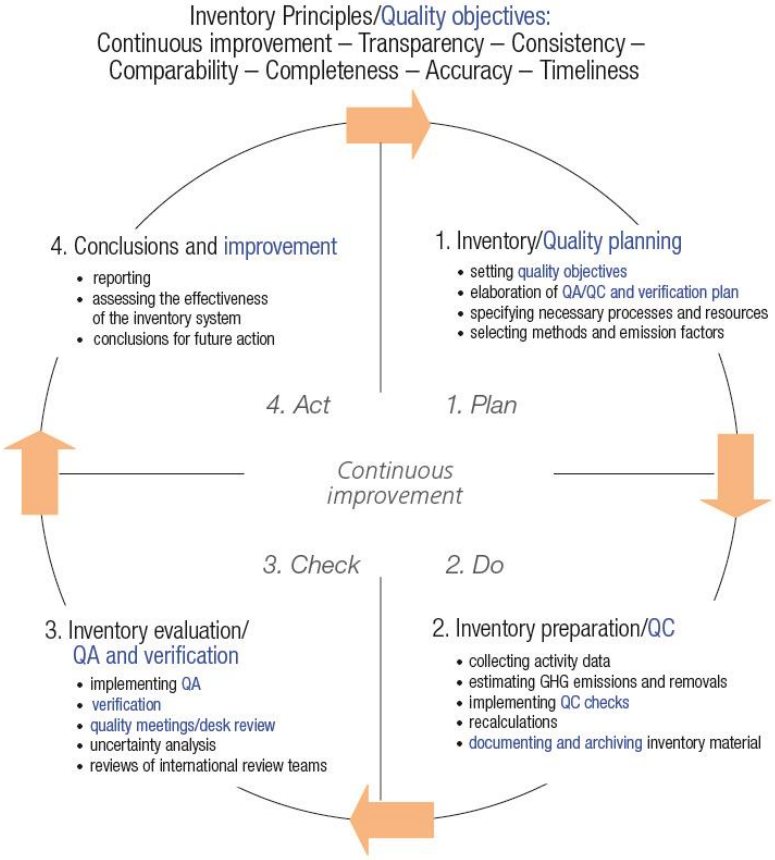
The methodologies, collection of activity data and choice of emission factors are consistent with the guidance in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

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 YLVA[9], 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.

[9] The YLVA data system replaces the VAHTI data system which has been mentioned in earlier biennial reports.

Figure 2.22 Inventory process and QA/QC management of the inventory



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 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. 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 as well as the 2019 Refinement of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

2.3.3 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 2.22). 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 2.2) are specified statements about the quality level 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.

Table 2.2 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

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 rele-

vant. 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 2.3.2).

2.3.4 Changes in Finland's GHG inventory arrangements since BR3

Since the submission of Finland' Third Biennial Report, very few changes have been made to the greenhouse gas inventory arrangements and the national system under Article 5, paragraph 1, of the Kyoto Protocol.

Statistics Finland has updated its agreements with ministries and expert organisations to take into account the changes in the inventory preparation since 2015 due to the implementation of the methodologies in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, as implemented by the Revised UNFCCC reporting guidelines national greenhouse gas inventories by Annex I countries (Annex to Decision 24/CP.19), and the implementation the Monitoring Mechanism Regulation (EU) 525/2013. The updates of the agreements have not included any significant changes in the institutional arrangement of the national system. By the submission date of the second biennial report, Statistics Finland had updated the agreement with the Ministry of the Environment. The agreements with the Ministry of Economic Affairs and the Employment, the Ministry of Agriculture and Forestry, the Natural Resources institute and the Finnish Environment Institute and the VTT Ltd were updated before the submission of the third biennial report. The updates to the agreement with the Energy Agency in was completed 2018. Statistics Finland has also an agreement with the Ministry of Transport and Communication. This agreement is being updated and will change to an agreement between Statistics Finland and the Finnish Transport and Communications Agency (Traficom).

3 Quantified economy-wide emission reduction target

3.1 Quantified economy-wide emission reduction target jointly with the European Union

Finland's emission reduction target for the years 2013–2020 is part of the joint target of the European Union. The EU quantified economy-wide emission reduction target is implemented through the EU Climate and Energy Package 2020[10]. Key assumptions and conditions related to the EU's target (for example sectors, base year, coverage of gases) are included in the document FCCC/AWGLCA/2012/MISC.1, the EU 6th National Communications and first Biennial Report under the UNFCCC, and CTF Tables 2(a–f). EU's Fourth Biennial Report gives more recent information on how the joint target is being fulfilled by the EU and its Member States.

Under the Climate and Energy Package 2020, the EU is committed to reducing its greenhouse gas emissions by 20 per cent by 2020 from the 1990 level. The majority of the reduction will be reached as part of the EU emissions trading scheme (EU ETS): in 2020, emissions from sectors covered by the EU ETS will be 21 per cent lower than in 2005. Under the revised EU ETS Directive[11], one single EU ETS cap covers the EU Member States and the three participating non-EU Member States (Norway, Iceland and Liechtenstein). There are no further differentiated caps by country. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020; these decrease by 1.74 per cent annually, starting from the average level of allowances issued by Member States for the second trading period (2008–2012). The annual caps imply interim targets for emission reductions in sectors covered by the EU ETS for each year until 2020. For further information on the EU ETS and for information on the use of flexible mechanisms in the EU ETS see the EU's Fourth Biennial Report under the UNFCCC.

The EU Effort Sharing Decision (ESD)[12] establishes binding annual greenhouse gas emission levels for Member States for the period 2013–2020. The ESD covers the emissions from the non-emissions trading sector (non-ETS) calculated as the total national emissions without LULUCF minus the national emissions in EU Emission trading sector for the Member State in question. The CO_2 emissions from civil aviation are also excluded from the non-ETS emissions. The non-ETS emissions come from sources such as transport, housing, agriculture and waste. The emissions will be cut by approximately 10 per cent from the 2005 level by 2020 within the EU as a whole. The ESD sets Finland's reduction obligation for the sectors not covered by the EU ETS as 16 per cent of the 2005 emissions. This reduction obligation has been determined in CO_2 equivalent (eq) tonnes after the EU internal review of the 2012 greenhouse gas emission inventory submission in the Commission Decision 2013/163/EU. The decision sets annual emission allocation for each Member State for the year 2013 to 2020. The Commission Implementing Decision 2013/634/EU adjusts these annual emission allocations taking into account the changes in coverage of the EU Emission Trading System from 2013 onwards.

In 2017, the annual emissions allocations of the EU Member States were further adjusted[13] to take into account changes introduced by the implementation of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories on the emissions levels in the inventory as these guidelines were applied in inventory reporting after the annual emission allocations under the ESD were agreed upon. These adjustments, which increased Finland's annual emission allocations with more than one percentage unit, apply to the ESD commitments for the years 2017 to 2020. Finland's annual

[10] https://ec.europa.eu/clima/policies/strategies/2020_en

[11] Directive 2009/29/EC

[12] Decision 406/2009/EC

[13] Decision 2017/1471/EU

emission allocations under the ESD, including mentioned adjustments, are presented in detail in Table 3.1. The annual emission allocations are also addressed as Finland's target path under the ESD. The target path represents Finland's contribution to the EU's joint target under the UNFCCC.

Table 3.1 Finland's target path for non-ETS emissions in accordance with the EU Effort Sharing Decision

	2013	2014	2015	2016	2017	2018	2019	2020
Finland's annual emission allocations	31.8	31.3	30.8	30.3	30.2	29.6	29.1	28.5

It is up to each Member State to decide how these targets will be achieved, but domestic measures are needed to fulfil the targets. Certified emission reduction units from the clean development mechanism and emission reduction units from joint implementation projects, as well as units transferred from other Member States, can be used to fulfil the targets with certain limitations. There is an annual limit of 3 per cent of the greenhouse gas emissions in 2005 for the use of project-based credits for each Member State. If these are not used in any specific year, the unused part for that year can be transferred to other Member States or be carried over for own use until 2020.

Finland fulfils also the additional criteria laid down in ESD Article 5(5) (d)[14], which allow for use of credits from projects in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) up to one additional per cent of their verified emissions in 2005. These credits cannot be carried over to subsequent years or transferred to other Member States.

A Member State that fails to meet its annual target under the ESD will be penalised with a deduction of the Member State's emission allocation for the following year equal to the amount of the excess emissions in the previous year multiplied by 1.08. Information on mitigation actions by Finland to achieve its target in provided in Chapter 4. Section 4.4 addresses the progress Finland has made towards meeting its emission reduction target.

The Climate and Energy Package 2020 also requires Finland to increase its use of renewable energy sources to 38 per cent of final energy consumption by 2020 and the share of biofuels in gasoline and diesel to 10 per cent by 2020. It includes also requirements for the increase of efficiency in the use of energy.

3.2 Other emission reduction targets

3.2.1 Paris Agreement and the EU Climate and Energy Package 2030

The Paris Agreement was adopted in December 2015 and entered into force in November 2016. The EU ratified the agreement in October. The Finnish national ratification was completed in November 2016.

The EU's joint nationally determined contribution (NDC)[15] under the Paris Agreement is to reduce the greenhouse gas emissions by 40 per cent by 2030 from the 1990 level. The details of the effort sharing between the Member States, including Finland have been agreed in the EU Climate and Energy Package 2030. As in the EU's Climate and Energy Package 2020, the emissions reduction obligations are divided between the EU Emissions Trading System (EU level target) and the non-ETS emissions[16] (Member-State level targets). In addition, the LULUCF sector[17] is now part of the

[14] The criteria referred to is that the Member State concerned has a renewable energies target for 2020 in excess of 30 per cent as set out in EU Directive 2009/28/EC. Finland's renewable target under the mentioned directive is 38 per cent.

[15] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/European%20Union%20First/LV-03-06-EU%20INDC.pdf

[16] Regulation (EU) 2018/842

[17] Regulation (EU) 2018/841

Member-State level obligations. The reduction target from the 2005 levels in the emissions trading sector is 43 per cent and in the non-emissions trading sector it is 30 per cent. The share of renewable energy in the EU is to be increased by 32 per cent and energy efficiency improved, indicatively, by 32.5 per cent. In the Effort Sharing Regulation, Finland's target for emission reductions in 2030 compared to the 2005 level is 39 per cent.

3.2.2 Kyoto Protocol

Finland is also implementing the second commitment period of the Kyoto Protocol to the UNFCCC (2013—2020). The EU, its Member States and Iceland are implementing its targets under the Kyoto Protocol jointly. Finland's target and progress towards the achievement of the target for the second commitment period of the Kyoto Protocol is reported annually in the national inventory report.

4 Progress in achievement of quantified economy-wide emission reduction targets

4.1 Background for the information provided

Finland's emission reduction target for the years 2013-2020 is part of the joint target of the European Union. The historical trend in the national total emissions without the LULUCF sector is the key indicator for progress in the achievement of the target. The EU joint target under the Convention refers to greenhouse gas emissions of the EU-28 and the emissions are calculated as the sum of the emission of the Member States. The EU-28 emissions[18] in 1990 without the LULUCF sector including the indirect CO_2 emissions were 5,654 million tonnes of CO_2 eq in 1990 and 4,330 million tonnes CO_2 in 2017 that is 23.5 per cent lower than in 1990. In 1990, Finland's total national emissions without the LULUCF sector including the indirect CO_2 emissions, 71.3 million tonnes CO_2 eq, were 1.3 per cent of the EU-28 emissions in 1990. In Finland, the corresponding emissions in 2017 were 55.4 million tonnes CO_2 eq (22 per cent lower than in 1990). Finland's emission trends 1990 – 2017 are reported in detail in CTF Table 1.

In the following sections, progress in achievement of quantified economy-wide emission reduction targets is described through mitigation actions (policies and measures) planned, adopted and implemented for achieving the targets and commitments under the Convention and EU's Climate and Energy Package 2020. A summary of the progress Finland has made towards its emission reduction target is presented in Section 4.4. Information on the effects of the mitigation actions and progress in achievement of the target under the Convention, where available and relevant, has been included also in CTF Tables 3 and 4.

The mitigation actions presented are based on the National Energy and Climate Strategy for 2030 and the Medium-term Climate Change Policy Plan (see Chapter 7, Sections 7.2.1 and 7.2.2). The Energy and Climate Strategy was presented by the Government in November 2016. The Medium-term Climate Change Policy Plan was approved in September 2017. It outlines, in particular, the actions that will enable Finland to attain its target in non-ETS sector emissions reductions. The mitigation actions are presented separately for the 'With Measures' projection (WM) and the 'With Additional Measures (WAM)' projection (see Section 5.1). The WM projection includes all energy policy measures implemented by 31 December 2017. The WAM projection includes in addition the policies and measures that were planned and approved by the government before 6 June 2019. Finland does not provide a without measures (WOM) projection. The WOM scenario is not applicable to Finland's national circumstances because mitigation policies and measures (such as measures related to energy efficiency improvements and use of renewable energy) have been implemented since the 1970s; therefore, any WOM scenario created on the basis of previous climate and energy strategies (e.g. 2013, 2008 or 2005) would be very complicated and require significant effort, particularly in predicting industrial structure. Information on arrangements for reporting within national climate policy framework is given in Finland's seventh National Communication (see Sections 4.5 and 7.1 of this report) for information, including information on possible changes in domestic institutional arrangements.

Emissions/removals in the LULUCF sector are not included in the EU target under the Convention. They are therefore not included in CTF Table 4 and CTF Table 4(a) is left empty. However, mitigation actions in the LULUCF sector are described in Section 4.2 below and presented in CTF Table 3. Also, projections for the LULUCF sector are presented in Chapter 5 and in CTF Tables 6(a) and 6(c).

[18] Data on EU-28 emissions are taken from EU's Draft BR4 report dated 20th October 2019.

4.2 Mitigation actions and their effects

Finnish regulations, policies and measures are strongly affected by the increasing number of directives, policies and measures of the EU. This chapter provides information on the most important policies and measures related to the reduction of the greenhouse gas emissions. Both existing and planned measures are described. The mitigation actions, or policies and measures, and their effects are presented in detail in CTF Table 3 and described by sector in the sections below.

Finland is continuosly seeking to improve the information on the effects of the policies and measures. For some individual measures, Finland has not been able to provide quantified estimates on the impacts on the national emissions. These are marked with NA (not available) in the CTF Table 3. There are various reasons why it has not been possible to make the estimates, such as the complexity and overlaps with other measures (for example, the EU ETS), the measure is still in a phase where the details of implementation are not known (for example, flexibility measures of the ESD and measures related to international bunkers), the policy or measure targets heteregenious groups and/or many actors with different responses to the measure, or where quantification of the effect is difficult (for example, measures providing advice and information).

For measures targeting F gas emissions and measures in the waste sector, only aggregate impact estimates of the policies and measures are provided to avoid double counting and to improve the accuracy of the estimated effects. The impacts of the individual measures are marked with IE (included elsewhere) in the CTF Table 3 and the aggregated estimates are provided in separate rows.

4.2.1 Energy

Policies and measures in the WM projection

The general objective of Finland's energy policy is to ensure energy security at competitive prices and with the lowest possible environmental impacts. Finland uses a diversity of energy sources, one third of which (including energy for transport) are domestic. The major trend is a steady increase both absolutely and in relative terms in the use of renewable energy. Direct governmental intervention to guide the choice of energy sources is rare in Finland. However, economic instruments, i.e. taxation and subsidies, are used to improve energy efficiency and to promote the development of domestic energy sources, such as biomass, hydro, wind and peat.

Within the energy sector, the greenhouse gas emissions are in practice reduced in two ways: 1) the primary energy consumption is reduced by cutting the end use or by increasing the conversion efficiency in power plants; 2) fuels and energy use are shifted to alternatives with less emissions.

The main policies and measures in the energy sector include the EU Emissions Trading System (ETS), an increase in renewable energy and energy conservation measures.

The EU ETS is an EU-wide domestic measure, while renewable energy sources are supported by various national measures: investment grants, taxation, support for research and feed-in tariffs.

Energy conservation measures concern all sectors of the economy. Energy efficiency agreements, i.e. a voluntary scheme for industry and municipalities, have proven to be efficient measures along with taxes and subsidies. For both new and existing buildings, building codes and regulations play an important role.

The policies and measures included in the WM projection for the energy sector are described in more detail in the following sections. A list summarising the policies and measures and their effects can be found in CTF Table 3. Energy

taxation and tax-related subsidies are described in Section 4.3.

EU Emissions Trading System

The EU ETS has been operating since 2005 and is the most important economic policy instrument for reducing emissions at both the domestic and EU level. EU ETS is considered as a domestic measure, even though entities with emission ceilings participating in the system can acquire emission units (AAUs, CERs and ERUs) through trading.

For the third trading period 2013-2020, there is a single EU-wide cap for the ETS sector. The main method of allocation is auctioning, and free allowances are allocated on the basis of harmonised rules. Finland's share of auctioned allowances is about 1.6 per cent of the total EU amount. The allowances are auctioned at the common auctioning platform for EU-25, currently managed by the European Energy Exchange (EEX). The Energy Authority has been appointed as the auctioneer for Finland. In 2017 and 2018 Finland auctioned 16.4 and 16.2 million European Emission Allowances (EUAs), respectively. In the period 2013-2020, some 450 Finnish installations are entitled to free allocation. In 2017, these installations were allocated approximately 17.7 and in 2018 approximately 16.5 million EUAs (estimate; final figures are not yet available). The free allocation is conducted according to Commission Decision 2011/278/EU and further complemented by Commission Decision 2013/448/EU.

The EU ETS covered only CO_2 emissions until the year 2012, in 2013 N_2O and PFC emissions from certain industries were also included. In addition to emissions from energy production and use, the EU ETS also includes emissions from industrial processes. Industrial processes currently count for some 15 per cent of EU ETS emissions in Finland (Table 4.1).

The share of EU ETS emissions with respect to the total greenhouse gas emissions in Finland was 45 to 50 per cent between the years 2013 and 2017 (Table 4.1). This share is clearly higher than the EU-28 average, which is around 40 per cent.

Table 4.1 Greenhouse gas emissions in the emission trading (ETS) sector and non-emission trading sector in Finland in 2013 to 2017, million tonnes CO_2 eq. Also, total national emissions and emissions from domestic aviation are presented. The ETS figures do not include emissions from aviation in the EU ETS as their coverage under the trading scheme is not consistent with the national greenhouse gas inventory.

	2013	2014	2015	2016	2017
ETS *	31.5	28.8	25.5	27.2	25.1
of which energy *	27.6	25.1	21.6	23.0	21.1
industrial processes *	4.0	3.7	3.9	4.2	4.0
Non-ETS	31.3	29.8	29.5	30.7	30.1
CO_2 from domestic civil aviation	0.2	0.2	0.2	0.2	0.2
Total	63.0	58.8	55.2	58.1	55.4

* Due to a statistical difference between the greenhouse gas inventory and ETS data, sums may not add up

The emissions in the EU ETS sector have decreased since 2010. The main reason for this has to do with a reduced use of fossil fuels and increased imports of electricity. A steady decrease is also foreseen in the future in the emissions from district heating and combined heat and power (CHP) production. Several condensing power plants have been decommissioned or moth-balled in recent years. The emissions from industry are not expected to change dramatically. Consequently, the EU ETS sector emissions are expected to decrease in the future. This is partly the result of the EU ETS making emission-free production of electricity and heat more competitive and partly the result of promotion of renewables and energy efficiency. However, some yearly variations to this trend can occur due to variations, for example, in the Nordic energy market and in weather conditions. Finland forms a part of the Nordic and Baltic electricity market and the import and export of electricity depends significantly on precipitation in the market area.

Energy efficiency

The Finnish economy is relatively energy intensive, which has led to fairly high per capita greenhouse gas emissions. Because energy use is efficient by international comparison, the high energy and emission intensities can be explained by structural factors. While the industrial structure has changed significantly towards less energy intensive industries, Finland still has a considerable number of energy intensive industries. The need for space heating, measured by average heating degree-days, is one of the largest in the world. In addition to this, factors that increase the energy intensity are the relatively large geographical area and sparse population.

In terms of the efficiency of energy use and improving energy efficiency, Finland is among the leading countries in the world. Co-generation of heat and electricity, broad coverage of energy efficiency agreements, (previous period 2008–2016 and present 2017–2025), and the systematic implementation of energy audits since early 1990s are good examples of successful energy conservation measures.

Energy Efficiency Directive (EED) made the energy audits compulsory for big companies. The EED has been implemented mainly with the Energy Efficiency Law[19] that came into force in the beginning of 2015.

Energy-efficiency requirements have designated the public sector as liable for setting an example in promoting energy conservation. Other areas of focus include the development of an energy-efficient community structure and enhancement of energy-efficiency in the heating of buildings, transport, household use, agriculture, industry, and the entire service sector.

The majority of energy-saving measures are based on EU-wide solutions, regulations, and recommendations. Public financing is targeted, inter alia, at research and development activities and enhancement of competencies, whereas fiscal solutions emphasise motivating energy savings while ensuring the conditions needed for industry to operate solidly.

For energy audits, the realised CO_2 emission reductions are estimated to be 0.39 million tonnes in 2020, 0.38 million tonnes in 2030 and 0.36 million tonnes in 2040. The vast majority of the emission reductions, almost 90 per cent, are estimated to occur in the emissions trading sector due to the large share of electricity and district heat in energy savings.

In buildings and housing, the emissions reductions are mainly due to the minimum standards for new buildings, energy efficiency agreements and subsidies to improve energy efficiency and promote renewable energy sources in building stock. Measures also include the regulation to ensure energy and resource efficiency in renovating buildings.

[19] 1429/2014

When houses with district or electric heating produced in the ETS sector are taken into account, the total impact of the measure is estimated to be 0.4 million tonnes CO_2 in 2020 and 1.4 million tonnes CO_2 in 2035.

Voluntary Energy Efficiency Agreements have played a central role since 1997 in increasing energy efficiency, e.g., in industry, private services and municipalities. The agreements have impacted the implementation of national energy policy as well as EU energy efficiency obligations. The role of the agreements has been especially important in achieving Finland's binding cumulative energy savings target under EED Article 7. Based on the implemented measures during the agreement period 2008–2016, and the following new period 2017–2025, the annual savings in force were at the end of 2017 about 13.9 TWh heat and fuels and 4.9 TWh electricity. The savings in energy costs were about EUR 635 million and the CO_2 emissions reduction about 5.6 million tonnes. Energy Efficiency Agreements covered well over 60 per cent of the total energy consumption in Finland at the end of 2018.

The CO_2 emission reductions achieved by Energy Efficiency Agreements are estimated to reach 8.3 million tonnes in 2020, 9.4 million tonnes in 2030 and 10.8 million tonnes in 2040. Most of the emission reductions, over 95 per cent, are estimated to occur in the emissions trading sector due to the large share of electricity and district heat in energy savings. The estimates reported for 2030 and 2040 are calculated based on assumptions that also the current agreement period 2017−2025 will have continuation. Voluntary agreements are one of the main instruments in Finland to improve energy efficiency and are playing a central role when implementing the Energy Efficiency Directive Article 7 including a binding national target for energy savings.

In 2010, an energy efficiency agreement was also launched in the agriculture sector under the Ministry of Agriculture and Forestry. The agreement was updated in 2016 for the period 2016 to 2020. Farms have received energy advice in the scope of the Farm Energy Programme (2010–2015) and the Rural Development Programme for Mainland Finland (2016–2020). Energy efficiency measures in agriculture are farm reparcelling to cut down energy use in farm traffic, support to fresh grain silos where energy use for drying of grain is avoided as well as support to investments to unheated cattle buildings and heat recovery from pig slurry.

Renewable energy

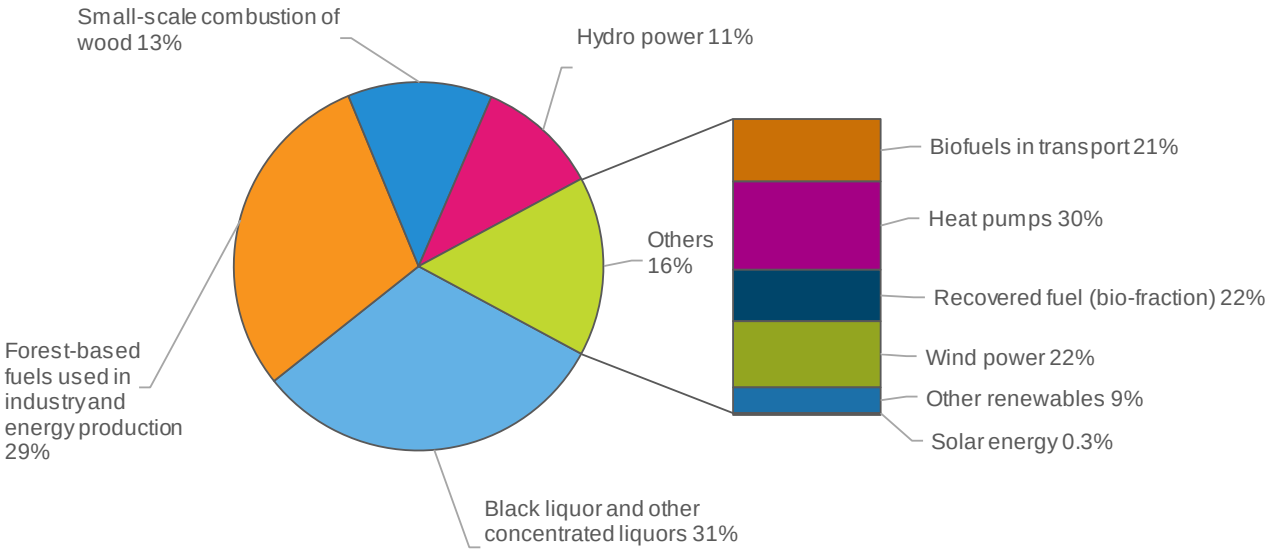
Finland is one of the world's leading users of renewable energy sources, especially bioenergy. The most important renewable energy sources include bioenergy – wood and wood-based fuels in particular – hydropower, wind power, ground and air heat pump energy and solar energy.

Renewable energy is one of the most significant means by which Finland's energy and climate targets can be achieved. Finland's obligation set by the European Union is to increase the share of renewable energy to 38 per cent of final energy consumption in 2020. The current high level of wood utilization in forest industry forms a backbone in meeting renewable energy targets.

The share of renewable energy sources in 2017 was 41.0 per cent of the final energy consumption, which is slightly more than in 2015 and 2016 when the shares were 39.3 per cent and 39.1 per cent, respectively. The most significant part of the renewable energy supply comes from biomass, especially from the side-products of the forest industry (see industrial forest-based fuels and black liquor in Figure 4.1). The remainder of renewable energy supply comes mainly from hydro power and wind power. The National Energy and Climate Strategy for 2030 outlines actions to increase the share of renewable energy further.

The share of renewable energy in the WM projection is well above 40 per cent in 2020. The objective of the national energy and climate strategy is that the use of renewable energy will be increased to account for over 50 per cent of the final energy consumption in the 2020s.

Figure 4.1 Share of renewable energy sources in 2017



The sliding feed-in premium system for the production of electricity from renewable energy sources came into force on 25 March 2011. The aid scheme concerns government support for electricity production based on wind power, biogas and wood fuels. In addition, there is a separate premium scheme for forest chip use (instead of peat and coal) for CHP plants. These feed-in premium schemes contribute to meeting the national objective for 2020 set by the EU for increasing the utilisation of renewable energy sources. The feed-in premium scheme was replaced by a technology neutral premium scheme based on tendering in 2018.

Renewable energy is also promoted through the Energy Aid Scheme (investment subsidy). Renewable energy investment subsidies are primarily targeted at the commercialisation of new technologies and to the non-ETS sector, including plants producing advanced biofuels for transport, wider use of alternative transport power sources, and small scale or other non-ETS electricity and heat production of companies and communities. The objective is that aid for different technologies will be phased out as a technology develops, the costs are reduced, and competitiveness improves. In addition, farms can apply investment aid for energy production plants such as bioenergy boilers or solar PV from another scheme.

Other measures that have been implemented to promote renewable energy include electricity tax exemption for small scale production, information measures and, in terms of wind power, land use planning.

In total, 2300 MVA of wind power has been approved for the feed-in tariff scheme. Finland's first offshore wind farm was granted a EUR 20 million investment subsidy in 2014 and was completed in 2017 having a total capacity of 42 MW. This project aims to demonstrate wind power technologies suitable for winter conditions in the Baltic Sea area where, for example, ice conditions can be very challenging due to pack ice.

In 2016, the wind power production was 3.1 TWh and in 2017 4.8 TWh. In the WM projection the production is estimated to be 7 TWh in 2020 and close to 10 TWh in 2030.

The effect on emissions has been estimated based on the assumption that wind power reduces the need to produce electricity mainly in condensing power plants using fossil fuels and peat (for more information on the IMPAKTI calculation tool used to estimate the emission reduction impacts of renewables, see Finland's third Biennial Report, Section 5.7.3). Using a marginal emission coefficient of 600 t CO_2/GWh, the promotion of wind power will reduce the

emissions in 2020 by 4.1 million tonnes CO_2 and in 2030 by 5.7 million tonnes CO_2 (see CTF Table 3). The reduction will occur totally in the ETS sector. The estimate includes the impact of all policies and measures promoting wind power (including the impact of the feed-in tariff).

Increasing the use of forest chips in multi-fuel boilers is the most central and cost-efficient way of increasing the use of renewable energy in the generation of power and heat. The use of forest chips will replace the use of other fuels (mainly peat) in heat and power production and heating oil on farms. The estimated emission reduction achieved due to the use of forest chips is 6.4 million tonnes in 2020 and 8.9 million tonnes in 2030.

Energy taxation provides an incentive for the use of forest chips and forest industry by-products in CHP production and building-specific heat production. The objective is that the majority of forest-based energy will continue to be produced on market terms from side streams of other wood use. Plenty of wood material is produced in forestry management operations and timber harvesting that is not suitable as raw material for wood processing, or for which there is not enough demand for this purpose. By means of different policy measures, this forest biomass will be channelled to replace fossil fuels in heating, CHP production and transport. The use of wood-based fuels will not be promoted by means of an aid scheme if the use of these fuels is profitable without any aid. In the current situation, an aid scheme is needed for the use of forest chips in CHP production. The feed-in premium system for wood fuel cogeneration plants has been closed.

The impact of the feed-in tariff for biogas has not been numerically estimated for 2020. The promotion of biogas will replace power and heat production using other fuels. CH_4 and N_2O emissions from material used for biogas production will also be avoided, such as CH_4 emissions from landfilling of biogenic waste or CH_4 and N_2O emissions from manure management.

Other measures to promote renewables include improving the logistics for harvesting and transporting forest chips and furthering the emergence of local heat entrepreneurs. Wind power will be advanced by reducing barriers for wind power investment and by enabling new demonstration projects for off-shore wind power. The historic use of and WM projection for renewable energy in Finland is shown in Figure 4.2 and Table 4.2.

Figure 4.2 Historic development and WM projection for renewable energy, TWh

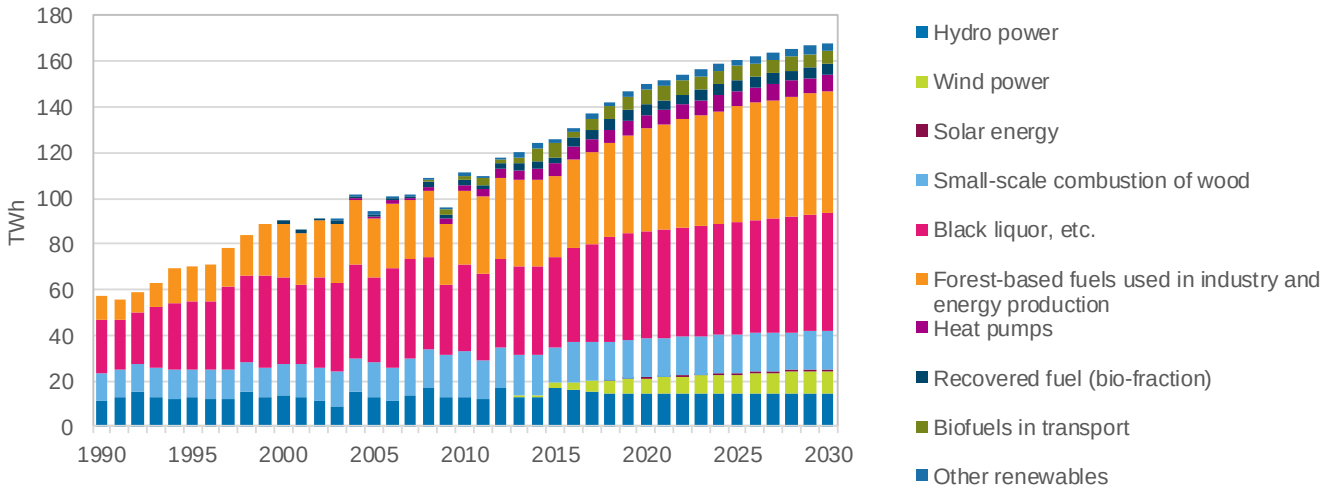


Table 4.2 Historic development and WM projection for renewable energy, TWh

	2005	2010	2015	2017	2020	2025	2030
Black liquor and other concentrated liquors	37	38	39	43	47	49	51
Forest-based fuels used in industry and energy production	26	32	36	40	45	51	54
Small-scale combustion of wood	15	20	16	17	17	17	17
Hydro power	13	13	17	15	14	15	15
Heat pumps	1	3	5	6	6	7	7
Wind power	0	0	2	5	7	8	9
Biofuels for transport	0	2	6	5	6	6	6
Recovered fuel (bio-fraction)	1	2	3	4	5	5	5
Other renewables	1	1	2	2	3	4	4
Total	94	111	126	137	150	161	168

Renewable energy policies and measures for the transport sector are described in Section 4.2.2.

Energy use in residential and other buildings

Policies and measures for buildings and housing aim at improving energy efficiency, making the energy use in buildings smarter, reducing ETS and non-ETS-emissions and increasing the use of renewable energy sources. Policy measures include standard-setting, economic instruments, dissemination of information, and education and research. Measures are targeted both at new buildings and at the existing building stock including the use and maintenance of the building stock. In addition to policy measures in the building sector, energy use is affected by the EU emissions trading scheme ETS-via changes in the prices of heat and electricity.

CO_2 emissions from the use of energy in buildings are mainly covered by the EU ETS. District heating is the source of about half of all space heating in Finland. The majority of district heating production falls within the sphere of the EU ETS. The total space heating energy used in residential, commercial and public buildings was 72 TWh in 2017 (19 per cent of the total end use of energy in Finland). Slightly less than 30 TWh of the space heating belonged to the non-ETS sector in 2017.

The Directive on the Energy Performance of Buildings (EPBD)[20] aims to reduce CO_2 emissions by improving the energy efficiency of buildings. The directive was implemented in Finland by a regulation that came into force at the beginning of 2008. This legislation on the energy efficiency of buildings includes the following:

- Act on Energy Certification of Buildings[21]
- The Ministry of the Environment Decree on Energy Certification of Buildings[22]
- Act on Inspection of Air-conditioning Systems[23]
- Amendments to the Land Use and Building Act,[24] which was expanded to cover energy efficiency requirements and details on how energy efficiency should be calculated[25].

[20] 2002/91/EC

[21] 487/2007

[22] 765/2007

[23] 489/2007

[24] 1129/2008

[25] 488/2007

The minimum requirements for thermal insulation and ventilation in new buildings have been set by the National Building Code since 1976. The energy efficiency requirements were tightened by 30 per cent compared to earlier requirements (2003) in December 2008 due to the implementation of the EPBD. The requirements were further tightened (by 20 per cent) in March 2011 due to the implementation of the Directive on the Energy Performance of Buildings (Recast).[26] The building regulation came into force in July 2012, and it is based on the overall energy consumption, which takes into account, among other things, air conditioning, cooling, lighting and heating, the washing water and heating energy. The regulation favours the utilisation of district heating and renewable energy when defining the energy performance of a building as a whole. Also, due to the implementation of the Directive on the Energy Performance of Buildings, EPBD, the regulation for the energy efficiency of the existing building stock was given in February 2013 and this Ministry of the Environment Decree[27] on improving the energy performance of buildings undergoing renovation or alteration came into force in June 2013. Due to the implementation of the EPBD, energy regulations were revised again in 2017 and nearly zero-energy regulations for new buildings were given and new regulations entered into force on 1 January 2018.

The Ministry of the Environment is responsible for legislation and guidelines regarding energy performance certificates, energy performance certificate templates and other instructions concerning the issuance of certificates. All new buildings need an energy certificate when the building permit is applied. For existing buildings, energy performance certificates are needed when the building (or its part, for example an apartment) is sold or rented. The Housing Finance and Development Centre of Finland (ARA) is the administrative authority ensuring the quality of certificates and the qualified experts, and the appropriate preparation and use of the certificates.

Low-carbon renewable energy heating systems have become increasingly popular in Finland, especially heat pumps in detached buildings. In 2017, about half of new detached houses had ground source heating pumps as their main heating systems. About 15 percent of new detached houses were connected to district heating and the rest had other heat pumps, direct electricity or forest-based energy (pellets, small-scale firewood) as the main heat source.

A tax incentive scheme for domestic employment of various service providers has been in effect since 2001. A household may deduct 20 per cent of personnel salary costs or 50 per cent of company-provided services from personal taxation. Although the deduction can be applied to various type of work carried within a household, the emphasis has been on encouraging households to make improvements and alterations in heating system and installing systems using renewable energy sources. At the moment, the annual maximum for tax deduction is EUR 2,400/person.

Based on the modification in the decree of the national building code for sewage and fresh water systems, water measurement instruments became compulsory in new apartment buildings at the beginning of 2011. The aim was to reduce the consumption of water and the need for heating it. The water measurement instruments provide information on the use of water in each apartment and make it so that the billing is done according to the actual water use, which provides a direct price signal for inhabitants. The requirement was expanded into the existing building stock in 2013 in the case of pipe and plumbing system repairs subject to a building permit.

Information provision and the campaigns supported by the Government seek to influence the behaviour of building users and owners. At the moment, activities exist for giving internet-based informational guidance, e.g. in repair, energy efficiency and building maintenance issues.

---

[26] 2010/31/EU

[27]- 4/2013

Improvement of the built environment, including the transport systems, plays a key role in reducing greenhouse gas emissions and mitigating climate change. The Energy-Smart Built Environment 2017 (ERA17) action plan originally proposed 31 necessary actions for reducing emissions in the built environment, for improving energy efficiency and for promoting the use of renewable energy. The overall target of the programme is to create an 'energy-smart built environment' that is energy-efficient and low in emissions and that provides a high-quality living and working environment. The action plan combined simultaneous and former programmes and was drawn up as a joint effort by the Ministry of the Environment, the Finnish Innovation Fund (Sitra) and the Finnish Funding Agency for Technology (Tekes) and in collaboration with the business sector, research institutions and the public administration. The programme has focused on land use, decentralised energy production, building policies, use and ownership of real estate and know-how for the years 2013 to 2014. The actions within the programme were continued from 2015 to 2017. The programme ended in 2017.

The emission impacts of building-related policy measures have been evaluated using EKOREM and POLIREM calculation models (see Finland's third Biennial Report, Section 5.7.3) and information on the emission coefficients for district heating and electricity. These models calculate the heat and energy consumption and the resulting greenhouse gas emissions of the building stock. The impacts of policy measures are evaluated by modifying the energy efficiency of the building elements (EKOREM) or specific consumptions of energy (POLIREM), or the distribution of heating systems. The energy savings are converted into emission reductions with an average emission coefficient in the case of district heating (210 kg CO_2/MWh) and with a mean marginal emission coefficient in the case of electricity (600 kg CO_2/MWh).

The regulation for the energy performance of new buildings entails 2.2 million tonnes of annual emissions reductions of CO_2 by 2030. Almost all of the emission reduction will take place in the EU ETS sector through the reduced use of electricity and district heat.

Due to the implementation of the Directive on the Energy Performance of Buildings (Recast), the regulation for the energy efficiency of the existing building stock was put into effect on 27 February 2013. It is estimated that the emission reductions due to improvements in energy performance in renovations and alterations will be annually 0.4 million tonnes CO_2 in 2020 and 0.94 million tonnes CO_2 in 2030. Most of the emissions reductions will take place in the EU ETS sector. However, there are expected non-ETS emissions reductions from oil fuel boiler replacements, especially in detached houses.

Consumer energy advice

The Ministry of Economic Affairs and Employment has been building an energy advice infrastructure for consumers since 2010. In 2014, this responsibility was transferred to the Energy Authority. In 2018, the Energy Authority commenced strengthening of regional advice services as part of the Energy Authority's programme on regional energy and climate work. The work started with 12 short experiment projects in 12 provinces. The Energy Authority invited tenders for regional energy advice service for each province in Finland during winter 2018–2019. Energy advisors were chosen in spring 2019. Now the government-funded energy advise service is provided throughout Finland for 4 years. The Energy Authority is responsible for the coordination of the projects. Main goal of the regional energy advise service is to increase awareness of energy efficiency and renewable energy. The target groups are in addition to consumers also municipalities and small and medium-size enterprises.

Motiva Oy, a hundred per cent state own sustainable development company in Finland, is the national coordination centre for consumer energy advice. In parallel to field activities in projects, coordination activities have been carried out to strengthen internet, telephone and e-mail advisory services and to develop advisor training, communications,

marketing, and monitoring and evaluation. Energy advisory services enable consumers to rationalize their ways to use energy, while they also learn of the possibilities offered by renewable energy sources.

Policies and measures in the WAM projection

Additional measures planned for the energy sector are:

- Phase out the use of coal for energy use during the 2020s.
- Technology neutral tendering processes in 2018−2020 on the basis of which aid will be granted to the most cost-effective new electricity production from renewable energy.
- An obligation to blend 10 per cent of bioliquids into light fuel oil used in machinery and heating.

Phasing out coal

The Energy and Climate Strategy for 2030 outlines that Finland will phase out the use of coal for energy by 2030. No new power plants burning hard or brown coal shall be built, nor shall any replacement investments based on coal be made. Once the existing plants based on pulverised fuel combustion have been decommissioned, coal will only be used as a backup fuel in exceptional situations.

On 29 March 2019 a law[28] prohibiting the use of coal in energy production as from 1 May 2029 was enforced. The prohibition will reduce the use of coal by an estimated 3 TWh compared to market-based development without the prohibition. A special incentive package to support replacement investments is under preparation for those district heating companies in towns and cities that undertake to give up the use of coal as early as 2025.

Renewable energy supply

In May 2018, the Parliament approved the amendment to the act[29]on production aid for electricity from renewable energy sources, which laid down provisions for the new premium system. The premium system is based on a competitive tendering process, and investments in different renewable energy sources compete with each other so that the cost-effectiveness target will be taken into account.

Tendering for 1.4 TWh of renewable electricity was held in December 2018 and the results were published in March 2019 [30].

Energy use in residential and other buildings

According to the Government report on the National Energy and Climate Strategy for 2030, there is an obligation to blend 10 per cent of bioliquids into light fuel oil used for heating of buildings. The Act on the Promotion of the Use of Biofuel Oil was approved by Parliament on 6 February 2019[31]. According to the Act, the proportion of biofuel oil in the light fuel oil used for heating and machinery will be at least 3 per cent in 2021 and, increasing thereafter by one per cent per year, to be at least 10 per cent in 2028. A commitment to phase out oil heating in the public sector is included in the Medium-term Climate Change Policy Plan.

[28] 416/2019

[29] 441/2018

[30] https://energiavirasto.fi/preemiojarjestelma

[31] 419/2019

Machinery

The Government report on the National Energy and Climate Strategy for 2030 includes an obligation to blend 10 per cent of bioliquids into light fuel oil used for machinery. The Act on the Promotion of the Use of Biofuel Oil was approved by Parliament on 6 February 2019[32]. According to the Act, the proportion of biofuel oil in the light fuel oil used for heating and machinery will be at least 3 per cent in 2021 and, increasing thereafter by one per cent per year, to be at least 10 per cent in 2028.

Additional measures for machinery are included in the Medium-term Climate Change Policy Plan, mainly to improve energy efficiency. The measures include, for example, the following:

- Promotion of biogas in machinery
- Changes in the taxation of light fuel oil
- Promotion of energy efficient and low emission machinery through public procurements
- Promotion of energy efficient use of machinery through information and advisory action
- Strengthening of the information base related to machinery.

Summary of policies and measures
A summary of the policies and measures in the energy sector is presented in CTF Table 3.

4.2.2 Transport

Policies and measures in the WM projection

Policies and measures within the transport sector under the WM projection are outlined in CTF Table 3. The WM projection includes all measures that were in use in the transport sector to cut down the emissions in the end of 2017. The measures are designed to achieve the target of the Climate Policy Programme for the Transport Sector and Finland's Long-term Climate and Energy Strategy, −15 per cent in 2020 compared to 2005. The measures also contribute to achieving the EU's Effort Sharing Decision target.

The WM projection contains the following measures: 1) promoting the use of biofuels within the transport sector, 2) improving the energy-efficiency of vehicles, and 3) improving the energy-efficiency of transport system by promoting the choices of more environmentally friendly modes of transport and curbing the growth of vehicle kilometres. It is assumed that the growth in transport performances needs to stay at a moderate level (0.5 to 1.5 per cent per year) so that it will be possible to achieve the climate policy aims within the transport sector.

Promoting the use of biofuels

The amendment to the national act on promoting the use of biofuels within the transport sector[33] came into force on 1 January 2011. Under the Act the annual minimum share of biofuels, measured from the total energy content of petrol, diesel and biofuels delivered for consumption, had to be 6 per cent in 2011–2014 and then gradually raising to 20 per cent in 2020. The energy content of second-generation biofuels (biofuels produced, for example, from waste material) is taken into account as double its actual energy content when calculating the share of biofuels for the purposes of the distribution obligation.

[32] 419/2019

[33] 446/2007

In 2017 approximately 10 per cent of all road transport fuels used were biofuels (without double-counting). The measure achieved an estimated 1.2 million tonnes of CO_2 reduction in transport-related greenhouse gas emissions in 2017. It is expected that biofuels will account for 20 per cent (double counting included) of all fuels consumed in transport in 2020. This would consist of first-generation biofuels (seven per cent of all road transport fuels sold) and second-generation biofuels (6.5 per cent of all road transport fuels sold). Biofuels would, in other words, replace 13.5 per cent of fossil fuels in transport in 2020, but as the contribution of second-generation biofuels is considered to be twice that made by other biofuels, the calculated share of all road transport biofuels would be 20 per cent. This means that fossil fuels equalling emissions of an estimated 1.6 to 1.7 million tonnes of CO_2 would be replaced by biofuels in 2020.

For the purposes of the ex-ante assessment of the policy measure, emissions occurring during cultivation of biofuel raw materials, where applicable, are allocated to the country of origin of the raw material. The assumed cultivation emissions are adopted from the information in the EU Renewable Energy Directive[34]. Emissions from biofuel production outside Finland are excluded from the reported estimates. For 2020 it is assumed that the raw materials origin mainly from abroad and that the net emission reduction impact in Finland of the policy measure is 1.6 million tonnes of CO_2.

Improving the energy-efficiency of vehicles

In the Climate Policy Programme for the Transport Sector 2009-2020, the aim for improving the energy-efficiency of vehicles is that by 2020 specific emissions of new cars sold in Finland would be near the EU target (95 g/km; the level in 2017 was at around 118.8 g/km), and that the rate of vehicle fleet renewal would be around six to seven per cent a year. In the updated programme, Environmental Strategy for Transport 2013–2020, the target is also that 50 per cent of new cars sold will be able to use alternative fuels in 2020.

The regulation of the European Parliament and of the Council[35] setting emission performance standards for new passenger cars (a binding CO_2 standard for passenger cars) entered into force in June 2009. The objective of the regulation is to establish manufacturer-specific emission performance standards for new passenger cars registered in the Community. It sets the target for the average CO_2 emissions for new passenger cars at 95 g/km by 2020. A corresponding regulation[36] for light commercial vehicles entered into force in 2011. This regulation sets a target of 175 g CO_2/km by 2017 and 147 g/km by 2020 for the average emissions of new light commercial vehicles registered in the Union. Furthermore, the new Regulation setting CO_2 emission performance standards for new passenger cars and for new light commercial vehicles[37] was adopted on 17 April 2019. The new Regulation sets CO_2 emission targets for new passenger cars, light commercial vehicles for the period beyond 2020 until 2030. The new Regulation will start applying on 1 January 2020, when the current Regulations setting CO_2 emission standards for cars and vans will be repealed. Incentivising different procurers to invest in environmentally friendly vehicles has been promoted since the EC Clean Vehicles Directive[38] entered into force.

In Finland, the tax on passenger vehicles consists of several elements that are differentiated according to vehicle-specific emissions (CO_2 g/km). Initially, at the event of the first registration, a one-time tax ("Car Tax") is paid. For

[34] 2009/28/EC

[35] 2009/443/EU

[36] 2011/510/EU

[37] 2019/631/EU

[38] 2009/33/EC

this registration tax, the lowest tax rate in 2019 (2.7 per cent) applies to cars with zero CO_2 emissions, while the highest tax rate (50 per cent) applies to cars with CO_2 emissions exceeding 360 g/km. Furthermore, the basic part of the vehicle tax, which is paid annually, is also differentiated according to CO_2 emissions of each vehicle similarly to the registration tax. This basic part of the emission-based vehicle tax is EUR 0.15-1.80 per day, depending on the car's specific CO_2 emissions. Vehicle tax is collected from the period that the vehicle has been announced to be used in traffic, or from the period of 365 days if the vehicle has not been announced to be taken out of traffic. The second part of the annual tax is based on the type of fuel the cars uses. Petrol-fuelled cars have no additional tax. Cars fuelled with diesel, methane or electricity have an additional annual tax (fuel fee) that is relative to the mass of the car ("mass in running order"), but not to the specific CO_2 rate itself. However, the CO_2 rate and vehicle mass have a certain correlation.

Energy efficiency of vehicles is also promoted by support for buying fully electric cars, for gas or ethanol conversions of old cars, for a public charging point infrastructure for electric cars, for biogas distribution stations and support designed for the charging point infrastructures of housing companies. Appropriations for these purposes have been reserved in the central government budget starting from 2018. Furthermore, an eight-month scrapping premium campaign was implemented in 2018, in which the buyer of a new car who scraps the old car was offered support from central government to the amount of EUR 1,000–2,000, depending on the power source of the car. In addition, a Green deal model for automobile dealers was concluded in 2018 directing them to present low-emission vehicle alternatives to customers.

Finland has also been active to provide people with more information about the CO_2 emissions of passenger cars. Examples of this include the energy label for cars, the online car comparison engine produced by the Finnish Transport and Communications Agency, which enables potential car buyers or used-car owners to compare different car models based on fuel consumption and CO_2 emissions[39], information campaign for alternative power sources[40] and the Choosing a Car website[41].

During the period 2007 to 2017, the average CO_2 emissions of new cars decreased by 33 per cent. The average CO_2 emissions in 2017 were 118.5 g/km for new petrol-driven passenger cars and 126.2 g/km for diesel-driven passenger cars (see Chapter 2, Figure 2.12). A total of some 118,600 new cars were sold in 2017 (the goal was 150,000).

Improving the energy-efficiency of the transport system

According to the Climate Policy Programme 2009-2020 for the Transport Sector, the energy efficiency in transport should be improved. This can be achieved through means such as coordinating transport and land-use, promoting walking, cycling and public transport, and public sector vehicle and transport service procurement. Energy efficiency in the transport sector can also be improved by enabling and developing new mobility services and shared mobility. Intelligent transport and the use of information technology (IT) will help to improve both the traffic safety and fluency as well as achieving the environmental targets in the transport sector. It also creates significant business opportunities for companies.

At the beginning of 2017, the energy efficiency agreements in the transport sector were substituted with the Responsi-

[39] https://autovertaamo.traficom.fi/?lang=en

[40] https://www.traficom.fi/fi/ajavaihtoehtoa (only in Finnish)

[41] https://www.motiva.fi/ratkaisut/kestava_liikenne_ja_liikkuminen/nain_liikut_viisaasti/valitse_auto_viisaasti (in Finnish)

bility Model[42], the target of which is to promote responsible and sustainable transportation. The Responsibility Model is a voluntary management system taking into account finance, safety, quality and environmental aspects, including energy efficiency. The Responsibility Model has been developed by the transport administration in cooperation with the transport sector.

In 2013, the Ministry of Transport and Communication prepared a decree[43] on new maximum masses and dimensions of heavy goods vehicles and vehicle combinations. The decree raises the maximum allowed height of a vehicle from 4.2 to 4.4 meters and the maximum allowed mass from 60 to 76 tonnes. The decree entered into force on 1 October 2013. One goal of this update was to improve the energy efficiency in road freight transport. This update was estimated to reduce the total CO_2 emissions in the transport sector by around 2 per cent annually. Since 2013, further increases in maximum masses and dimensions have been affected by making minor amendments to the decree. In January 2019, the maximum length of vehicle combination in road traffic was increased from 25.25 to 34.5 meters, while the maximum permissible mass remained at 76 tonnes.

A national strategy and implementation plan for the promotion of walking and cycling, covering the period 2011 to 2020, was released in 2011. This strategy is aimed at increasing the share of trips made walking or cycling. The target is that by 2020, the share of walking and cycling rises from the current 32 per cent to 35 to 38 per cent in the modal split, and the proportion of short trips made by passenger cars decreases correspondingly.

The popularity of public transport, walking and cycling is also promoted through Mobility Management., which was made a national-level project in 2010. Mobility Management is a broad concept, the objective of which is to reduce dependence on private cars. The aim is to offer better information about alternative transport modes and more attractive services, and to promote public transport, cycling, walking, carpooling and car sharing. Mobility Management activities at the city/regional level are supported through a yearly appropriation of EUR 0.9 million from National Government. Cities and regions can apply for this funding every year. Around 30 projects were funded both in 2017 and 2018.

Policies and measures in the WAM projection

CTF Table 3 sets out the main policies and measures included in the WAM projection for the transport sector. The WAM projection is based on the National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan for 2030, and contains the following measures: 1) promoting the use of biofuels in the transport sector (additional measure), 2) improving the energy-efficiency of vehicles (additional measures), and 3) improving the energy-efficiency of the transport system (additional measure).

The obligation to distribute transport biofuels will be gradually increased as of 2021, from 18 per cent to 30 per cent by 2029 as the Act[44] entered into force on 1 April 2019. Similarly, the obligation to distribute advanced biofuels will be tightened from 2021 onwards, reaching 10 percentage points by 2030. With the new legislation the double counting mechanism will be abolished. Promoting the use of biofuels (additional measure) includes increasing the physical share of biofuel energy content in all liquid fuels sold for road transport to 30 per cent by 2030. It has been estimated that the emission reduction from avoided fossil fuel use will be as much as 1.6 million tonnes CO_2 in 2030. In the ex-

[42] https://www.traficom.fi/fi/vastuullisuusmalli

[43] 407/2013

[44] 419/2019

ante assessment of the impact of the policy measure, it is assumed that biofuel in gasoline is bioethanol and biofuel in diesel is biodiesel. Taking the domestic emissions of biofuel raw material cultivation into account in accordance with the EU Renewable Energy Directive[34], the net emission reduction impact of the policy measure is assessed to 1.2 million tonnes CO_2 in 2030.

Improving the energy-efficiency of vehicles (additional measures) includes very stringent CO_2 standards for new cars and light commercial vehicles (i.e. reaching 64 g CO_2/km for cars and 106 g CO_2/km for light commercial vehicles in 2030). In addition, the energy efficiency of heavy-duty vehicles is expected to further increase. In May 2018, the European Commission proposed a Regulation on reducing CO_2 emissions from new heavy-duty vehicles. The Regulation[45] entered into force 14 August 2019. In November 2017, the Proposal for a Directive of the European Parliament and of the Council amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles was released. The general objective of this initiative is to increase the market uptake of clean, i.e. low- and zero-emission vehicles, in public procurement and hence to contribute to reducing overall transport emissions, and to competitiveness and growth in the transport sector. The new Directive[46] was published on 12 July 2019. It has been estimated that the emission reduction effects of improving the energy-efficiency of vehicles will total around 1.2 million tonnes CO_2 by 2030.

According to the National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan for 2030, the aim is to reduce the number of car journeys with no passengers but only the driver, and to halt the increase in the use of passenger cars in urban areas regardless of growth in population. For that aim, the current self-service market, where people own a vehicle and self-cater for their transport and mobility needs, has to be replaced by a service market, where people do not own vehicles anymore, but buy transport and mobility services.

The development of new service models and the revolution of the transport market will be promoted by reforming and relaxing the current legislation on the transport market through the introduction of a unified regulatory act (Act on Transport Services). The Act will provide a better response to user needs, facilitate companies' access to the market and promote the interoperability of different parts of the system. At the same time, the deployment of new technologies, digitalisation and new business concepts is encouraged. The reform will be implemented in three stages, most parts of the first and second stage entered into force 1 July 2018. The Act on Transport Services envisages that essential data on transport services are made open, laying down provisions for the interoperability of different ticket and payment systems. This is expected to facilitate combinations of different transport services.

Another measure to improve the energy efficiency of the transport system is to coordinate transport and land use as well as promote the conditions for walking, cycling and public transport, especially in urban areas. The Act on Transport services brings together transport market legislation and creates preconditions for digitalisation of transport. In overall, public transport is regulated with the requirements of the EU's PSO regulation. Competent public authorities organise public transport in their area if there is no market-oriented transport. Digitalisation of transport services in large scale cities has been promoted through EUR 3.5 million government subsidy in 2018.

A new programme and a government resolution to promote walking and cycling was adopted in 2018. The resolution and the programme include ten sets of measures aiming to increase the number of walking and cycling trips by 30 per cent by year 2030. At least half of this increase should come from replacing car journeys. An entirely new measure mentioned in the programme is a joint investment programme by the state and municipalities to improve the condi-

[45] 2019/1242/EU

[46] 2019/1161

tions for walking and cycling in the urban street network. To launch the programme a total of EUR 7 million has been allocated for 2018–2019.

Improving the energy-efficiency of the transport system (additional measure) includes reducing the number of car journeys with only the driver, and to halt the increase in the use of passenger cars in urban areas regardless of a growth in population. It has been estimated that the emission reduction effects of improving the energy-efficiency of the transport system will be as much as 0.4 million tonnes CO_2 by 2030.

Summary of policies and measures
A summary of the policies and measures in the transport sector is presented in CTF Table 3.

4.2.3 International bunkers

Policies and measures in the WM projection

Finland has participated actively in IMO's and ICAO's work to limit emissions from international traffic. At the ICAO Assembly in October 2016, a global carbon offsetting scheme for international aviation was adopted. By this decision, aviation became the first industrial sector to have a global market-based measure scheme in place. The Carbon Offsetting Scheme for International Aviation (CORSIA) Standard and Recommended Practices (SARPs) became applicable on 1 January 2019. The approach for CORSIA is based on comparing the total CO_2 emissions for a year (from 2021 onwards) against a baseline level, which is defined as the average CO_2 emissions from international aviation covered by the CORSIA for the years 2019 and 2020. Under CORSIA, aircraft operators will be required to purchase offsets for the growth in CO_2 emissions covered by the scheme from 2021 onwards. CORSIA aims to address any annual increase in total CO_2 emissions from international civil aviation above 2020 levels.

In July 2011, IMO approved binding energy efficiency targets for new ships. An Energy Efficiency Design Index (EEDI) will be calculated for each ship during the planning phase. The EEDI regulations will gradually improve energy efficiency of new ships so that new ships built from 2015 onwards are more energy efficient than the ships built during 2000-2009 on the average (10 per cent more energy efficient in and after 2015, 20 per cent in and after 2020 and 30 per cent in and after 2025). The new regulation has been in force since the beginning of 2013. In addition, all ships, the gross tonnage of which is 400 tonnes or more, are required to compile a Ship Energy Efficiency Management Plan (SEEMP) following a guidance format prepared by IMO. These measures were implemented in the national legislation[47] of Finland at the end of 2014.

At EU level, the Regulation on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport (MRV Regulation)[48] entered into force in 2015. The first monitoring year was 2018. From 2019, by 30 April each year, companies shall submit to the Commission verified annual emission reports. In July 2019, the Commission made publicly available the information on CO_2 emissions from maritime transport in accordance with the MRV Regulation. The information covers around 10,800 ships and the CO_2 emissions reported by these ships represent more than 130 million tonnes of CO_2 emissions in 2018.[49]

Aviation has been included in the EU emissions trading scheme (EU ETS) since 2012. Between 2013 and 2016, the

[47] 1113/2014

[48] 2015/757/EU

[49] https://ec.europa.eu/clima/news/commission-publishes-information-co2-emissions-maritime-transport_en

EU ETS covered flights between aerodromes located in the member states of the European Economic Area. In February 2017, the European Commission decided to continue the intra-EEA scope beyond 2016. In the absence of a new amendment, the EU ETS would revert to its original full scope from 2024. From the beginning of 2021, a linear emission reduction factor will be introduced for aviation emissions trading, which will reduce the amount of allowances allocated free of charge to aircraft operators each year by 2.2 per cent, calculated based on the amount of allowances in 2020. The future of the EU ETS and its adjustment to CORSIA will be reviewed based on the developments of the contents and effectiveness of the global scheme.

As a member of the European Union, Finland is implementing the EU ETS for aviation. The number of allocated EU aviation allowances (EUAAs) in 2017 was smaller than the emissions from the aviation sector. Aircraft operators therefore had to purchase EUAs from the stationary sector to comply with their emissions cap, set separately from the EU ETS cap for stationary installations.[50]. The Ministry of Transport and Communications is actively involved in EU policymaking to enhance the effectiveness of the EU ETS for aviation.

As a Member of the EU and European Civil Aviation Conference ECAC, Finland submits its State Action Plan[51] for International Aviation CO_2 Emissions to ICAO every two years in order to communicate Finland's activities to address CO_2 emissions from international civil aviation.

Policies and measures in the WAM projection

The Directive of the European Parliament and of the Council on the deployment of alternative fuels infrastructure entered into force in October 2014[52]. According to the Directive, all Member States have been required to draft a national policy framework for the development of an alternative transport fuel market and deployment of a related infrastructure by November 2016. The national policy framework specifies the alternative transport fuels and their distribution infrastructure targets for 2020 and 2030 as well as the measures by means of which the targets will be achieved. Each Member State shall submit to the Commission a report on the implementation of its national policy framework by 18 November 2019, and every three years thereafter. Finland's first national plan for a distribution network for alternative transport fuels[53] was published in March 2017.

According to the plan, in maritime transport the objective is to decrease greenhouse gas emissions by 40 per cent by 2050 (compared to 1990) with measures including the use of LNG (liquefied natural gas) and biofuels. In aviation, the target is to bring the share of renewable or other emission-reducing solutions up to 40 per cent as a minimum by 2050.

At IMO, the member states have reached an agreement on a three-step approach to decreasing greenhouse gas emissions from international shipping. The first step is to compile data on fuel consumption, following the mandatory data collection system (DCS), which was adopted at the 70th session of the Marine Environment Protection Committee (MEPC 70) in 2016. The second step is to analyse the data and the third step is to consider how to reduce greenhouse

[50] Trends and projections in the EU ETS in 2018 - The EU Emissions Trading System in numbers. EEA Report No 14/2018.

[51] https://arkisto.trafi.fi/filebank/a/1531731619/cd3a5096c1aca9af86acd2a079dac9c9/31344-State_Action_Plan_of_Finland_2018_International_Aviation_CO2_Emissions.pdf

[52] 2014/94/EU

[53] http://urn.fi/URN:ISBN:978-952-243-501-9

gas emissions from international shipping. At MEPC 70 in 2016 IMO, the member states also approved the Roadmap for Developing a Comprehensive IMO Strategy on Reduction of GHG emissions from Ships. In April 2018, MEPC 72 adopted the Initial IMO Strategy on reduction of GHG emissions from ships. The Initial Strategy envisages a reduction in total greenhouse gas emissions from international shipping and identifies three levels of ambition as follows: Firstly, carbon intensity of ships to decline through implementation of further phases of EEDI for new ships. Secondly, carbon intensity of international shipping to decline with reductions in CO_2 emissions per transport work, as an average across international shipping, by at least 40 per cent by 2030, pursuing efforts towards 70 per cent by 2050, compared to 2008. Thirdly, to peak greenhouse gas emissions from international shipping as soon as possible and to reduce the total annual greenhouse gas emissions by at least 50 per cent by 2050 compared to 2008. According to the Roadmap, by 2023 IMO member states should come to an agreement on a final strategy on short, medium, and long-term measures, taking into account the results from the IMO Data Collection System.

The Black Carbon (BC) emissions also have a huge impact on climate change, especially in the polar areas. Finland is committed to decreasing BC emissions in the polar regions and supports legally binding regulations on black carbon that are currently lacking in the Polar Code. The Finnish Transport and Communications Agency Traficom together with the Finnish Meteorological Institute (FMI) and VTT Technical Research Centre of Finland Ltd have been conducting studies to test the candidate measuring methods and collect data on BC emissions from shipping. Preliminary results are introduced in IMO, but more research work is needed before any regulations to limit BC emissions can be considered.

Summary of policies and measures

A summary of the policies and measures for international bunkers is presented in CTF table 3.

4.2.4 Industrial processes and product use

The most important greenhouse gas emissions from industrial processes are CO_2 emissions from iron and steel, hydrogen and cement production. The main factors affecting the development of these emissions include changes in industrial production activity.

In the WM projection, the growth of the industrial production increases the emissions. Most of the industrial process emissions in this sector are part of the EU ETS, which also is the main measure for reduction of the process emissions. No additional measures are planned for these emissions. The policies and measures described in the WM and WAM projections address therefore only measures related to the F gases.

Policies and measures in the WM projection

The amount of emissions from F gases (HFC, PFC, SF_6) was about two per cent of total emissions in 2017. HFC emissions increased since the 1990s until 2013 but have started to decline since their peak level. Both PFC and SF_6 have variating emission trend and in the recent years the emissions have increased again. Compared to 1990, PFC emissions were 28-fold in 2017. SF_6 emissions were 4 per cent lower in 2017 compared to 1990. F gases are not produced in Finland.

The most important regulations affecting the amount of these gases are the F gas regulation[54] and the directive relating to HFC emissions from air-conditioning systems in motor vehicles.[55] Also, technical development has affected the

[54] 2014/517/EC

[55] 2006/40/EC

development of emissions. Main features of the F gas regulation in cutting the F gas emissions are a phase down of HFCs that can be placed on the EU market, bans on the use of HFCs in certain applications and obligations related to leak checking and repairs, F gas recovery and technician training.

The WM projection for F gases includes the impacts of the EC regulation and the EC directive referred to above. Emissions from refrigeration and air conditioning equipment are expected to decline due to measures and technical changes leading to smaller charges and decreased leakage. The main features of the F gas regulation in cutting the emissions will lead to a replacement of HFCs with low GWP alternatives in most applications.

Emissions from electricity distribution equipment have declined heavily as a result of voluntary actions by the industries. A steady increase of emissions is assumed in the future but the peak level of emissions in the 1990s will not be reached. Restrictions forced by the EC regulation have a decreasing effect on emissions from foam blowing and aerosols in the future. The emissions from other sources are expected to stay quite steady. Emissions from refrigeration and air-conditioning equipment account for more than 90 per cent of Finnish F gas emissions, and therefore the projected overall emission trend is declining.

Policies and measures in the WAM projection

The WAM projection of F gases is based on a few additional measures that are expected to promote the alternative low GWP non-HFC technologies in the refrigeration and air conditioning equipment sector in addition to the F gas regulation. These additional measures include criteria for public procurement that are related to F gases and information and education campaigns.

It is estimated that the emission reduction achieved by these additional measures will be 0.2 million tonnes CO_2 eq. in 2030.

Summary of policies and measures

A summary of the policies and measures in the industrial processes and product use sector is presented in CTF Table 3.

4.2.5 Agriculture

Policies and measures in the WM projection

Finnish agricultural policy is based on the view that the competitive disadvantage due to natural conditions (such as the short growing period, low temperatures, frosts and problematic drainage conditions) must be compensated for in order to have profitable domestic production and to make agriculture sustainable and multifunctional. The objectives of sustainable and multifunctional agriculture include taking into account greenhouse gas emissions, the possible need for adaptation measures and other environmental and socio-economic aspects. These objectives can be reached through the Common Agricultural Policy (CAP) of the EU as well as through national measures. According to conclusions made by the European Council, agricultural production should continue in all areas of the Community.

The starting point of agriculture emission projection is that domestic food production will be secured and maintained at the current level and mitigation policies are implemented where the most cost-efficient reduction potential exists. Some of the effective climate policy measures may conflict with agricultural policy objectives and measures, such as securing the availability of food and animal welfare and reducing the strain on water systems. If Finnish consumption

patterns remain unchanged, a reduction in domestic agricultural production would probably not reduce global greenhouse gas emissions because domestic production would be replaced by production elsewhere.

Changes in agricultural policy and farming subsidies have had a significant influence on agricultural activities, and hence, on the emissions from this sector.

There are measures in the CAP aiming to reduce greenhouse gas emissions. Environmental compensation payments are part of the Rural Development Program for Mainland Finland 2014–2020. These payments are essential tools for promoting sustainable development in agriculture, and 86 per cent of Finnish farmers have participated in them. Their objectives are to decrease nutrient load on the environment, especially on surface and ground waters, and to preserve plant and animal biodiversity and the rural landscape. The measures also aim at maintaining or improving the productive capacity of agricultural land and reducing greenhouse gas and other air emissions as well as to adapt to climate change. One measure to reduce greenhouse gas emissions from organic soils is support for long-term cultivation of grass on organic soils.

In the Rural Development Programme there are several measures for climate change mitigation and adaptation: environment payment for incorporation of slurry, recycling of nutrients and organic matter, environment management of grassland, plant cover on arable land in winter and use of organic mulch for horticulture crops and seed potato to increase the amount of carbon in arable soil. Agricultural investment aid can be targeted to controlled subsurface drainage and more efficient handling, storage and use of manure. There is also a support system for investments in renewable energy, for example, in biogas plants. As a part of the programme advisory services will be provided regarding the cross-compliance conditions, greening payments, climate change mitigation and adaptation, biodiversity, protection of water and soil, environment payments, maintaining agricultural land, organic production and issues related to environmental efficiency, including more efficient energy use and renewable energies. Implementation of the Rural Development Programme 2014 to 2020 started in 2015.

Nitrates directive (1991/676/EEC) is a part of cross-compliance which is implemented in whole Finland. The reduced use of nitrogen fertilisers and improved manure management resulting from the measures defined in the directive has decreased not only nutrient losses to water systems but also the greenhouse gas emissions. For example, the use of mineral fertilisers has decreased by 40 per cent (based on sales statistics) between 1990–2016.

The Climate Programme for Agriculture ("Steps towards environmentally-friendly food")[56] was finalised in November 2014 and it is under implementation. The Climate Programme for Finnish Agriculture prepared by the Ministry of Agriculture and Forestry aims to further enhance the sustainability of the Finnish food system, which is founded on profitable food production and responsible consumption. By improving sustainability in a comprehensive way, it is also possible to increase the profitability of production. The objective is to improve the energy and material efficiency and reduce emissions per litre or kilogram of production. The Climate Programme for Finnish Agriculture presents a total of 76 measures to facilitate the adaptation of food production and consumption to climate change and/or to mitigate the climate change. Key measures identified in the Climate Programme for mitigation are carbon sequestration into soil, measures relating to the use of peatlands, handling and treatment of manure, more accurate nitrogen fertilization, improvements in energy efficiency, and production and consumption of renewable energy.

---

56 http://mmm.fi/documents/1410837/1867349/Climate_programme_agriculture_WEB_03072015.pdf/1a6f135c-068c-48aa-ad00-787562628314

Making use of the agricultural nutrients project[57] was a three-year pilot programme carried out in 2016 to 2018. It was part of the government key project for the circular economy, introduced in the government programme. It conveyed information on the funding possibilities related to the recycling of nutrients and essential research knowledge to practical operators. It identified the bottlenecks in nutrient recycling and facilitated their elimination as well as promotes the networking and new experiments of nutrient recycling operators. Nutrient recycling will be promoted also in the new government programme starting 2019.

The Rural Development Programmes for Mainland Finland have been the main instruments to implement climate change mitigation and adaptation measures in the agriculture sector. Rural Development programmes are evaluated as defined in the Parliament and Council regulation[58]. At programme level Finland has defined an evaluation plan and an implementation plan for evaluating climate change issues.

Policies and measures in the WAM projection

In the Government Report on Medium-term Climate Change Plan for 2030 – Towards Climate-Smart Day to-Day Living measures to cut down emission from agricultural sector are: continuous perennial cropping on organic soils, afforestation and silvopaludiculture (afforestation with raised ground water table) of cultivated organic soils, raising the ground water table through controlled subsurface drainage, promoting biogas production (emission reductions would be shared between energy and agricultural sectors, i.e. reductions in emissions from manure management would be included in agriculture and reductions in emissions from fossil fuel use in energy), promoting the increased sequestration and storage of carbon in soil and the implementation of the 4per1000 initiative through research projects and experiments. In the consumption side, measures related to food are: reducing food waste and following the national nutrition recommendations. Afforestation and silvopaludiculture on cultivated organic soils and planting wetland forests in areas with organic soil are entirely new measures, others are measures to enhance existing measures.

Summary of policies and measures

A summary of the policies and measures in the agriculture sector is presented in CTF Table 3.

4.2.6 Land use, land-use change and forestry

Policies and measures in the WM projection

The land use, land-use change and forestry (LULUCF) sector affects the mitigation of climate change in three different ways, by:

- Conserving and enhancing carbon storages and sinks
- Creating new carbon storages and sinks
- Substitution, i.e. replacing fossil-based energy, raw materials and products with renewable biomass.

The LULUCF sector as a whole is as a net sink in Finland because the emissions under this sector are smaller than the removals. This net sink from the LULUCF sector can vary greatly from one year to the next: in 1990 and in 2017 it was 14.8 and 20.4 million tonnes CO_2 eq., respectively. According to the National Forest Inventory, the annual increment of growing stock has been increasing since the 1970s, reaching its current level of 108 million cubic metres, of which 103 million cubic metres in forests available for wood supply. The high fluctuation in net biomass removals in the forest land category have been mainly caused by the changes in the international market of forest industry prod-

[57] http://mmm.fi/en/recyclenutrients

[58] 1305/2013/EU (rural development regulation)

ucts, which affect the amount of domestic commercial roundwood fellings.

Finland's forest policy aims at sustainable forest management, and the policy measures include legislation, the National Forest Strategy 2025 (NFS), financial support and extensive public forestry organisations. More information on these is provided in Finland's Seventh National Communication, Section 4.4. The National Forest Strategy 2025 was adopted by the Government in 2015. It is implemented by eleven key projects which were updated in 2019.

According to the NFS, forest growth and health will be maintained and enhanced through active forest management. Climate change mitigation and adaptation in forests are supported by diversifying forest management. Over the long term, forest management techniques must be adapted to new and changing climate conditions. Timely and careful forest management can improve the growth but also the resistance of growing stock to damages while safeguarding the ecosystem services of forests and producing wood biomass sustainably. The strong legislative and structural basis in place in Finland already can be used to reach multiple climate and forest related objectives of current policies: This includes legislation to prevent forest pests and diseases, to ensure forest regeneration and to protect habitats and species biodiversity, a long-term programme of forest tree improvement to ensure good-quality seed, ongoing projects to further develop research-based silvicultural measures as well as extensive extension services for forest owners on forest management and silviculture. Several updates have been made over the years to this legislative and structural basis, such as modifications to Forest Act[59] and the Forest Damages Prevention Act[60] in 2014 to take into account climate change adaptation by allowing more diverse forest management and by adjusting timber removal practices to earlier occurrence of pests due to warming climate. Measures related to the adaptation to the climate change are described in more detail in Finland's NC7. Relevancy and functioning of both the Forest Act and the Forest Damages Prevention Act were reviewed in 2019.

Forests will be a key part of the Finnish bioeconomy and therefore the NFS aims to increase the use of wood to replace fossil resources with renewable biomass. The objectives and measures in the National Energy and Climate Strategy for 2030 are consistent with the policy defined in the NFS regarding the increase in industrial roundwood and energy wood, and they will help achieve the target set by the directives on promoting the use of energy from renewable sources.[61] The global economic development will greatly influence the achievements of the NFS goals.

The national measures are set out in the NFS[62]. The measures, consistent with the National Energy and Climate Strategy for 2030, aim to secure the climatic advantages provided by forests and to ensure the availability of renewable raw materials. The strategy is implemented by a total of ten strategic projects updated in 2019. The completely new projects added to the National Forest Strategy apply to climate sustainable forestry, international forest policy and EU policies as well as new products made from wood. More projects than before also include the diversification of forest management methods, the safeguarding of biodiversity, water protection and the diversification of business. Projects to be considered as cross-cutting include the improvement of the availability and usability of forest, nature and environmental data and facilitation of their integration with other data sources. The cross-cutting projects include also an aim to build common understanding and cooperation between various actors with pluralistic communication and interaction.

---

[59] 1093/1996 (amendment 1085/2013)

[60] 1087/2013

[61] 2001/77/EC and 2009/28/EC

[62] http://mmm.fi/en/nfs

With regard to agricultural soils, CO_2 emissions and removals from croplands and grasslands are not expected to be subject to large changes in the WM projection by 2030. The CO_2 emission reductions due to increasing the area of perennial crops on organic soils and due to other measures in the Rural Development Programme (see Section 4.2.5) are presented in CTF Table 3.

Policies and measures in the WAM projection

The National Energy and Climate Strategy for 2030 underlines the sustainable use and management of forests (incl. biodiversity) through balanced implementation of the National Forest Strategy, emphasizing forest vitality and health, growth and carbon sinks. As a part of the implementation of the 2019 Government Plan for Analysis, Assessment and Research, a study on "Potential actions in the land use sector to achieve the climate objectives" was completed in 2019. The results of this study[63] seeking solutions to reduce emissions caused by deforestation, to increase afforestation and to produce impact and costs assessments will be further examined and measures implemented in the near future.

Measures which are identified in the Medium-term Climate Change Policy Plan relating to reducing emissions from organic soils from the agriculture sector also have effects on emissions from the LULUCF sector (see Chapter 4.2.5).

Summary of policies and measures

A summary of the policies and measures in the LULUCF sector is presented in CTF Table 3.

4.2.7 Waste management and waste tax

Policies and measures in the WM projection

A new Waste Tax Act (1126/2010) entered into force in the beginning of 2011. The purpose of the New Waste Tax Act is to collect tax from those waste fractions which could be technically and environmentally recovered, but which are disposed to landfill sites. The tax list of waste is based on Commission Decision 2000/532/EC on the Waste List. The industrial landfills are under taxation as well. The waste tax was EUR 40 per tonne as in 2011 and EUR 50 per tonne in 2013. In 2014 it was raised to EUR 55 per tonne and in 2016 to EUR 70 per tonne.

The enforcement of the Waste Act (646/2011) and the Decree on Waste (179/2012) have increased recycling and recovery. Landfilling has been reduced and greenhouse gas emissions of the waste sector have diminished. The Decree on Packaging and Packaging Waste (518/2014) is also intended to increase recycling.

The restrictions on landfilling of biodegradable municipal solid waste and other organic wastes have been made stricter. The Decree on Landfills (331/2013) restricts the amount of biodegradable and other organic waste to less than 10 per cent total organic carbon (TOC) or loss on ignition (LOI) after 2016 except for building waste where the rule will enter into force in 2020. These restrictions are expected to increase incineration of waste from current levels. According to the national energy and climate strategy of 2016 additional effort will be taken to enforce the restrictions on the landfilling of biodegradable waste.

[63] Packalen et al. 2019. The role of the land-use sector in climate change mitigation. Article Series of Government's analysis, assessment and research activities 2/2019. https://tietokayttoon.fi/documents/1927382/2116852/2-2019-The+role+of+the+land-use+sector+in+climate+change+mitigation/37efaa69-a7e6-dc43-fc47-b0b7b4037b69/2-2019-The+role+of+the+land-use+sector+in+climate+change+mitigation.pdf?version=1.0

Currently no additional measures are scheduled for the waste sector. Hence, there is no separate WAM projection.

Summary of policies and measures

A summary of the policies and measures in the waste sector is presented in CTF Table 3.

4.2.8 Land-use planning and spatial structure

The development of the urban structure has long-term effects on greenhouse gas emissions from transport and buildings. The most significant solutions that concern cutting emissions in the urban structure are associated with sustainable urban development: the urban structure and effective functioning of urban subregions, coordination of land use and transport, creating preconditions for renewable energy production and enabling a low-emission lifestyle. In urban subregions, the preconditions for this include good public transport services and a network of pedestrian and cycling routes, a living and well-functioning city centre and good accessibility of recreational and green areas. Effective urban subregions are a prerequisite for a thriving business life and Finland's competitiveness. There may be significant differences between the practical solutions used to reduce emissions in different parts of the country.

Preconditions for increasing wind power production include coordinating wind power construction with land use in the surrounding areas, giving sufficient consideration for negative impacts and ensuring local acceptability. In order to promote planning, the Land-Use and Building Act contains specific provisions on local master plans that apply to wind power construction directly. Rapid progress has been made in recent years in land-use planning for wind power construction. An amendment to the Land-Use and Building Act (1.4.2017) for the installation and construction of solar panels and solar collectors harmonises and streamlines the permit procedure so that permit consideration would only be required for solar panels or collectors that have significant impacts on the townscape or the environment.

The most recent National Energy and Climate Strategy for 2030 includes policy objectives that aim to minimise greenhouse gas emissions related to land use and the urban structure.

The National Energy and Climate Strategy for 2030 specifies the following policy objectives in relation to the spatial structure and related land-use planning:

- The effectiveness of land use and mobility in urban subregions will be promoted by developing legislation and the land-use planning system, by updating the national land use objectives, and through agreements between the central government and municipalities. Transport infrastructure implementation will be linked to land-use planning and construction with the aim of reducing emissions.
- In growing urban subregions, new construction will primarily be directed to areas with existing services and public transport. Outside growing urban centres, land use steering will be developed taking into account the need to develop areas, new trends of the natural resources economy and the strive for local energy production. Rural centres and villages will be strengthened to safeguard the local availability of services.
- In land-use planning and construction, and when making efforts to develop the steering of these sectors, preparation is made for utilising solar power.

In land-use planning, Finland will prepare to utilise extensively the country's wind power potential. In order to minimise the negative impacts of wind power plants, an effort will primarily be made to centralised wind power construction in large units at a sufficient distance from permanent housing.

Nearly all regions in Finland and many individual municipalities have prepared their own climate strategies. It is, however, difficult to provide quantitative emission reduction potentials for the policies and measures concerning land-use planning and the urban structure. The urban form influences emissions mainly in the energy sector, for example, through its effects on transport and the heating of buildings. In particular, emissions from daily mobility may be many

times higher in car-oriented zones compared to urban centre areas. Emissions from the heating of buildings depend greatly on energy solutions for the dwelling and possible district heating. The location of a dwelling is also connected to emissions via the consumption of goods and services as well as long leisure trips, mainly due to spatial differences in income levels. The overall reductions in emissions in different regions are thus dependent not only on the urban structure, but also on complex processes that include lifestyle changes as well as economic conditions and developments.

4.3 Energy taxation

Energy taxes are a substantial revenue source for the Government. They generate around EUR 4,700 million annually, or more than 10 per cent of the Government tax revenue. Over the past ten years, energy taxes have been increasing steadily in terms of the amount generated and as a share of the total tax revenue. Energy taxation is a key instrument of the Government's energy and climate policy.

Energy taxes are levied on electricity, coal, natural gas, peat, tall oil and liquid fuels. Major changes to the structure of energy taxation were introduced in January 2011. Since then, energy taxation has taken into account of the energy content, carbon dioxide emissions, local emissions and sulphur content of fuels. The overall tax rates are driven primarily by the energy content component and the CO_2 component. An additional surcharge, called the strategic stockpile fee, is also added to the total to cover expenses incurred by the state when securing the supply of energy. Energy taxation rates for 2019 are presented in Table 4.3.

The energy content component is levied on both fossil fuels and biofuels based on their volumetric energy content. Higher rates apply to fuels used in the transport sector. Lower rates apply in the case of gas oil, biofuel and heavy fuel oils and electricity used for agricultural purposes. The CO_2 component is based on the lifetime CO_2 emissions of the fuel in question, and for this reason biofuels are subject to a CO_2 tax rate that is reduced from 50 to 100 per cent if they meet the European Union's sustainability criteria. To support combined electricity and heat production (CHP), the energy content tax for heating fuels used in CHP is zero.

Furthermore, a reduced energy content tax is applied to fuel grades that are better in terms of local emissions than traditional fossil fuels. Local emissions are emissions causing health effects in nearby areas like NO_x and particle emissions. The reduction corresponds to the imputed value of the emission benefit in accordance with the principles set out in the EU Directive[64] on the promotion of clean and energy-efficient road transport vehicles.

Energy taxation rules include exemptions and reduced tax rates resulting in tax expenditure. Fuel for commercial aviation and shipping are not taxed. Peat is currently taxed at a lower rate.

In transport, diesel fuel accounts for more than 50 per cent of CO_2 emissions and energy content. Diesel and corresponding biofuels are taxed at lower rates than gasoline and corresponding biofuels, leading to a tax expenditure compared to the taxes levied on gasoline. To compensate the difference, an annual propelling force tax is levied on diesel passenger cars and vans. In heating and process use, waste and biomass are not taxed and account for more than 40 per cent of the energy content and emissions from the heating and process use of fuels. All heating fuels are taxed at a lower rate than transport fuels.

Electricity used by industry is taxed at a much lower rate than electricity used for commercial and residential purposes. Energy taxes are not levied on energy used for the transformation of other fuels and for electricity in rail.

[64] 2009/33/EC

Table 4.3 Energy taxation rates in 2019

Product	Energy content tax	Carbon dioxide tax	Strategic stockpile fee	Total
Motor gasoline c/l	52.19	17.38	0.68	70.25
Small engine gasoline c/l	32.19	17.38	0.68	50.25
Bioethanol c/l	34.25	11.40	0.68	46.33
Bioethanol R c/l	34.25	5.70	0.68	40.63
Bioethanol T c/l	34.25	0.00	0.68	34.93
MTBE c/l	42.41	14.12	0.68	57.21
MTBE R c/l	42.41	12.56	0.68	55.65
MTBE T c/l	42.41	11.01	0.68	54.10
TAME c/l	45.67	15.20	0.68	61.55
TAME R c/l	45.67	13.84	0.68	60.19
TAME T c/l	45.67	12.47	0.68	58.82
ETBE c/l	44.04	14.66	0.68	59.38
ETBE R c/l	44.04	11.95	0.68	56.67
ETBE T c/l	44.04	9.24	0.68	53.96
TAEE c/l	47.30	15.75	0.68	63.73
TAEE R c/l	47.30	13.46	0.68	61.44
TAEE T c/l	47.30	11.18	0.68	59.16
Biogasoline c/l	52.19	17.38	0.68	70.25
Biogasoline R c/l	52.19	8.69	0.68	61.56
Biogasoline T c/l	52.19	0.00	0.68	52.87
Ethanol-diesel c/l	15.18	11.65	0.35	27.18
Ethanol-diesel c/l	15.18	6.40	0.35	21.93
Ethanol-diesel c/l	15.18	1.15	0.35	16.68
Diesel oil c/l	32.77	19.90	0.35	53.02
Diesel oil para c/l	25.95	18.79	0.35	45.09
Biodiesel oil c/l	30.04	18.24	0.35	48.63
Biodiesel oil R c/l	30.04	9.12	0.35	39.51
Biodiesel oil T c/l	30.04	0.00	0.35	30.39
Biodiesel oil P c/l	25.95	18.79	0.35	45.09
Biodiesel oil P R c/l	25.95	9.40	0.35	35.70
Biodiesel oil P T c/l	25.95	0.00	0.35	26.30
Light fuel oil c/l	10.28	16.90	0.35	27.53
Light fuel oil, sulphur-free c/l	7.63	16.90	0.35	24.88
Biofuel oil c/l	7.63	16.90	0.35	24.88
Biofuel oil R c/l	7.63	8.45	0.35	16.43
Biofuel oil T c/l	7.63	0.00	0.35	7.98
Heavy fuel oil c/kg	8.56	18.78	0.28	27.51

Kerosene-type jetfuel c/l	56.76	19.24	0.35	76.35
Aviation gasoline c/l	51.70	17.21	0.68	69.59
Methanol c/l	26.10	8.69	0.68	35.47
Methanol R c/l	26.10	4.34	0.68	31.12
Methanol T c/l	26.10	0.00	0.68	26.78
LPG c/kg	9.81	18.09	0.11	28.01
Bio-LPG c/kg	9.81	18.09	0.11	28.01
Bio-LPG R c/kg	9.81	9.04	0.11	18.96
Bio-LPG T c/kg	9.81	0.00	0.11	9.92
Coal €/t	52.77	147.81	1.18	201.76
Natural gas €/MWh	7.63	12.94	0.084	20.654

Product	**Energy tax**	**Strategic stockpile fee**	**Total**
Electricity I c/kWh	2.24	0.013	2.253
Electricity II c/kWh	0.69	0.013	0.703
Tall oil c/kg	27.51	0.00	27.51
Peat €/MWh	3.00	0.00	3.00

c=0.01€

4.4 Estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry

Finland's total national greenhouse gas emission without the LULUCF sector are presented in the CTF Table 4. The emissions in 2017 (55.4 million tonnes CO_2 eq.), the most recent inventory year in the latest inventory submission to the UNFCCC, are 22 per cent lower than in the base year 1990 (71.3 million tonnes CO_2 eq.) The estimated total impact of mitigation actions on the emission trend is presented in Section 5.4. The total reduction in the emissions due the policies and measures implemented by end 2017 is estimated to be around 34 million tonnes (estimate for the year 2020).

Finland's national level emission level target, as part the joint EU target, is to reduce its non-ETS emissions so that the emissions are below the target path (the target is presented in more detail in Section 3.1 and Table 3.1). The progress made in achieving this target is illustrated in the Table 4.4.

Table 4.4 Finland's target path (annual emission allocations) for non-ETS emissions in accordance with the EU Effort Sharing Decision and corresponding emissions for the years 2013 to 2017 (2018 emission data are preliminary).

	2013	2014	2015	2016	2017	2018	2019	2020
Finland's annual emission allocations	31.8	31.3	30.8	30.3	30.2	29.6	29.1	28.5
Non-ETS emissions [1]	31.6	30.1	29.9	31.4	30.1	30.0 [3]		
Distance to the target [2]	-0.2	-1.1	-0.9	1.0	-0.1	0.4		

[1] Due to the annual implementation of the EU ESD, the emissions used for assessing compliance are not updated after the compliance assessment. Hence the emissions may differ from the most recent inventory data.

[2] Distance to the target is expressed as a negative number when actual emissions are below annual emission allocations

[3] Instant preliminary data

The EU ESD reviews and compliance assessment for the years 2013 to 2016 have been completed and Finland has met its targets for these years, for the year 2016 using emissions allocations left over and transferred from the previous years. The review of the emission estimate for 2017 has been completed, but the compliance assessment is still ongoing. The final and reviewed inventory estimates for 2018 will be available only in 2020. Based on the preliminary data, Finland will need to use left-over allocations from previous years to meet the 2018 target.

Finland has not reported on use of market mechanisms in Table 4 or 4(b) as the targets for the years 2013 - 2017 have been meet with domestic policies and measures. This is foreseen also for the years 2018 to 2020. In case this would not happen, Finland can use units from market-based mechanisms in accordance with the flexibilities described in Section 3.1 to meet is target.

Information on the use of flexible mechanisms under the EU ETS (EU-wide measure, see Chapter 3) is reported in the EU's Fourth Biennial Report under the UNFCCC.

The emissions from the LULUCF sector are not included in the EU joint target, or Finland's contribution to the emission reduction under this target under the UNFCCC, and therefore not given in the CTF Tables 4 and 4(a)I but are presented in CTF Table 1. In Finland, the LULUCF sector has been a net sink in the period 1990 – 2017, the net removals in 2017 (20.4 million tonnes CO_2 eq.) where 38 per cent higher as those in 1990 (14.8 million tonnes CO_2 eq.).

The total national greenhouse gas emissions with the LULUCF sector where 38 per cent lower in 2017 (35.0 million tonnes CO_2 eq.) than in 1990 (56.5 million tonnes CO_2 eq.).

4.5 Information on changes in domestic institutional arrangements

Finland has not made major changes in the domestic institutional, legal, administrative and procedural arrangements for domestic compliance, monitoring, reporting and archiving of information and evaluation of the progress towards Finland's emissions reductions obligations and targets since the submission of Finland's Third Biennial Report. The present domestic institutional arrangements are described in detail in Finland's 7th National communication.

The Climate Change Act entered into force in June 2015, establishing a framework for long-term and cost-effective planning and monitoring of climate policy in Finland. The climate change policy planning system includes a medium-term climate change policy plan as well as a long-term climate change policy plan and a national adaptation plan for climate change. The first medium term climate change policy plan was approved in 2017. The preparation of the Medium-term Climate Change Policy Plan and the Government's annual climate change report was coordinated by the Ministry of Environment and all relevant ministries were involved in the work. In addition, the Government is obliged to issue regular reports on the implementation of climate policies to the Parliament in form of Annual Climate Reports. The first report was given to the Parliament in June 2019 (see also Section 7.2.2). The act includes also provisions on the duties of a multidisciplinary expert body, Finland´s Climate Change Panel, in support of the planning of climate policy.

Information on the latest energy and climate strategy, Government Report on National Energy and Climate Strategy for 2030, and the first medium-term plan, Medium-term Climate Change Plan for 2030, is given in Chapter 4 of Finland's 7th National Communication, which describes also the tasks and work of the Climate Change Panel. In addition to the information given in the most recent national communication, a law[65] prohibiting the use of coal in energy production as from 1 May 2029 was enforced on 29 March 2019, which is in line with the Energy and Climate Strategy for 2030.

A new EU regulation on the Governance of the Energy Union and Climate Change Actions requires that every EU member state prepare an integrated national energy and climate plan by the end on 2019 and a long-term strategy for low-carbon development by the beginning of 2020. Preparation for the integrated national energy and climate plan is currently ongoing. The draft integrated national energy and climate plan that was submitted to the European Commission in December 2019 is based on the National Energy and Climate Strategy for 2030 and the Medium-term Climate Change Plan for 2030. Finland's long-term strategy for low-carbon development is also currently in preparation. It will complement and replace the report 'Energy and Climate Roadmap 2050' prepared by the Parliamentary Committee on Energy and Climate Issues in October 2014, that has served as a strategy-level guide toward the long-term national objective of achieving a carbon-neutral society. Statistics Finland is the national entity responsible for compiling the Finnish greenhouse gas inventory. Statistics Finland publishes the greenhouse gas inventory data three times every year. The publications include information on monitoring progress with Finland's commitments to reduce its greenhouse gas emissions under the EU and the Kyoto Protocol. The national inventory system and changes made to it since the previous biennial report are described in Chapter 2 of this report.

[65] 416/2019

5 Projections

5.1 Overview of WM and WAM projections

The projected greenhouse gas emissions and key assumptions and parameters used in the projections analysis presented in this Chapter and the CTF Tables 5, 6(a) and 6(c) are based on the National Energy and Climate Strategy for 2030, the Medium-term Climate Change Policy Plan (2017) and their projections with updates of, among others the macroeconomic development and power market projections. Background data and assumptions for the projections are presented in a separate background report to the strategy publication and in Finland's draft National Energy and Climate Plan submitted to the Commission 20 December 2018 [66]. A detailed description of methodologies, models and the process for collection and use of data is available in Finland's national system for policies and measures and projections[67].

The year 2017 (most recent inventory year available in the annual greenhouse gas emission inventory submission 2019) has been used as starting point for the projections. Policies and measures that have been implemented by 31 December 2017 are included in the "With Measures" (WM) projection. The "With Additional Measures" (WAM) projection includes in addition the policies and measures that are planned and approved by the Government or implemented after 1 January 2018. The policies and measures included in the WM and WAM projections, including estimated impacts on greenhouse gas emissions, are presented in detail in Chapter 4. A "Without Measures Projection" is not applicable for Finland's national circumstances and has therefore not been provided (see Section 4.1 for details).

In order to supplement the information given in the CTF tables, Chapter 5 provides information on emission reductions brought about by single or groups of policies and measures. This illustrates the links between the policies and measures and the way they contribute to the "With Measures" (WM) and "With Additional Measures" (WAM) projections.

In the projections, data for the historical years up to 2017 are from the greenhouse gas inventory. For these years the rows "Total excluding LULUCF" and "Total including LULUCF" in the columns for CO_2 as well as total emissions include indirect CO_2 emissions contrary to sectoral figures where indirect CO_2 emissions are not included. Consequently, the total figures for the years 2015 to 2017 are slightly higher than the sum of the sectors.

Economic growth and the change in the structure of the economy play a key role in the estimation of energy consumption and emissions. The rate of economic growth is determined by the growth rates of labour input and average labour productivity. In the long term, economic growth is determined almost solely by the growth of labour productivity, because labour input cannot grow without bounds. In the short and medium term, however, factors affecting labour input growth matter, too, because changes in labour input affect directly the potential output of the economy. In Finland, the ageing population is the single most significant factor in terms of its effect on labour input and thus development of the national economy in the short and medium term. Another factor that will affect the availability of labour is the level of structural unemployment. The population forecast of Statistics Finland is used in the projections. It estimates that the population will increase from the current 5.5 million to 5.8 million by 2035. The average size of households will decrease slightly, while the number of households is expected to grow from 2.7 million to 2.9 million

[66] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans

[67] http://cdr.eionet.europa.eu/fi/eu/mmr/art04-13-14_lcds_pams_projections/pams/pams/envxhjklq/Finland_National_system_2019.pdf

during the period The economic outlook provided by the Ministry of Finance forms the basis for the estimate regarding the development of the Finnish economy in the near future, whereas longer-term development assumptions are based on the Uutta, vanhaa ja sinivalkoista – Suomi 2040 (New, old and blue-white – Finland 2040) -report of VTT Technical Research Centre of Finland Ltd[68] and the modelling related to the report. In the case of forest industry, the growth assumptions are based on the expertise of Pöyry Management Consulting and published in the report Suomen metsäteollisuus 2015–2035 (Finland's forest industry 2015–2035)[69]. Pöyry bases its assessment on regional and global demand projections of pulp, paper and wood products, on the competitiveness of production facilities located in Finland and on investment plans published by the forest industry. The production of chemical pulp is expected to increase although the domestic use of it is likely to decrease with falling paper and paperboard production volumes. In the study, Pöyry estimates the production of printing and writing paper to decrease with 2.5 million tons from 2014 to 2035, the production of paperboard to increase with over 1 million tons and the production of other papers to remain at current level. Pöyry foresees investments in new pulp mills and a 1.8 million ton increase in chemical pulp production by 2035, but simultaneously a 0.9 million ton decrease in mechanical pulp production. Altogether, Pöyry estimates the production volume of paper and paperboard to be around 8.5 million tons and the total pulp production to be 12 million tons in 2035. For comparison, 10.3 million tons of paper and paperboard and 10.8 million ton of pulp was produced in 2017. The growing figures of chemical pulp are reflected in the amounts of bioenergy use within the forest industry itself (mostly black liquor and other concentrated liquors) and in the energy sector where more industrial wood residues and logging residues are available (see Table 4.2).

In 2016, the Finnish economy returned to a growth path after a long period of recession that began in 2009. The growth has been driven by an increase in private consumption and the recovery of public and private investment. Foreign trade has accounted for a very significant share of total output, even though it was not until 2018 that the level of exports returned to the same level as in the years preceding the global recession. The Finnish economy has experienced a structural change in the 2010s, the role of services has increased and traditional industries have been forced to adapt to changes in global demand and competition. The Government serving from 2015 to 2019 carried out reforms to consolidate public sector and to bring the Finnish economy onto a path of sustainable growth and higher employment. These reforms as well as the similar reforms carried out by the two previous Governments were one of the key factors supporting the economic boom of the Finnish economy that started in 2016. The impact of the reforms is included in the economic growth assumptions of the WM and WAM projections. The outlook of the economy for the current government that started its term in December 2019 is not as bright as it was for the two previous ones. The economy is expected to grow much less than in previous years and this slowdown is expected to continue in the first years of the next decade. The growth rate is expected to be less than 1.5 per cent in the coming years. In 2022 and 2023, the growth rate is expected to fall below 1.0 per cent. Against this backdrop, the economic growth expectation after 2020 would seem to be low compared to the assumptions used in the Seventh National Communication. There are of course many uncertainties related to the economic development in the coming decade, and it is possible that the economic growth will once again gain traction in the course of the 2020s. The growth challenge, however, is still there due to the ageing population and the diminishing work force, which do not just add pressure to the public finances but also affect economy's ability to grow.

Gross final energy consumption is levelled off in the projections as a result of increased energy efficiency in all sectors. The WAM projection includes additional energy efficiency measures particularly in transport, but also an increased energy use in biorefineries. Altogether the gross final consumption level is slightly lower in the WAM projection compared to the WM projection. The difference increases with time. The gross final energy consumption has a downward trend in

[68] https://www.vtt.fi/inf/pdf/technology/2018/T327.pdf

[69] Suomen metsäteollisuus 2015 – 2035. Loppuraportti X304203, 19.1.2016, Pöyry Management Consulting, https://tem.fi/taustaselvitykset

the WAM projection. Furthermore, the energy related emissions are substantially lower in the WAM projection. The lower emissions are the result of policy measures that replace fossil fuels with renewables and electricity.

Despite the relatively flat final consumption projection the primary energy consumption varies clearly in the projections. The main reason for this is the substantial changes in domestic nuclear power production (increase in 2020 and late 2020s), which replaces or is replaced by electricity import. Expressed in primary energy, the value of nuclear power is three-fold that of imported electricity, despite the same amount of electricity fed to consumption. The development of the primary energy supply in the WM projection is shown in Figure 5.1.

Figure 5.1. Historical development (1990 to 2017) and WM projection (up to 2030) of the primary energy supply, TWh

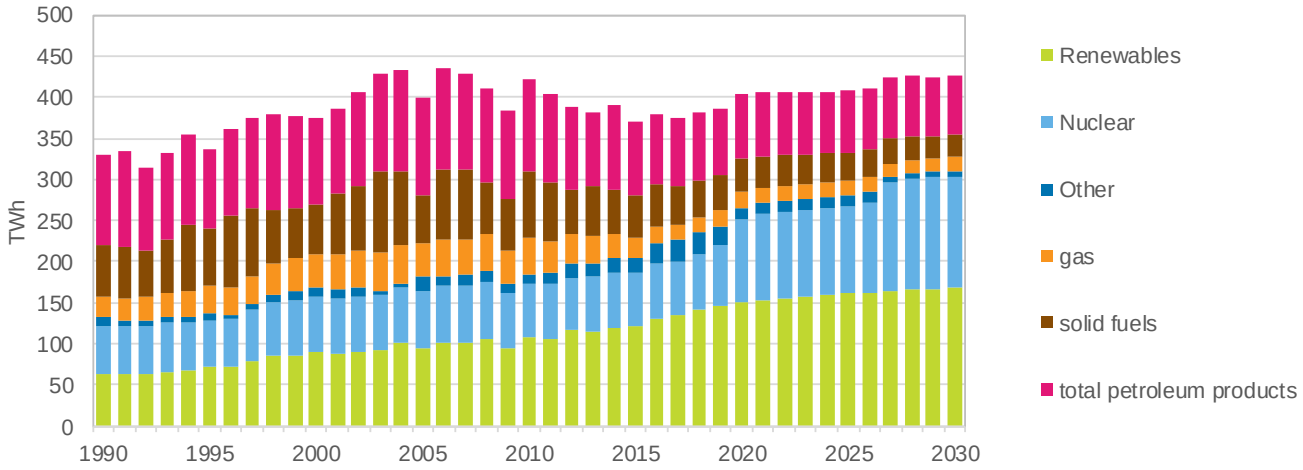


Table 5.1 shows a summary of the main assumptions of the WM projection for 2017 to 2030. Numerical values for related key variables and assumptions are presented in CTF 5.

Table 5.1 Assumptions of the WM projection

Parameter	Trend 2017 to 2030
GDP growth	2. per cent annually
Structure of economy	Increasing share of services
Structure of industry	Less capital and energy intensive
Population growth	Increasing 0.35 per cent annually
Population structure	Ageing
Technology development	Gradual introduction of improved and more energy efficient technology

5.2 Split to EU ETS/non-ETS sectors and aggregate emission projections

In addition to providing projected total national and sectoral emissions and removals, the reporting includes a split of greenhouse gas emissions to EU ETS and non-ETS sectors. The split for the emissions projections between ETS and non-ETS sectors is based on a data set of greenhouse gas emissions covering the years 2005-2017 and being provided by Statistics Finland. The ETS sector coverage has been expanded through a transfer of emissions sources from the non-ETS to the ETS sector over the years. The data set presents an allocation of the historical greenhouse gas emissions to three categories; emissions that have belonged to the EU ETS or the non-ETS sector during all three ETS periods (2005-2007, 2008-2012 and 2013- 2020), respectively, and those that have been transferred from non-ETS to

ETS sector. Furthermore, the data set allocates greenhouse gas emissions to branches with a level of detail higher than in the greenhouse gas emissions inventory.

In the projections the coverage of ETS corresponds to the scope of 2013. The relative shares of EU ETS and non-ETS emissions are set for the individual branches and greenhouse gases based on historical data. The individual shares are assumed to remain constant over time in the projections. Consequently, the EU ETS/non-ETS split basis in the projections is very detailed due to the comprehensive historical data.

Table 5.2 Greenhouse gas emissions projections

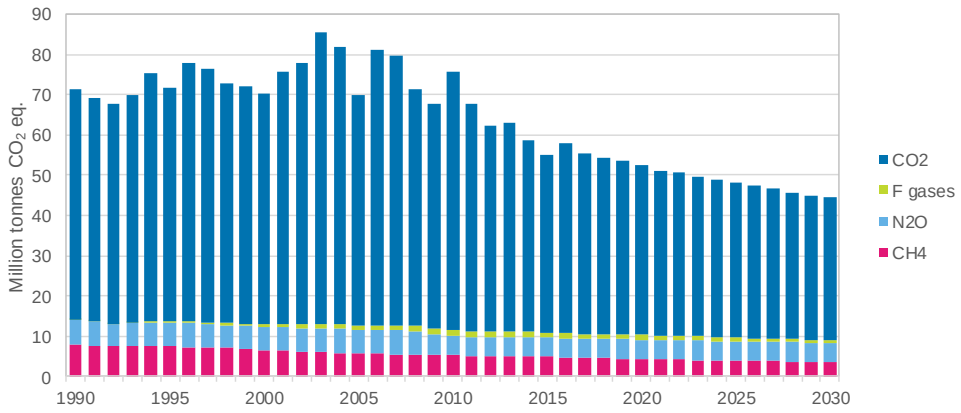
	2017	2020	2025	2030
	million tonnes CO_2 eq.			
With measures projection (WM)				
Total emissions (excl. LULUCF)	55.4	52.5	48.3	44.4
of which non-ETS	30.1	29.1	27.4	26.0
With additional measures projection (WAM)				
Total emissions (excl. LULUCF)	55.4	52.2	45.7	39.2
of which non-ETS	30.1	28.8	24.7	21.4

5.3 'With Measures' projection

5.3.1 Total effects

Total emissions in the WM projection for the years 1990 to 2030 are shown in Figure 5.2 (total emissions without the LULUCF sector)[70] and Table 5.3 (without and with the LULUCF sector). Compared with the base year of 1990, the total greenhouse gas emissions without LULUCF, and also CO_2 emissions, are projected to be 26 per cent lower in 2020 and 38 per cent lower in 2030. CH_4 emissions are expected to continue to decline steadily being 44 per cent lower in 2020 and 53 per cent lower in 2030 than in 1990. N_2O emissions are projected to remain at current levels, which is one fourth lower than in 1990. The amount of emissions from F gases is small and expected to decrease in the coming years.

Figure 5.2 Greenhouse gas emissions without LULUCF, with indirect CO_2 by gas according to the latest greenhouse gas emission inventory (1990 to 2017) and the WM projection (up to 2030), million tonnes CO_2 eq.



[70] Unless otherwise specified, total emissions refer to total national emissions without LULUCF with indirect CO_2 emissions

Table 5.3 Greenhouse gas emissions according to the most recent inventory data (1990 to 2017) and the WM projection (2020 to 2030)

	GHG emissions and removals (kilotonnes CO_2 eq.)									
	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2017**	**2020**	**2025**	**2030**
Sector										
1. Energy	53 558	55 338	53 746	53 707	60 237	40 603	41 023	37 911	34 028	30 317
2. Industrial processes and product use	5 393	5 059	5 985	6 760	6 177	5 873	5 922	6 324	6 566	6 646
3. Agriculture	7 510	6 795	6 548	6 522	6 630	6 514	6 501	6 572	6 406	6 339
4. Land use, land-use change and forestry	-14 772	-14 048	-18 885	-24 428	-22 149	-20 067	-20 378	-23 460	-20 051	-16 524
5. Waste	4 672	4 596	3 850	2 823	2 583	2 134	1 888	1 597	1 279	1 078
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Indirect CO_2 emissions	167	135	109	89	68	53	53	52	48	44
Gas										
CO_2 emissions without net CO_2 from LULUCF [1]	57 139	58 280	57 147	57 132	64 165	44 177	44 758	42 064	38 669	35 415
CO_2 emissions with net CO_2 from LULUCF [1]	38 702	40 646	34 766	29 367	38 932	21 098	21 357	15 607	15 622	15 897
CH_4 emissions without CH_4 from LULUCF	7 746	7 451	6 608	5 569	5 369	4 870	4 606	4 363	3 932	3 679
CH_4 emissions with CH_4 from LULUCF	9 280	8 904	7 956	6 775	6 347	5 791	5 526	5 276	4 842	4 587
N_2O emissions without N_2O from LULUCF	6 362	6 003	5 739	6 019	4 754	4 698	4 689	4 748	4 728	4 743
N_2O emissions with N_2O from LULUCF	8 493	8 137	7 888	8 151	6 860	6 790	6 792	6 831	6 814	6 829
HFCs	0.02	150	715	1158	1384	1390	1279	1233	947	536
PFCs	0.2	2	3	2	1	3	6	4	4	4
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	52	37	26	22	22	38	50	44	46	48
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (without LULUCF, without indirect CO_2)	71 133	71 788	70 130	69 813	75 627	55 123	55 334	52 404	48 278	44 380
Total (with LULUCF, without indirect CO_2)	56 361	57 740	51 245	45 385	53 478	35 056	34 956	28 944	28 227	27 857
Total (without LULUCF, with indirect CO_2)	**71 300**	**71 923**	**70 239**	**69 902**	**75 695**	**55 176**	**55 387**	**52 457**	**48 326**	**44 425**
Total (with LULUCF, with indirect CO_2)	**56 528**	**57 875**	**51 354**	**45 475**	**53 546**	**35 110**	**35 010**	**28 996**	**28 275**	**27 901**

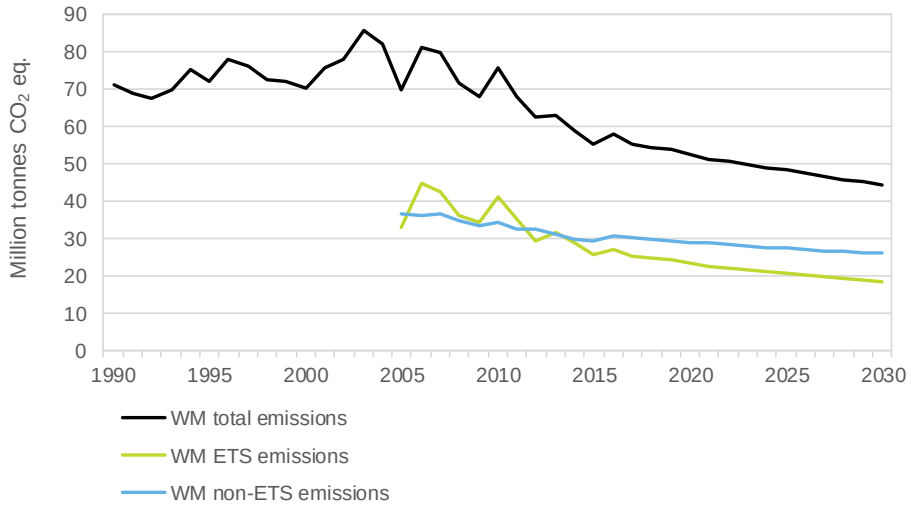
NO = not occurring

[1] Includes indirect CO_2 emissions

The split of greenhouse gas emissions between the EU ETS sector and the non-ETS sector is illustrated in Figure 5.3. The emissions in the EU ETS sector have reached their peak in the mid-2000s and are expected to decline further. In 2017, emissions in the EU ETS sector counted for 45 per cent of the total greenhouse gas emissions, whereas the non-ETS sector counted for 54 per cent[71]. In 2017 emissions in the EU ETS sector declined seven per cent compared to previous year due to decreased use of coal, natural gas and peat. Fossil fuels were replaced with renewable energy and also import of electricity increased. Emissions in the non-ETS sector declined two per cent.

The emissions from the non-ETS sector have decreased since 2005 and the decrease is expected to continue (Figure 5.4). In the WM projection, the emissions from the non-ETS sector in 2020 are 15 per cent and in 2030 24 per cent below the 2005 level when taking into account the change of scope of the EU ETS.

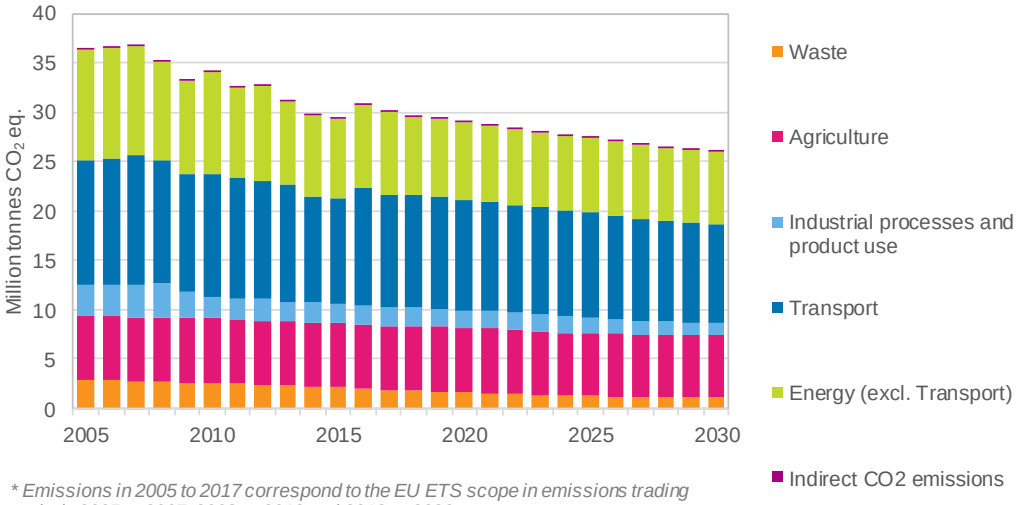
Figure 5.3. The split of greenhouse gas emissions between the EU ETS sector* and the non-ETS sector (2005 to 2017) based on the latest greenhouse gas inventory and the WM projection (up to 2030). The development of the total emissions without the LULUCF sector is also presented



** Emissions in 2005 to 2017 correspond to the EU ETS scope in emissions trading periods 2005 to 2007, 2008 to 2012 and 2013 to 2020.*

[71] The sum of the emissions in the ETS and non-ETS sectors is not fully equal to the total national emissions without LULUCF due exclusion of CO_2 emissions from the domestic aviation from both the ETS and non-ETS sector emissions due to different scope than that for aviation in the greenhouse gas inventory.

Figure 5.4 Emissions in the non-ETS sector* by sector (2005 to 2017) based on the latest greenhouse gas inventory and the WM projection (up to 2030)



** Emissions in 2005 to 2017 correspond to the EU ETS scope in emissions trading periods 2005 to 2007, 2008 to 2012 and 2013 to 2020.*

The development of total emissions with regard to the number of inhabitants, primary energy use and economic development is presented in Table 5.4.

Table 5.4 Greenhouse gas emission intensity based on the latest greenhouse gas inventory for 2010 to 2017 and the WM projection for 2020 to 2030

	2010	2015	2017	2020	2025	2030
Emissions per capita, tonnes CO_2 eq. /capita	14.1	10.1	10.0	9.4	8.5	7.7
Emissions per GDP *, kg CO_2 eq./EUR	0.35	0.26	0.24	0.23	0.19	0.16
Emissions per primary energy, tonnes CO_2 eq./MWh	0.18	0.15	0.15	0.13	0.12	0.10

* 2018 prices for 1990 to 2017, 2016 prices for 2020 to 2030

5.3.2 Sectoral emissions

Energy

The energy sector is strongly affected by policy measures to reduce greenhouse gas emissions, to enhance energy efficiency and to increase the share of renewable energy sources.

Finland belongs to the integrated Nordic-Baltic electricity market and has cross-border transmission capacity to Sweden, Russia and Estonia. The supply and demand situation in the regional electricity market is a very important factor affecting the greenhouse gas emissions of the Finnish power supply. The domestic condensing power production varies from year to year and has particularly in past caused notable variation in the emissions of the energy supply in Finland. Condensing power capacity has, however, decreased significantly lately due to shutdowns of several power plants, which leads to lower emissions in coming years.

In the WM projection, the most significant future changes in electricity and heat production are the start-up in 2020 of a 1600 MW nuclear power plant unit currently under construction, one additional nuclear power plant unit in the late 2020s and the increase in the use of renewable energy sources. All these changes reduce emissions.

The historical and projected emissions from the energy sector (excl. transport) in the WM projection are presented in Table 5.5. The emissions in the energy sector are mainly CO_2 emissions from the combustion of fossil fuels and peat.

Table 5.5 Historical (1990 to 2017) and projected (2020 to 2030) greenhouse gas emissions from the energy sector (excluding transport) based on the latest inventory and the WM projection, respectively

	Historical							WM projection		
	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.							million tonnes CO_2 eq.		
Total emissions	41.5	44.0	41.6	40.8	47.5	29.7	29.5	26.5	23.3	20.1
CO_2	40.8	43.2	40.9	40.0	46.6	29.0	28.8	25.8	22.5	19.3
CH_4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
N_2O	0.4	0.4	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5

Historically, emissions from space heating on site as well as district heating have varied according to the heating demand (cold or warm winters). Likewise, the emissions from condensing power have varied strongly depending on the hydro situation in the Nordic-Baltic electricity market. Future years are in the projections assumed to be standard years (i.e. long-term average plus impact of climate change) with respect to heating demand and hydro levels. Consequently, the energy sector emissions are smoother in the future years of the WM projection than in historical years.

The importance of CH_4 and N_2O emissions within the energy sector is small. Less than 10 per cent of all CH_4 emissions in Finland come from incomplete combustion of fuel, which is mainly caused by fireplaces and small heating boilers. CH_4 emissions from power and heating plants are small.

Transport

The WM projection for the transport sector includes all measures, which were in use in the transport sector to cut down the emissions in the end of 2017. It is assumed that the use of biofuels is increased to at least 13.5 per cent in total of the road transport fuels sold in 2020 (without double-counting) and the growth in transport operations and annual mileages stays at a moderate level (0.5–1.5 per cent per year) (see also Section 4.2.2). The annual fluctuations in emissions from the transport sector are particularly explained by the annual fluctuation in the proportion of biofuels. The proportion of biofuels was at its highest in 2014 and 2015. In 2016, the proportion of biofuels decreased compared to previous years, whereas in 2017 the proportion of biofuels more than doubled compared to 2016. This fluctuation in the proportion of biofuels is a result of the legislation on the distribution obligation that enables front-loaded implementation of the distribution obligation.

Greenhouse gas emissions from transport sector are estimated to decrease by 1.5 million tonnes from 2005 to 2020 and by 2.6 million tonnes from 2005 to 2030 (Table 5.6).

Table 5.6 Historical (1990 to 2017) and projected (2020 to 2030) greenhouse gas emissions from transport based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical							WM projection		
	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.							million tonnes CO_2 eq.		
Total emissions	12.1	11.3	12.1	12.9	12.7	10.9	11.5	11.4	10.7	10.3
CO_2	11.8	11.1	11.9	12.8	12.6	10.8	11.4	11.3	10.6	10.1
CH_4	0.1	0.1	0.1	0.04	0.02	0.02	0.02	0.01	0.01	0.01
N_2O	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Industrial processes and other product use

The most important greenhouse gas emission sources in this sector are iron and steel, hydrogen and cement production. The main factors affecting the development of emissions include changes in industrial production. In the WM projection, the growth of the industrial production increases these emissions. Most of the emissions other than F gases in this sector are part of the EU ETS, which also is the main measure for reduction of the process emissions. No additional measures are planned for the emissions covered by the EU ETS.

The WM projection for F gases includes the impacts of the EU regulation on F gases[72] and the EC directive relating to emissions from air-conditioning systems in motor vehicles[73]. Emissions from refrigeration and air-conditioning equipment are expected to decline as a result of these measures and technical changes leading to smaller charges and decreased leakage. The main features of the F-gas regulation in cutting the emissions are the phase down of HFCs that can be placed on the EU market and the bans on the use of F-gases in different applications. They will lead to a replacement of F-gases with low GWP alternatives in most applications.

Emissions from electricity distribution equipment have declined heavily as a result of voluntary actions of the industries. A steady increase of emissions is assumed in the future but the peak level of emissions in the 1990s will not be reached. Restrictions forced by the EU regulation have a decreasing effect on emissions from foam blowing and aerosols in the future. The emissions from other sources are expected to stay quite steady. Emissions from refrigeration and air-conditioning equipment account for more than 90 per cent of Finnish F-gas emissions, and therefore, the projected overall emission trend is declining

Table 5.7 Historical (1990 to 2017) and projected (2020 to 2030) greenhouse gas emissions from industrial processes and other product use based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical							WM projection		
	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.							million tonnes CO_2 eq.		
Total emissions	5.4	5.1	6.0	6.8	6.2	5.9	5.9	6.3	6.6	6.6
CO_2	3.7	3.4	3.9	4.0	4.6	4.2	4.3	4.8	5.3	5.7
CH_4 *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N_2O	1.7	1.5	1.4	1.6	0.2	0.3	0.3	0.2	0.3	0.3
F gases	0.1	0.2	0.7	1.2	1.4	1.4	1.3	1.3	1.0	0.6

* CH4 emissions below 0.3 kt CO_2 eq.

Agriculture

In recent years, the changes in the emissions from agriculture have been small. In the WM projection, the emissions are expected to increase slightly (two per cent between 2005 and 2020), as synthetic fertilizers and organic soils are estimated to be increasing sources up to 2020 (Table 5.8). After 2020 the decline in livestock numbers and N fertilization will slightly reduce the total emissions after 2020 and the total greenhouse gas emissions from agriculture will be one per cent lower in 2030 compared to 2005.

Energy-related emissions related to agriculture are reported in the energy sector and not included in Table 5.8.

[72] 2014/517/EU

[73] 2006/40/EC

Table 5.8 Historical (1990 to 2017) and projected (2020 to 2030) greenhouse gas emissions from agriculture based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical							WM projection		
	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.							million tonnes CO_2 eq.		
Total emissions	7.5	6.8	6.5	6.5	6.6	6.5	6.5	6.6	6.4	6.3
CO_2	0.6	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2
CH_4	2.8	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.5	2.4
N_2O	4.1	3.8	3.7	3.7	3.8	3.7	3.8	3.8	3.7	3.7

LULUCF

The land use, land-use change and forestry sector (LULUCF) as a whole is expected to be a net sink in the WM projection (Table 5.9).

Table 5.9 Historical (1990 to 2017) and projected (2020 to 2030) greenhouse gas emissions and removals from the LULUCF sector based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical							WM projection		
	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.							million tonnes CO_2 eq.		
Total emissions	-14.8	-14.0	-18.9	-24.4	-22.1	-20.1	-20.4	-23.5	-20.1	-16.5
CO_2	-18.4	-17.6	-22.4	-27.8	-25.2	-23.1	-23.4	-26.5	-23.0	-19.5
CH_4	1.5	1.5	1.3	1.2	1.0	0.9	0.9	0.9	0.9	0.9
N_2O	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

Finland's National Forest Strategy (NFS), adopted by the Government in February 2015 and operationalizing Government policy, specifies the main objectives for forest policy and forest-based business and activities until 2025. The vision of the Strategy is "Sustainable forest management is a source of growing welfare".

The strategy is implemented by eleven key projects. NFS projects were updated in 2019.

According to the NFS, climate change mitigation and adaptation in forests are supported by diversifying forest management. Forests' viability, i.e., growth and health will be maintained and enhanced through active forest management. Over the long term, forest management techniques must be adapted to new and changing climate conditions. Timely and careful forest management can improve the growth but also the resistance of growing stock to damage while safeguarding the ecosystem services of forests and producing wood biomass sustainably. Current forest legislation and ongoing measures for the climate and forest related objectives are briefly described in Chapter 4.2.6.

Forests will be a key part of the Finnish bioeconomy and therefore the NFS aims to increase the use of wood to replace fossil resources with renewable biomass. Natural Resource Institute (Luke) has used MELA forestry model for the projection estimations. When the harvesting increases up to 80 million cubic meters (including the use of wood for bioenergy), the estimated carbon sink of forests (incl. trees and soil) will be approximately at the level of −28 million tonnes of CO_2 eq. per annum by 2025. With regard to agricultural soils, CO_2 emissions from croplands and grasslands are not expected to be subject to large changes according to the existing WM projection.

The LULUCF projections were updated in 2019. Due to the large forest land area and large growing stock, even mod-

erate changes in activity data (such as growing stock to start with), in parameters used in the estimation of emissions/removals or in assumptions used in projections have a large impact in the projected values. Any updates may therefore change the LULUCF projections considerably also in future.

The most significant changes compared with BR3 and NC7 reporting were made in the forest sink estimation.

Main changes between the BR4 and the BR3/NC7 in the construction of LULUCF projections are: For forest land, the model version MELA2016 was used for the projections in the BR4, whereas the version MELA2012 was used for the BR3/NC7 projections. The main changes made to the MELA2016 were the following:

1) The growth calibration model for trees was modified to better fit the new increment data measured by the National Forest Inventory.
2) Simulations for the previous projections produced a higher stem number and volume for small trees, meaning also high natural mortality rate for small trees for the first years of simulations. This part of the modelling was modified to better match the natural mortality measured in the National Forest Inventory.

The assumption about the harvest rate was the same as the one used in the BR3/NC7 projection.

For harvested wood products, the projection based on the same assumption on the development of Finnish forest industry as was behind the forest land projection (the domestic roundwood consumption and demand were derived from the production volumes of the forest industries). Previously, the HWP projection was based on an average of historical annual sinks. This change produced about a 1 million tonnes of CO_2 higher sink for wood products than formerly was reported. Also, some other changes and updates in initial data and assumptions were made. For example, emissions (CO_2, N_2O, CH_4) from peat production are about 0.1 million tonnes of CO_2 eq. lower in the BR4 projection due to the decreasing trend in area. On the other hand, an update in the Yasso soil model estimation of carbon stock changes in mineral soils of forest land and cropland decreased the carbon sink of mineral soils by some 3 million tonnes of CO_2 eq. for the most recent years of the greenhouse gas inventory with similar changes in the projections.

Waste

Greenhouse gas emission projections for the waste sector include CH_4 from landfills and anaerobic digestion, CH_4 and N_2O emissions from composting and wastewater treatment. Projections for the waste sector do not include emissions from waste incineration, which are reported in the energy sector.

Greenhouse gas emissions from the waste sector will decrease in the WM projection (Table 5.10). The main reason for this reduction is the implementation of the Landfill Directive[74] and national legislation[75] and strategies aimed at reducing the amount of waste generated and minimising the amount of waste disposed at landfills. Over a longer period, the amount of greenhouse gases from landfills will decline as a consequence of the restrictions on landfilling of organic waste.

[74] Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

[75] Government Decree on Landfills 331/2013, Waste Act (646/2011), Decree on Waste (179/2012) and the Decree on Packaging and Packaging Waste (518/2014)

Table 5.10 Historical (1990 to 2017) and projected (2020 to 2030) greenhouse gas emissions from the waste sector based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical							WM projection		
	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.							million tonnes CO_2 eq.		
Total emissions	4.7	4.6	3.9	2.8	2.6	2.1	1.9	1.6	1.3	1.1
CH_4	4.6	4.5	3.7	2.7	2.5	2.0	1.8	1.5	1.2	1.0
N_2O	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Indirect CO_2 emissions

The WM projection for indirect CO_2 is based on the assumption that their share of the total national emissions without LULUCF will remain at present level, 0.1 per cent of total national emissions without the LULUCF sector.

International bunkers

According to the most recent greenhouse gas emission inventory, the fuel consumption for international aviation was 28,653 TJ and for international marine transportation 14,228 TJ in 2017. The annual growth rate by 2030 is estimated at 2 per cent for international marine transportation and 3 per cent for international aviation. Based on these assumptions and using the emissions in 2017 as the basis, the total greenhouse gas emissions from bunker fuels are projected to be 2.5 million tonnes CO_2 eq. in 2020 (0.7 million tonnes CO_2 eq. from marine and 1.8 million tonnes CO_2 eq. from aviation bunkers). The corresponding total estimate for 2030 is 3.3 million tonnes CO_2 eq. (0.9 million tonnes CO_2 eq. from marine and 2.4 million tonnes CO_2 eq. from aviation bunkers).

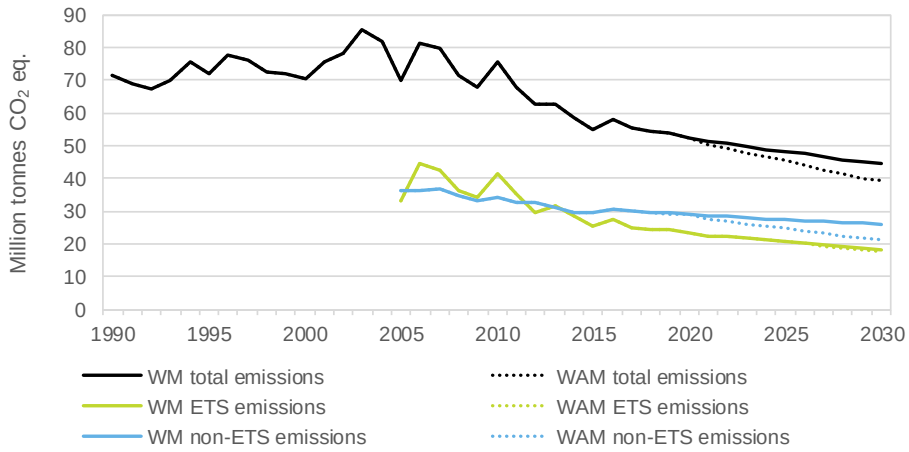
These projected emissions of marine and aviation bunkers do not take into account the impact of the measures presented in CTF Table 3 which aim at improving energy efficiency and increasing the use of alternative fuels.

5.4 'With Additional Measures' projection

With the existing policy measures Finland is on track to meet its 2020 emission reduction and renewable energy targets. The effect of the additional measures is aimed at the 2020s and in full at the year 2030 at the latest. With a few exceptions all the planned measures described in Chapter 4 are included in the WAM projection. Measures for which the impact on the energy balance is not yet known have not been included in the WAM projection, i.e. promoting the use of biogas.

The effect of the policies and measures included in the WAM projection on the total greenhouse gas emissions is illustrated in Figure 5.5. Continuous lines portray the WM projection and dashed lines the WAM projection.

Figure 5.5 Greenhouse gas emissions in EU ETS* and non-ETS sectors in the WAM projection (dashed lines) compared to the WM projection (solid lines) in the years 2018 to 2030 and historical emissions for 1990 to 2017 based on the most recent inventory



** Emissions in 2005 to 2017 correspond to the EU ETS scope in emissions trading periods 2005 to 2007, 2008 to 2012 and 2013 to 2020.*

The total greenhouse gas emissions in 2030 are estimated to be 44 million tonnes CO_2 eq. in the WM projection and 39 million tonnes CO_2 eq. in the WAM projection. The additional emission reduction measures in the WAM projection will mainly affect the non-ETS sector.

Table 5.11 presents a summary of the WAM projection emissions and the difference between them and the emission levels in the WM projection.

Table 5.11 Greenhouse gas emissions on a gas-by-gas basis for the WAM projection and difference between them and the WM projection in 2020-2030, million tonnes CO_2 eq. (the greenhouse gas emissions in 2010 and 2015 are based on the most recent inventory and shown for comparison)

	Historical			WAM projection		
	2010	2015	2017	2020	2025	2030
	million tonnes CO_2 eq.			million tonnes CO_2 eq.		
CO_2	64.2	44.2	44.8	41.8	36.2	30.9
CH_4	5.4	4.9	4.6	4.4	3.9	3.6
N_2O	4.8	4.7	4.7	4.7	4.7	4.3
F gases	1.4	1.4	1.3	1.3	0.8	0.4
Total emissions	**75.7**	**55.2**	**55.4**	**52.2**	**45.7**	**39.2**
difference to WM	0.0	0.0	0.0	-0.3	-2.6	-5.3

Additional measures planned for the energy sector are:

- Technology neutral tendering processes in 2018−2020 on the basis of which aid will be granted to the most cost-effective new electricity production from renewable energy.
- Phase out the use of coal for energy use during the 2020s.
- An obligation to blend 10 per cent of bioliquids into light fuel oil used in machinery and heating.

It is estimated that the emission reductions in energy sector (excluding transport) achieved by these additional measures will be 1.4 million tonnes CO_2 eq. in 2030.

The WAM projection for transport is based on the National Energy and Climate Strategy and Medium-term Climate Change Policy Plan for 2030 measures. The measures are expected to promote the share of biofuel energy content in

all fuels sold for road transport (30 per cent by 2030), very stringent CO_2 standards for new cars and light commercial vehicles (i.e. reaching 64 g CO_2/km for cars and 106 g CO_2/km for light commercial vehicles in 2030) and reducing the number of car journeys with only the driver, and to halt the increase in the use of passenger cars in urban areas regardless of a growth in population. In addition, the energy efficiency of heavy-duty vehicles is expected to further increase once the proposed new Regulation setting CO_2 emission performance standards for heavy-duty vehicles and the proposed amendment of the Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles will be adopted. It is estimated that the emission reductions in transport achieved by these additional measures will be 3.2 million tonnes CO_2 eq. in 2030 compared to the WM projection.

The WAM projection of F-gases is based on a few additional measures that are expected to promote the alternative low GWP non-HFC technologies in the refrigeration and air conditioning equipment sector in addition to the F-gas regulation. These additional measures include criteria for public procurement that are related to F-gases and information and education campaigns. It is estimated that the emission reductions achieved by these additional measures will be 0.2 million tonnes CO_2 eq. in 2030.

Additional measures in the agricultural sector have been identified in the Medium-term Climate Change Policy Plan in accordance with the National Climate Change Act. Implementation of these measures is planned to begin from year 2021. In the agricultural sector the estimated additional total emission reductions in the WAM projection are 0.5 million tonnes CO_2 eq. in 2030. The main reductions are based on activities planned to be put into practice on organic soils, for example by promoting long-term grass cultivation and afforestation. The potential emission reduction impact concerning N_2O emissions is 0.45 million tonnes CO_2 eq. in 2030–2040. Use of biogas produced in the agriculture sector to replace fossil fuels is a new measure which will reduce CH_4 emissions in the agriculture sector in 2030 by 0.05 million tonnes CO_2 eq. and in the energy sector in 2030–2040 by 0.3 million tonnes CO_2 eq.

National Forest Strategy 2025 was approved by the Government in February 2015. The National Energy and Climate Strategy (2016) underlines the sustainable use and management of forests (incl. biodiversity) through balanced implementation of the National Forest Strategy emphasizing especially forest health, growth and carbon sinks. Measures to prevent deforestation and to increase afforestation will be included in the climate policy programme for the land-use sector.

For cropland and grassland, the WAM measures include developing farming to increase removals by sinks, e.g., through a pilot project and proposals for the renewal of the CAP. Increased knowledge to study and monitor the impact of measures for carbon sequestration is also promoted and needed. Measures which are identified in the Medium-term Climate Change Policy Plan relating to reducing emissions from organic soils (long-term grass cultivation, afforestation) from the agriculture sector also have effects on emissions from the LULUCF sector.

Currently no additional measures are being planned for waste management.

5.5 Total effect of policies and measures

5.5 Total effect of policies and measures

The aggregated estimates for the greenhouse gas reduction impacts of already implemented individual policies and measures presented in Chapter 4 are 34 and 45 million tonnes CO_2 eq. for 2020 and 2030 (without LULUCF), respectively. The planned measures will reduce greenhouse gas emissions increasingly in the 2020s reaching an additional annual reduction of 5.7 million tonnes CO_2 eq. in 2030. The total effect of the policies and measures by gas is shown in Table 5.12.

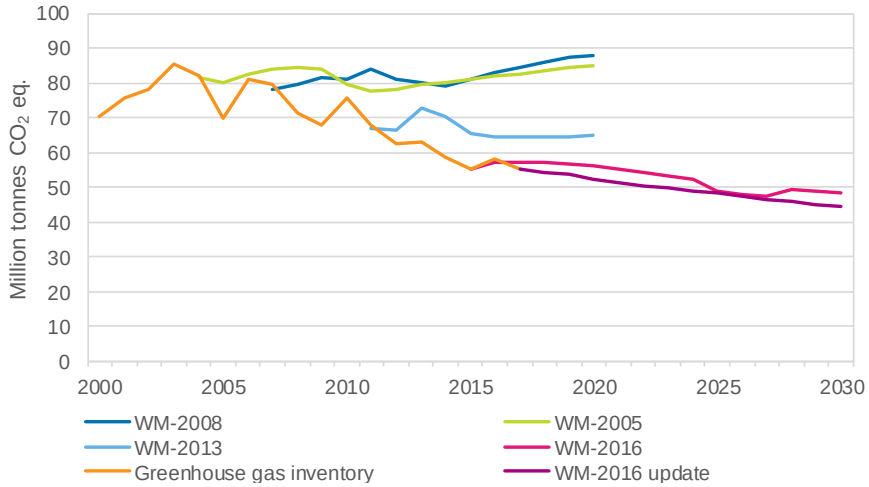
Table 5.12 The estimated total effect of implemented and planned policies and measures (PaMs) calculated based on estimated impact of individual PaMs for the years 2020 and 2030 (million tonnes CO_2 eq). The total emissions in 2017 based on the most recent inventory are also given for comparison.

		Implemented measures		Planned measures	
	Total emissions in 2017	Total effect of PaMs in 2020	Total effect of PaMs in 2030	Total effect of PaMs in 2020	Total effect of PaMs in 2030
CO_2	44.8	29.4	38.7	0.4	5.0
CH_4	4.6	2.9	3.4	0.0	0.05
N_2O	4.7	NE	NE	0.0	0.4
F-gases	1.3	1.9	3.0	0.0	0.2
Total	55.4	34.2	45.0	0.4	5.7

The estimated total effect of policies and measures contains noticeable uncertainties. The mitigation impact has not been estimated for all policies and measures. Furthermore, the impact estimates of individual policies and measures are not fully additive, which may result in an overestimation of the mitigation impact in certain sectors. The overlapping effect of measures has been paid due attention to, for example, in the case of simultaneous increase of biofuel content and energy efficiency in the transport sector and in heating. Altogether, the total emission reduction is likely larger than the reported total effect.

Figure 5.6 shows Finland's greenhouse gas emissions in the WM projections in the last four national climate and energy strategies, i.e. strategies from the years 2005, 2008, 2013 and 2016. The WM projections in the previous national climate and energy strategies projected significantly higher emissions for 2017 than those reported in the latest greenhouse gas inventory. This suggests that the additional measures implemented in the 2010s have had a substantial impact on the total emissions.

Figure 5.6 Greenhouse gas emissions according to the most recent inventory for 2000 to 2017 and in the WM projections of the climate and energy strategies published in 2005, 2008, 2013 and 2016 up to 2020 and 2030 respectively, including an updated projection of WM-2016.



The main difference between the projections shown in Figure 5.6 is that most measures from previous WAM projections have been implemented since the previous reporting and are therefore included in the following WM projections. The most significant change compared to the previous Biennial Report (BR3) is caused by the fact that since then domestic conventional condensing power capacity has been shut down even further. Furthermore, combined heat and power plants are struggling with their feasibility because of the low electricity price level in the Nordic-Baltic power market and are

according to power market studies likely to be shut down a head of time. The use of fossil fuels in power plants is consequently therefore lower than anticipated in earlier projections. The projections have been updated accordingly. In addition to the power and heat production changes, the economic growth has also been updated to reflect the most recent development and expert views.

The total effect of implementing additional measures can be seen in the emission development trend after 2015, which has levelled off in the 2013 and 2016 projections, whereas it continued to increase in the projections from 2005 and 2008.

In the updated WM-2016 projection, the emissions in 2020 are projected to be about 40 per cent below the projected levels in 2005 and 2008 WM projections,19 per cent below the 2013 WM projection and 6 per cent below the 2016 WM projection.

5.6 Economic impacts

5.6.1. Impacts on the national economy

The impact assessment including the economic impacts of policies and measures described in this report is based on two separate impact assessments reports, one prepared for the Finland's National Energy and Climate Strategy and the other prepared for the Medium-term Climate Change Plan (KAISU).

The impact assessment compares the impacts of the new policy measures of the WAM projection to the development in the WM projection. For the economic impact assessment, a dynamic applied general equilibrium model that describes the economy from the perspective of decisions made by households, companies and the public sector is used. The global TIMES-VTT energy system model is used for the energy system modelling. TIMES-VTT contains a detailed representation of the Finnish, Swedish, Norwegian and Danish energy systems and data on other countries in a more aggregated form.

In the WAM projection, reductions in greenhouse gas emissions will mainly be achieved by means of energy system and non-ETS sector measures. The impacts of emissions trading are already taken into account in the WM projection. However, the structure of both the production and consumption change in the WAM projection, which has an impact on the budgetary position of the public sector. In addition, the support required by biorefineries increases public expenditure, while the growing share of biofuels and a slower transport performance reduces the fuel tax accrual. In the modelling, it is assumed that budget neutrality is achieved by a small increase in commodity tax (for example, through value added taxation).

The conclusion of the impact assessments of the National Energy and Climate Strategy is that the proposed actions and measures allow Finland to reach the targets of the EU Effort Sharing Decision and national targets to increase renewable energy, to reduce fossil fuel consumption, and to increase self-sufficiency of energy consumption. The largest share of additional emission reductions would be achieved in the transport sector followed by reduction of emissions from oil heating of buildings, machinery, waste management, F-gases and agriculture.

The realization of the targets of the energy and climate strategy affects economic steering and the national economy. According to the impact assessments, the gross domestic product would be 0.6 percentage-points lower than the baseline in 2030. The employment would grow over 3 per cent by 2030 compared to 2015 but would remain 0.15 percentage-points lower than in the baseline.

Forest biomass is the largest growing renewable energy source from 2015 to 2030. The impact assessment of Finland's National Energy and Climate Strategy from 2016 concludes that the existing felling potential in the Finnish

forests will be large enough to supply the estimated needs of both forest and energy industries. Finnish forests will remain a carbon sink. Natural Resources Institute Finland (Luke) is updating scenarios for carbon sinks based on new data on forest growth.

The strategy will affect climate change, nature's biodiversity and water basins, air pollution, health and living conditions. The details of the practical implementation are essential. They will influence how the increased harvesting affects biodiversity and what welfare impacts different population groups will experience.

In the impact assessment of the Medium-term Climate Change Plan the assessments of the measures of the non-ETS sector under the effort sharing regulation have been updated and extended. According to the results of the energy system model TIMES, a realistic overall emission reduction potential compared to the baseline (WM projection) sums up to 5.1–6.8 million tonnes CO_2-eq. in year 2030. The largest potentials are identified in transportation, but there is also substantial uncertainty regarding these emission reductions and associated costs. Additional emission reductions are achievable especially through decreasing the use of mineral oil in heating of buildings and in fuel use of work machines. An increased share of biofuels in transport, heating and machinery are the most significant individual measures. In total, the measures of KAISU have only a minimal impact on the growth of gross domestic product. In combination with other policy measures, the measures of KAISU affect environment, people's health and living conditions in many ways. The level of impacts depends on many factors, making the anticipation of impacts uncertain. Careful monitoring is therefore needed to verify the reaching of targets and other impacts.

Economic impacts of policies and measures have also been reported in Section 5.5. of the Finland's Seventh National Communication under the United Nations Framework Convention on Climate Change[76]. The information in the Seventh National Communication is based on the situation at the end of 2017 and the impacts of the policy measures of Finland's National Energy and Climate Strategy. The results related to the Medium-term Climate Change Plan on macroeconomic level are very similar to those of the National Energy and Climate Strategy.

The domestic product in 2030 is in the WAM projection approx. 0.6 per cent smaller than in the WM projection. This is caused by lower private consumption and investments than in the WM projection and a slowing down of foreign trade. The decline in exports affects the domestic product most. On the other hand, imports also decline, which increases the domestic product.

While the change in employment in the national economy as a whole is put at -0.15 per cent, it is expected that primary production and energy supply sectors preserve their current employment levels.

More employment is created especially in the production of biofuels and bioenergy. The increase in the biorefining of forest raw materials (300 ktoe) increases employment by 2 000 person-years. In other biorefining sectors, the increase (300 ktoe) is estimated to be 150 person-years. It is expected that the 2 TWh increase in wind power capacity will create 400 person-years' worth of employment.

As coal use is phased out, chip and pellet boilers and heat pumps will replace coal in the heat production. The quantitative impact on employment is, however, difficult to estimate.

The impact of the WAM measures on the national economy in 2030 in comparison to the WM projection is shown in Table 5.13.

---

76 http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/952371_finland-nc7-1-fi_nc7_final.pdf

Table 5.13 Impacts of additional climate and energy measures on the national economy in 2030.

	Change compared to the WM scenario, per cent	Impact on the domestic product compared to the WM scenario, percentage points
Domestic product	–0.59	
Private consumption	–0.40	–0.23
Investments	–0.85	–0.10
Public consumption	0	0
Exports	–1.75	–0.76
Imports	–1.33	0.49

5.6.2. Investment needs for policy measures

Examples of existing investment needs and forward investment assumptions concerning the planned policies and measures are presented below:

Investment needs for the ban of coal

Economic impact of the premature investment costs in cities Helsinki and Vaasa are EUR 34 million. In addition to this EUR 2–4 million must be invested in additional equipment in other cities with multi-fuel boilers.

Investment generated by the tender process for renewable electricity production

Assuming an investment cost for wind power of EUR 1.5 million per MW, the overall investment cost for the 1.4 TWh tendering would be EUR 600–750 million.

Investment needs for the centralized data exchange solution

The total cost of the centralized data exchange solution, the Datahub, is approximately EUR 36 million, of which the transmission system operator accounts for EUR 19.6 million and the electricity companies EUR 16.6 million. The average investment of electricity companies per customer is EUR 0.5 per year for 10 years. Investments are almost equally distributed between retailers and distribution system operators.

Investment needs for the production if biofuels

According to the research study "Biopolttoaineiden kustannustehokkaat toteutuspolut vuoteen 2030 (Cost-effective implementation paths for biofuels by 2030)", the development of the WAM projection presented in the energy and climate strategy is estimated to amount to a total of 800,000 oil equivalent tonnes (toe) of biofuels in 2030. The amount of bioliquids needed to replace light fuel oil is estimated at 34,000 toe/a in heating and 69 000 toe/a in machinery, i.e. a total of 103 000 toe/a. Biofuels production capacity in Finland is currently more than 500,000 toe, so the additional requirement by 2030 would be around 400,000 toe, if the obligations presented are to be fully met with domestic production.

Based on the estimates made earlier, the cost of investing 400 ktoe in production capacity would be up to EUR 1.300 million by 2030. However, there are significant uncertainties about the estimation of the amount of biofuel needed. If, for example, the energy efficiency did not improve and the number of electric cars would be half of the 250,000 vehicles expected in 2030, the required amount of biofuels would be raised annually by about 600 ktoe in 2030 situation.

Investment needs for the public recharging points for electric vehicles

Finland´s national plan for distribution network for alternative transport fuels estimates that in 2030 at least 25 000 public recharging points should be provided for a minimum of 250 000 electric vehicles. The amount is based on the

Alternative Fuels Infrastructure directive (2014/94/EU), which indicates that the appropriate average number of re-charging points should be equivalent to at least one recharging point per 10 cars.

If we assume that the average investment cost of one fast charger is approximately EUR 40,000 and the average investment cost of one medium speed charger is approximately EUR 14,000, the estimated investments of building the public charging infrastructure are EUR 415 million by 2030. This is based on an assumption that ten percent of the public recharging points are fast chargers.

Investment needs in electricity interconnector capacity

The estimated costs of the construction of an alternating current connection of 800 MW between northern Finland and northern Sweden are just under EUR 200 million. The transmission line is planned from Messaure in Sweden via Keminmaa to Pyhänselkä in Finland, spanning a distance of around 370 kilometres.

5.6 Sensitivity analysis of the projections

Energy use and hence the greenhouse gas emissions are sensitive to the assumptions made on economic growth. Sensitivity analysis has therefore been carried out for the WM projection varying the economic growth of industry and service branches as well as the building sector. No sensitivity analysis on the transport sector was made, but generally, a lower economic growth could have both a reducing and an increasing impact on the energy use for transport. On one hand, the need for transport is likely to be lower, but on the other hand, the renewal of the transport fleet slower. In the sensitivity analysis, the energy use in the transport sector is kept unchanged.

The manufacturing industry uses about 45 per cent of the country's final energy and 47 per cent of the electricity. The forest industry has a significant impact on the energy sector, including renewable energy production, energy consumption and electricity generation. Iron and steel production is another energy-intensive branch, the development of which influences the projections noticeably. The energy balances projections of these branches are based on product group specific volume estimates. Both branches develop generally positively in the WM projection, even though some product groups decrease (e.g. manufacturing of paper) already in the base case WM. In the sensitivity analysis the annual growth of the volumes in forest industry and metal industry is 1 percentage point less than in the WM projection from 2018 onwards.

A lower economic growth projection for the building sector has also been formed. The effect of a lower economic growth on construction and on the use of heating sources was assessed. The analysis is presented in a report published by the Finnish Environment Institute[77].

In addition to the branches and sectors mentioned above, the development of the other industry and service branches was varied by lowering the annual growths with 1 percentage point from the WM assumptions. No dynamic effects were taken into account.

The main assumptions and results of the sensitivity analysis are presented in Table 5.14. The overall effect of a lower economic growth results in a steadily decreasing final energy consumption. In 2030 the final energy consumption would be only 293 TWh. The total energy consumption is in 2030 about 20 TWh lower than in the WM projection. The impact on the electricity consumption is also noticeable, lower growth results in a difference of 6 TWh in 2030. The electricity generation is fairly low-carbon so the effect of a reduced electricity consumption on emissions is small. The greenhouse gas emissions in 2030 would in total be only 1.5 million tonnes of CO_2 eq. lower than in the WM projection. Most of the emission reduction would take place in the ETS sector, only 0.2 million tonnes of CO_2 eq. in the non-ETS sector.

[77] Baseline scenario of energy consumption of the building stock in Finland for 2015–2050. Rakennusten energiankulutuksen perusskenaario 2015–2050. (in Finnish, with an abstract in English). Finnish Environment Institute, report 35/2016.

Table 5.14 Main results for the sensitivity analysis on how the economic growth rate affects the overall energy balance and greenhouse gas emission

	2017	2020		2030	
	Historical	WM	Lower growth	WM	Lower growth
Primary energy consumption, TWh	374	405	399	425	404
Gross final energy consumption, TWh	309	313	308	313	293
Electricity consumption, TWh	86	87	86	92	86
GHG emissions, Mt CO_2 eq.	55.4	52.5	52.0	44.4	42.9
of which non-ETS emissions,Mt CO_2 eq.	30.1	29.1	29.0	26.0	25.8

5.7 Methodology

5.7.1 Approach and responsibilities

The approach and responsibilities in preparing the projections have not changed since the preparation of the 3rd Biennial report. The preparation of the reported WM and WAM projections was coordinated by the Ministry of Economic Affairs and Employment under the Ministerial Working Group on Bio-economy and Clean Solutions. The ministries most involved in preparing the projections were the Ministry of Economic Affairs and Employment, the Ministry of the Environment, the Ministry of Transport and Communications, the Ministry of Agriculture and Forestry, and the Ministry of Finance.

The sectoral projections and calculations were made by various experts within the contact network set up by the main ministries involved in drafting the climate policy. The ministries have consulted expert organisations for acquiring data, assessments of policies and measures and modelling of sector-specific projections. The following authorities and expert organisations contributed to the reporting in 2019: Energy Authority, Finnish Environment Institute (SYKE), VTT Technical Research Centre of Finland Ltd, Motiva Ltd, Tampere University of Technology, Natural Resources Institute Finland, Finnish Transport and Communications Agency, Benviroc Ltd and Statistics Finland.

The Ministry of Economic Affairs and Employment was responsible for the projections regarding the amount of energy used by industry, households and services and for the calculations regarding fuel and carbon dioxide emissions in the energy production sectors as a whole; it was also responsible for coordinating the calculations. The Ministry of the Environment was responsible for the projection regarding space heating, for the analysis of the regional and urban structure, and for emission projections and calculations for waste and machinery. The duty of the Ministry of Transport and Communications included making projections for fuel and electricity usage as well as emissions from the transport sector. The Ministry of Agriculture and Forestry oversaw the calculation of emissions and removals in the agriculture and land use, land-use change and forestry sectors.

5.7.2 Assumptions underlying calculations

The common key variables and assumptions are presented in Table 5.15. Specific sectoral and category-specific data is given in CTF Table 5.

Table 5.15 Key variables and assumptions used in the projections analysis for 1990 to 2030

		Historical							Projected		
	Unit	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
Population	Million inhabitants	5.00	5.12	5.18	5.26	5.38	5.49	5.51	5.60	5.69	5.77
Gross Domestic Product	Million EUR *	145603	142392	182423	207297	215899	216344	228239	230340	254930	284050

* 2018 prices for 1990 to 2017, 2016 prices for 2020 to 2030

Finland's population will increase from the current 5.5 million to about 5.8 million by the year 2035. The age structure of the population will change significantly over the next couple of decades as the share of older age groups increases. The number of households is expected to increase from the current 2.7 million to approximately 2.9 million by 2035. At the same time, however, the average size of households will decrease. The number, structure and location of households will have an impact on the energy demand.

The GDP is assumed to increase in the coming years. In the projections the annual growth during 2017 to 2020 is on average 1.4 per cent. In the 2020s the growth will be higher, 2.1 per cent per annum on average, as the Government's reforms are starting to pay off and the competitiveness of the Finnish economy increases.

Assumed fossil fuel prices in the world market and the assumed prices of emissions allowances in the EU's emissions trading system correspond to the values recommended or suggested by the EU Commission for greenhouse gas emission projections. The price of crude oil is assumed to be EUR 13.86/GJ in 2020 and EUR 17.33/GJ in 2030. The price of coal is in the corresponding years assumed to be EUR 2.64/GJ and EUR 3.79/GJ, respectively, and the price of natural gas EUR 8.91/GJ and EUR 10.49/GJ, respectively. Emission allowance prices are expected to rise in 2020 to EUR 15.5/ t CO_2 and in 2030 to EUR 34.7/t CO_2.

In the transport sector, greenhouse gas emissions are influenced by a decline in specific energy consumption and, in particular, by an increased share of biofuels. It is estimated that the share of bio-based road transport fuels will increase to 13.5 per cent in 2020 and in the WM projection remain at this level thereafter. In the WAM projection the share increases to 30 per cent in 2030.

The landfilling of waste is increasingly replaced with recycling and energy recovery. In 2010, the amount of municipal waste incinerated at waste incineration plants was approximately 244,000 tonnes. Several new waste incineration plants have been constructed in recent years and in 2017 the incinerated amount was already more than 1.6 million tonnes. This is of the same order as the WM projection estimates from 2020 onwards, which estimate that the amount of municipal waste incinerated at waste incineration plants will be more than 1,240,000 tonnes per annum. In addition, co-incineration plants are expected to use 420,000 tonnes of waste-based fuels annually. Currently waste co-incineration is included in the emissions trading sector.

5.7.3 Description of models and methods

A fairly large number of models are applied for the preparation of the greenhouse gas emission projections and for impact assessment of policy measures. These are described in detail in Finland's third Biennial Report, Section 5.7.3. The descriptions are still valid and have therefore not been repeated here.

6 Provision of financial, technological and capacity-building support to developing country Parties

This section aims to give an overview on the financial, technological and capacity-building support to developing country Parties provided by Finland. Financial support provided with exact figures is reported in the CTF Tables 7, 7a, 7b separately for years 2017 and 2018. Provision of technology development and transfer support and of capacity-building support is summarized in the CTF Tables 8 and 9.

6.1 Provision of new and additional financial resources

Finland has integrated the goals and objectives of the UNFCCC, the Paris Agreement and the Kyoto Protocol into its development policy, while taking into account the fact that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties. Integration of climate change has been one of the cross-cutting objectives of Finland's development policy and development cooperation since 2012[78]. The latest development policy which has been outlined in the Government Report on Development Policy, published in February 2016[79], takes account among others of the current situation in developing countries, the goals of the UN 2030 Agenda for Sustainable Development and the Climate Convention and the Paris Agreement. Finnish development policy strives to strengthen the rights of the most vulnerable, promote gender equality, and improve climate change preparedness and mitigation. Therefore, besides providing funds to the operating entities of the financial mechanism of the UNFCCC and the funds under the Kyoto Protocol, Finland provides support through bilateral, regional and other multilateral channels.

The primary goal of Finland is to support multiannual projects (both bilateral and multilateral) and make multiannual agreements with multilateral institutions. Besides reducing the administrative burden this approach also helps to improve predictability of funding. These multiannual projects and agreements are based on joint planning and dialogue between partners, and thus the support level can also be better tailored to the specific needs which helps to provide resources more adequately than when giving support in a more ad-hoc manner.

Finland's development aid disbursements were in 2017 EUR 961 million which was 0.41 per cent of gross national income (GNI). The Official Development Assistance (ODA) figures for 2018, which is the final year in this report, amounted to EUR 833 million (0.36 per cent of GNI). As part of the general government adjustment measures the government decided in 2015 on substantial cuts on the appropriations for development cooperation starting from 2016. As such the cuts have also some implications to the climate related support provided to developing countries.

After the Copenhagen fast-start finance pledge, Finland decided to use the year 2009 as a baseline for defining new and additional funding. The Finnish fast-start finance commitment of EUR 110 million was implemented through a net increase of Finnish funding directly allocated to developing countries' climate activities in 2010–2012 compared to the year 2009. The baseline figure for overall Finnish climate funding (as grants) in 2009 was approximately EUR 26.8 million.

[78] Finland's Development Policy Programme 2012; http://formin.finland.fi/public/default.aspx?contentid=251855&nodeid=15457&contentlan=2&culture=en-US

[79] Government Report on Development Policy 2016; http://formin.finland.fi/public/default.aspx?contentid=341918&nodeid=49540&contentlan=2&culture=en-US

While the fast-start finance period is now over, the international public climate finance that Finland has provided has continued to be higher than in the base year used for fast-start finance. The total allocations were about EUR 119 million in 2017 and EUR 47 million in 2018[80]. The division between mitigation and adaptation support varies according to the year, but it is usually rather balanced. However, in 2017 about 76 per cent was allocated to mitigation and 24 per cent to adaptation which is largely due to one big disbursement namely to the new IFC Climate Program (see CTF table 7a for 2017). In 2018, the division was 63 per cent to mitigation and 37 per cent to adaptation. The method to divide funding between mitigation and adaptation support is described in Section 6.2.

According to the new Development Policy Report (2016) the Finnish Government considers important that business sector promotes sustainable development in its field, respecting the best practices and obligations of corporate social responsibility. Therefore, particular focus is placed on responsible private sector engagement and mobilizing private sector finance and expertise. This tendency is also present in the Paris pledge by Finland[81], stating that "Finland intends to provide over half a billion euros in new investment funding for developing countries over the next four years, a substantial part of which will contribute to climate finance". The first allocation (EUR 130 million) from this investment package was made in 2016 to Finnfund (Finnish Fund for Industrial Cooperation Ltd.) which is a state-owned development finance institution. Reporting of the resources directed to Finnfund is outflow-based, i.e. the capitalization of Finnfund materializes in the Finnish climate reporting only when Finnfund has invested the funds to developing countries.

In 2017, Finland set up a joint climate fund with the World Bank's private sector arm International Finance Corporation (IFC) to support renewable and clean energy solutions in developing countries (Finland-IFC Blended Finance for Climate Fund[82]). This 114-million-euro investment will be used over a five-year investment period to create markets and mobilize private investments for climate change solutions in countries where no investments are available, or investing is very difficult due to a challenging operational environment and lagging market development. The funding is primarily targeted at the least developed countries (LDCs), other lower income countries and lower middle-income countries. The fund's first investment, a venture capital investment in early-stage renewable energy projects in Africa, is an interesting example. In 2018, this programme was complemented with a small project development component. The overall objective of the component is to identify and develop high potential projects for the main climate fund that would not otherwise materialize. The component will focus especially in projects in LDCs and low-income countries, and in countries classified as fragile.

Finland has contributed additional resources to the Global Environment Facility (GEF) to prevent and mitigate global environmental problems in developing countries. Finland has allocated funds to the GEF since it was first established in 1991. The negotiations for the seventh replenishment period (July 2018 – June 2022) ended in spring 2018 during which Finland pledged about EUR 31 million.

The GEF divides the funds by environmental focal areas. According to the sixth comprehensive evaluation of the GEF

[80] In the CTF tables 7, 7a and 7b Finland uses the exchange rates for USD as provided by the OECD.

[81] UNFCCC; List of Recent Climate Funding Announcements; https://unfccc.int/list-of-recent-climate-funding-announcements

[82] https://www.ifc.org/wps/wcm/connect/e84ceea1-c706-4225-b7ef-ee90b411b856/Finland-IFC-Climate-factsheet-112017_v1.pdf?MOD=AJPERES

(OPS6) in dollar terms, the climate change single focal area projects account for 29 percent of total GEF Trust Fund utilization from the pilot phase starting in 1991 to the GEF-6 period 2014 to 2018. However, at the same time multifocal area projects address global environmental issues that are relevant to more than one focal area. The share of such projects in the GEF portfolio has been growing, rising from 29 percent in GEF-5 to 52 percent in GEF-6 until June 30, 2017. This means that in practice climate benefits stemming from the GEF projects are wider than the dollar term allocation to the climate focal area. For GEF-6 reporting, for which the final instalment by Finland was made in 2018, we use the indicative focal area programming targets as agreed in the replenishment negotiations as proportion for climate (about 28 per cent).

6.2 Tracking climate finance

Finland uses the so-called Rio markers developed for the OECD Development Assistance Committee's Creditor Reporting System (OECD DAC CRS) to track adaptation and mitigation-related (and also biodiversity and desertification) finance based on the data provided in the CRS. As the markers give qualitative rather than quantitative information, there is a need for follow-up work in order to obtain quantitative results. Depending on whether adaptation or mitigation is the principle objective or a significant objective, the share varies usually between 10 and 100 per cent. These shares are given on case-by-case basis, using the project document or relevant documentation from multilateral organisations (e.g. budget information or agreed strategies) by the desk officer. Even when the project has climate (mitigation and/or adaptation) as its principle objective the climate share used for reporting might be lower than 100 per cent of the total disbursement. The projects that target both mitigation and adaptation, e.g. many projects tackling sustainable forest management, are reported as crosscutting.

An important element in this phase is to make sure that the total sum of all Rio markers does not exceed 100 per cent in order to avoid double-counting. The GEF-6 reporting on climate allocation mentioned above is a good example of how we try to keep all Rio markers below or at 100 per cent. The core support to multilateral organisations is only taken into account when the organisation itself can provide data on exact thematic budget allocations.

6.3 Finance

In this section, information is provided on Finland's financial support for non-Annex I Parties to mitigate greenhouse gas emissions and adapt to climate change and for capacity building and technology transfer in the areas of mitigation and adaptation (CTF Table 7). Finland's development policy includes both climate change mitigation and adaptation in developing countries. Finland promotes low carbon development and the capacity of its partner countries to adapt to climate change, and it furthers the integration of these goals into partner countries' own development planning.

Related to response measures, Finland strives to implement its commitments under the Kyoto Protocol in such a way that social, environmental and economic impacts on other countries, and on developing countries in particular, are minimised. Finland supports developing countries by helping them to build their capacities and develop their economic infrastructure, thus helping them diversify their economies and improve energy production. For example, through the Energy and Environment Partnership Programme (EEP), Finland supports the participating developing countries in developing, adopting and scaling-up appropriate and affordable renewable energy and energy efficiency technologies for improved energy access and local employment. Finnish-supported EEP programmes have been executed in the Mekong Region and southern and East Africa.

Finland has also consistently and in the long term worked to reform harmful fossil fuel subsidies for both climate and wider environmental, social and economic reasons as well as to promote carbon pricing/taxation. The fossil fuel subsidy reform and carbon pricing provide the appropriate enabling environment for climate finance and set the framework for a low-carbon development path. Finland is a part of the Friends of Fossil Fuel Subsidy Reform (FFFSR), which is an informal group of non-G20 countries set up in June 2010, aiming to build political consensus on the importance of fossil fuel subsidy reform. Other members include Costa Rica, Denmark, Ethiopia, New Zealand, Norway,

Sweden and Switzerland. Finland is also a part of the Carbon Pricing Leadership Coalition (CPLC). In addition, in our Tax and Development – Finland's Action Programme[83] for 2016–19 we recognize the fossil fuel subsidy reform as part of the wise management of public resources. More information on specific activities addressing in particular minimising the adverse impacts of response measures on developing countries is provided in Finland's Seventh National Communication and in Chapter 15 of Finland's most recent national inventory report.

6.3.1 Addressing the needs of NAI Parties

Finland follows the principles of the Paris Declaration on Aid Effectiveness signed by donor and partner developing countries, which stresses the ownership and alignment of the partner country in development cooperation. When giving bilateral support, Finland takes into account our Development Policy and its priorities. Detailed project planning is carried out only after consulting with the partner countries. These country consultations are the tool used to engage partners in preparation of the cooperation plans (so-called country strategies) based on the needs and priorities of the partner country, including needs and priorities related to enhancement of endogenous capacities and technologies. In multilateral institutions, developing countries participate in the board-level decision-making process, including priority setting. For example, at the GEF the country focal point reviews the project concepts and assesses if they are national priorities for GEF assistance. These practices ensure that the resources provided by Finland address the needs of non-Annex I Parties.

6.3.2 Private finance leveraged

As there are no appropriate data collection systems in place and due to confidentiality clauses related to some private sector data, at the moment Finland does not estimate nor report regularly climate-related private finance mobilized. Finland focuses instead at the moment on following and actively participating, when possible, in the multilateral discussions on the subject.

Private sector projects in developing countries are being supported, for example, by the Finnish Fund for Industrial Cooperation Ltd. (Finnfund) and Finnpartnership (the Finnish Business Partnership Programme). Finnfund is a state-owned development finance institution that finances private projects in developing countries by providing long-term risk capital for profitable projects. The funding modalities include equity investments, mezzanine, loans and/or guarantees. It cooperates with Finnish and foreign companies, investors and financiers. Finnpartnership, on the other hand, aims to increase business-to-business cooperation between companies in Finland and in developing countries.

As outlined in previous National Communications both organizations are active in the climate change field. About half of all investments made in recent years can be regarded as climate finance because they have been used for renewable energy projects, as well as projects to prevent deforestation, to support energy and material efficiency, or to improve the ability of poor people to adapt to the challenges posed by climate change. Since 2011, Finland has been able to include climate change co-operation and ODA-eligible co-operation projects with these institutions in its total climate funding figures. During the reporting period, approximately EUR 17.6 million (in 2017) and EUR 9.8 million (in 2018) of the funding that Finnfund provided can be included in the Finnish public climate funding. According to rough estimates, the public funding through Finnfund's climate-related projects leverages private funding at a level at about two to three times that of Finnfund's funding for the investment, and the ratio can even be higher.

[83] https://um.fi/publications/-/asset_publisher/TVOLgBmLyZvu/content/julkaisu-verotus-ja-kehitys?curAsset=0&stId=47307

As mentioned in Section 6.1., the Finnish Government considers it important that businesses promote sustainable development in their own fields. In this context the government of Finland decided to use around 530 million euros during 2016-2019 as investment funding to support programmes/projects in line with Finnish development policy, especially to climate funding and creating sustainable jobs and livelihoods in private sector. The first allocation (EUR 130 million) from this package was made in 2016 to Finnfund, as mentioned in Section 6.1. Furthermore, as outlined above new Finland-IFC Blended Finance for Climate Fund was launched in 2017 and supported with the first installment of EUR 68 million (out of EUR 114 million in total).

Other climate finance and technology transfer activities presented above and below, such as the Energy and Environment Partnership (EEP), have also leveraged private finance. In the case of the EEP programme in Africa, leverage ratio is 1:2.01 and a total of about EUR 114 million was mobilised by December 2016. Furthermore, 30 per cent of supported projects have been scaled up or replicated after the EEP engagement. Finland decided in 2017 to allocate EUR 15 million to the new Energy and Environment Partnership Trust Fund (EEP Trust Fund) administrated by the Nordic Development Fund (NDF) covering Southern and East Africa for the period from 2018 to 2022[84].

6.3.3 Multilateral assistance

Finland has supported developing countries' climate actions through multilateral aid, giving core support, for example, to the GEF and the LDCF (see section 6.1. and CTF Table 7). Furthermore, as reported already above the new Finland-IFC Climate Fund was established in 2017.

Finland contributed EUR 4.1 million to the World Bank's Partnership for Market Readiness (PMR) in November 2012. The objective of the Partnership is to develop carbon market capacity in developing countries and countries with economies in transition through developing and piloting carbon market instruments. Finland actively participates in the Partnership Assembly meetings to foster cost-effective climate change mitigation action and knowledge sharing on carbon pricing. The PMR will end in 2020 and the discussions on its possible successor programme have started.

The Multilateral Development Banks have been working together and with the OECD DAC to harmonise their climate finance tracking systems. As a result of this work, Finland has included in its climate finance reporting from 2012 onwards the portion of its core support to these banks that is climate relevant.

An example of Finland's effort to promote sustainable use of forest resources and to support developing countries' capacity to collect, analyse and use reliable information on their forest resources is FAO's "Sustainable Forest Management in a Changing Climate" programme. The Finnish funded EUR 15.3 million programme (2009-2017) implemented capacity development activities in three continents (Tanzania, Zambia, Vietnam, Peru and Ecuador) and had very strong linkages with the bilateral projects in Zambia and Tanzania. In addition to the direct country support, the programme established a platform for developing and sharing forest monitoring and assessment related tools and methods. The Open Foris open source tool for forest data collection, analysis and dissemination (www.openforis.org) is used in over 50 countries.

The programme has been implemented in close collaboration with FAO's other forest monitoring related programmes, such as Global Forest Resource Assessment (GFRA), United Nation's Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) and National Forest Monitoring and Assessment programme (NFMA). During its duration (2009–2017) the Programme has also engaged a number

[84] https://um.fi/news/-/asset_publisher/GRSnUwaHDPv5/content/afrikan-energia-ja-ymparistokumppanuudessa-aloitettiin-uusi-vaihe?curAsset=0&stId=47307

of international and national institutes, e.g. Natural Resources Institute Finland (Luke), USFS, CATIE, JRC, in supporting these capacity building activities.

While speaking of the forest sector, a good example of the results of long-term forestry cooperation is the successful combating of illegal logging in Laos. Finland and the World Bank jointly provided funding (1994–2000, 2003–2017) for a sustainable forestry programme as a result of which illegal logging and the timber exports connected with them declined by as much as 75 per cent between 2016 and 2017. The volume of timber saved from logging corresponds to an annual volume of 4.5 million tonnes in carbon dioxide equivalents (tCO2e). About 40 per cent of this can be attributed to the programme. Success was possible because the project was supported by the Laotian political leadership, local personnel were committed to the project and up-to-date tools were available for the work.

The Nordic Development Fund (NDF) is a multilateral development finance institution established by the five Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) in 1998. NDF's capital is provided from the development cooperation budgets of the five Nordic countries. The original subscribed and paid-in capital by the Nordic countries is equivalent to approximately EUR 1 billion. Since 2009, NDF focuses on climate change and development in low-income countries and flexibly uses several instruments including grants, loans and equity, and combinations of these, in financing projects. For the period 2017–2018, NDF has approved financing for projects for a total value of EUR 91.45 million. Disbursements during this period totalled EUR 66.3 million. Total commitments since the introduction of the climate and development focused mandate in 2009 reach EUR 373.3 million.

6.3.4 Bilateral assistance to developing countries

The goal of Finland's development policy is the eradication of poverty and inequality and the promotion of sustainable development. The legally binding obligations that come from the multilateral environmental agreements (MEAs) are taken into account in Finland's development policy. Providing assistance in implementing the MEAs constitutes a long-term investment in building sustainable national development policies and achieving national and international environmental targets. From the standpoint of development cooperation, the implementation of UNFCCC objectives is one of the most important targets.

In long-term partner countries the co-operation is based on country programmes that are prepared in consultation with partners and that build on national development plans. These country consultations are the tool used to engage partners in preparation of the cooperation plans (so-called country strategies) based on the needs and priorities of the partner country, including needs and priorities related to enhancement of endogenous capacities and technologies, as appropriate. Finland supports projects and programmes that promote environmentally sustainable development in its partner countries and regions. The ratio varies according to the year, but generally, the bilateral co-operation projects have accounted for close to a half of all Finnish climate funding.

The form of assistance varies between regions and programmes. The Energy and Environment Partnership (EEP) projects in southern and East Africa as well as in the Mekong region mentioned above account for a large part of the mitigation projects in the energy sector. In 2017, the Finland Ukraine Trust Fund for supporting Renewable Energy and Energy Efficiency was launched.

With regard to adaptation, the most important element has been capacity building in partner countries. Finland has been very active in the field of meteorological co-operation. The Finnish Meteorological Institute (FMI) has provided technical assistance and capacity building to the national meteorological and hydrological services in Sudan, South Sudan, Tajikistan and Kyrgyzstan through the Inter-Institutional Cooperation Instrument (ICI).

Besides the examples provided above on the climate relevant bilateral cooperation, more examples and information about the projects can be found in the OECD webpages (http://stats.oecd.org/Index.aspx?DataSetCode=RIOMARKERS).

6.4 Technology development and transfer

Finland has specific programmes and financial arrangements for transferring environmentally sound technology to developing countries. These activities comprise the transfer of both 'soft' technology, such as capacity building, creating information networks and enhancing training and research, and 'hard' technology, that is, technology to control greenhouse gas emissions and for adaptation measures (see also CTF Table 8). The differences between these types of technology are not always clear, and some activities have characteristics of both. Finland's 7th National Communication (NC7) provides examples of previous projects supporting transfer of, or access to, environmentally-sound technologies and lists factors contributing to their success (Table 7.6 in NC7).

The EEP Mekong Programme has financed biogas production both from agro-industry waste streams and household scale in Thailand and Cambodia. Technologies are financially sustainable and replicable, with climate benefits both through replacement of fossil fuels and avoidance of methane emissions. In Africa, the EEP programme has achieved savings in wood and charcoal use by funding manufacturing of clean and efficient cookstoves. Clean cooking additionally delivers health benefits through reduced exposure to indoor smoke and mitigates black carbon emissions and deforestation. The Finland Ukraine Trust Fund for supporting Renewable Energy and Energy Efficiency promotes energy efficiency in buildings and heating systems as well as demonstrates waste-to-energy and circular economy solutions.

The Finland-IFC Climate Fund has invested in African wind power development, targeting eleven African countries with no significant investments in wind power so far with plans to implement 3 GW of capacity. The investment will open markets in target countries and demonstrate auction mechanisms in catalysing renewable energy investment.

In addition, Finland has supported technology transfer and development through multilateral funds such as the Global Environment Facility (GEF), the Nordic Development Fund (NDF) and the World Bank ESMAP programme. Through the Friends of Fossil Fuel Subsidy Reform group, Finland has supported national studies to replace harmful fossil fuel subsidies with more sustainable and effective social protection measures.

6.5 Capacity building

Finland supports capacity building among non-Annex I parties in several types of projects (see also CTF Table 9). Most of the Finnish bilateral projects that have a climate-related objective as their principal or significant objective also include a capacity building component. Finland also supports several multilateral climate-related funds (such as LDCF and the World Bank's Partnership for Market Readiness), which include a strong capacity building component in their activities. As an example, Finland is one of the world leaders as a donor in supporting the capacity building of non-Annex I partner countries' hydro-meteorological services at all levels. During the reporting period, the most important capacity support programmes for hydro-meteorological institutions were going on in the Central Asia as well as in Sudan and South Sudan.

Together with other Nordic countries, Finland supported a capacity building programme in the waste management sector of Peru under the Nordic Partnership Initiative for Upscaled Mitigation Action (NPI) between 2011 and 2018. Finland also supported carbon market-related capacity building in developing countries in Asia under the Asian Development Bank's Technical Support Facility in 2016–2018.

Since 2004, Finland has funded an international course on environmental law and diplomacy. The support is expected to continue also in the coming years. This 'Course on Multilateral Environmental Agreements' is organised annually

by the University of Eastern Finland in cooperation with UNEP and partners in developing countries. The course transfers past experience in the field of international environmental law to current and future negotiators of multilateral environmental agreements (MEAs), including the UNFCCC. In addition to teaching environmental law, the course aims to foster contacts between developing and industrialised countries and thus support international environmental negotiations. The course specialises each year in different themes: in 2017 the theme was Trade and environment and in 2018 Environment and human rights. Most courses have included some components related to climate change.

7 Other reporting matters

7.1 Introduction

In this chapter of the biennial report, Parties are encouraged to report, to the extent possible, on the domestic arrangements established for the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments or the level of emission reduction that is required by science. Parties are also encouraged to report, to the extent possible, on the progress made in the establishment of national rules for taking local action against domestic non-compliance with emission reduction targets.

Finland's Seventh National Communication (Chapters 2 to 6) describes the domestic climate change policy-making process, including legislative and administrative arrangements as well as monitoring and assessment of compliance with Finland's emissions reduction commitments. Information on changes in domestic institutional arrangements is presented in the Section 4.5.

Finland has not established specific national rules for taking action against domestic non-compliance with emission reduction because such rules are established in EU legislation (see, e.g., the 4th Biennial Report of the European Union, Section 3.2 and 4.2.2).

Interaction between research and policy making, regional and municipal action and initiatives are addressed in the Seventh National Communication. This information is not repeated here.

Parties are also encouraged to provide any other information in this chapter it considers relevant to the achievement of the Convention. In Finland, the mitigation and adaptation objectives and actions are largely defined in national, governmental, regional and/or sectoral strategies, programmes and plans. Section 7.2 gives information on the aims and contents of the most relevant strategies, programmes and plans relevant for climate change mitigation.

7.2 Strategies, plans and programmes

The programme of Finland's Prime Minister Sanna Marin's Government (December 2019) has a target of climate neutrality by 2035. The Government will work to ensure that Finland is climate neutral by 2035 and carbon negative soon after that. Finland will do this by accelerating emissions reduction measures and strengthening carbon sinks.

The Finnish Government is committed to reforming the climate policies of the European Union and Finland so that Finland can do its part to limit the global mean temperature increase to 1.5 degrees Celsius. Finland will also continue the Nordic climate and energy cooperation in order to achieve carbon neutrality and will work to strengthen the position of the Nordic countries as leaders in international climate policy.

Finland aims to be the world's first fossil-free welfare society. Electricity and heat production in Finland must be nearly emissions-free by the end of the 2030s while also taking into account the perspectives of security of supply. In general, regulation, subsidies and taxation should promote transition to low-carbon economy. To achieve climate neutrality, there is a need to focus domestic policy, especially on transport. According to the Government Programme, there will, for example, be specific focus on energy taxation, sectoral low-carbon roadmaps and a biogas programme. In addition, a climate programme for the land-use sector will be developed. Operating aid is decreased, and stronger focus will be on innovation financing. EU instruments, especially the Emissions Trading System, are essential instruments in transition. Low-carbon energy technologies need to be developed (R&D&I, deployment) in all fronts. Smart and resource-efficient solutions are important. Sector coupling is necessary for flexibility. Well-functioning energy markets and operating environment in general play a big role in decarbonisation.

7.2.1 National Energy and Climate Strategy for 2030

In 2016, Finland prepared a National Energy and Climate Strategy for 2030[85] that was submitted to the Parliament as a Government Report. An extensive background report adds further detail to the Government report. As background for strategy preparation, several studies were conducted, stakeholders were consulted across a broad front, and citizens had the opportunity to influence the strategy's contents.

The National Energy and Climate Strategy for 2030 outlines concrete actions and objectives to enable Finland to achieve the energy and climate targets specified in the Government Programme for 2015–2019, and jointly adopted in the EU for 2030, and to systematically set the course for reaching the 2050 targets. The Medium-term Climate Change Policy Plan (see Section 7.2.2) outlines especially the actions in the non-ETS sector emissions reductions. The starting point of the energy and climate strategy is to look at the energy and climate policy in different sectors comprehensively from the perspectives of emissions reduction, energy policy, growth and employment. The energy and climate policies have a long-time span and are in line with the Roadmap in 2014 contained in the Report of the Parliamentary Committee on Energy and Climate Issues. The National Energy and Climate Strategy takes into account Finland's special features, including the cold climate, long transport distances, extensive energy-intensive industry and domestic raw material resources, especially forest biomass.

The greatest non-ETS sector reductions in emissions will be achieved in the transport sector, which is a key part of the medium-term climate change policy plan of 2017.

7.2.2 Medium-term Climate Change Policy Plan

The Climate Change Act (609/2015) that entered into force in June 2015 established a framework for the long-term and cost-effective planning and monitoring of climate policy in Finland with the aim of reducing anthropogenic emissions of greenhouse gases into the atmosphere, mitigating climate change, and adapting to climate change through national actions. The Climate Change Act is a goal-oriented framework act, which applies to state authorities but does not contain substantive legislation on different sectors.

The act contains a provision on a climate change policy planning system that includes a medium-term climate change policy plan adopted by the Government once every government term as well as a long-term climate change policy plan adopted at least once every ten years and a national adaptation plan for climate change.

The Medium-term Climate Change Policy Plan shall include an action plan that proposes the measures for reduction of anthropogenic greenhouse gas emissions and mitigation of climate change in the sectors outside emissions trading, and projections of greenhouse gas emissions and the effects of policy measures on the emissions. The preparation of the plans is coordinated by the Ministry of the Environment and all relevant ministries are involved in the work. The first Medium-term Climate Change Policy Plan was released in September 2017[86].

According to the Climate Act, an Annual Climate Report shall be presented to the Parliament every year. The first report was submitted to the Parliament in June 2019[87]. The report contains information on the emission trends in the sectors outside EU emissions trading (i.e. the Effort Sharing Sector) as well as on implementation of the policy

[85] For more information, visit https://tem.fi/en/energy-and-climate-strategy-2016

[86] http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80703/YMra_21_2017.pdf?sequence=1&isAllowed=y

[87] https://julkaisut.valtioneuvosto.fi/handle/10024/161717

measures contained in the Medium-term Climate Change Policy Plan. The Annual Climate Report provides a tool for monitoring of the implementation of the Medium-term Climate Change Policy Plan and emission developments in the Effort Sharing Sector in relation to the targets set in the plan. If needed, the report also contains information on further actions required to meet the targets. The Annual Climate Report includes also sectoral level analyses.

7.2.3 Finland's Integrated National Energy and Climate Plan

A new EU regulation on the Governance of the Energy Union and Climate Change Actions requires that every EU Member State prepare an integrated National Energy and Climate Plan by the end of 2019. Finland has submitted its draft plan to the Commission on 20th December 2018[88] and will finalise the plan by 31 December 2019.

Finland's Integrated National Energy and Climate Plan is based on the Government reports on the National Energy and Climate Strategy for 2030 and the Medium-term Climate Change Plan for 2030. The measures in the transport sector have been specified in the final report of the working group on transport networks[89].

7.2.4 Low-Carbon Development Strategy

Finland's long-term objective is to be a carbon-neutral society. The report published by the Parliamentary Committee on Energy and Climate Issues in October 2014, "Energy and Climate Roadmap 2050", serves as a strategic level guide on the journey towards this target. The roadmap analysed the means of constructing a low-carbon society and achieving an 80-95 per cent reduction in greenhouse gas emissions from the 1990 level in Finland by 2050

A new long-term strategy for low-carbon development is currently in preparation and it is expected to be finalised by the end of 2019. The aim of Finland's new long-term strategy is to contribute to fulfilling the European Union's and the Member States' commitments under the UNFCCC and the Paris Agreement to reduce anthropogenic greenhouse gas emissions and enhance removals by sinks and to promote increased carbon sequestration as is defined in the EU Regulation on the Governance of the Energy Union and Climate Action[90].

7.2.5 Climate policy for the transport sector to 2030

National Energy and Climate Strategy for 2030 and Medium-term Climate Change Policy Plan set out concrete actions and targets through which Finland will achieve the EU energy and climate objectives to 2030. Transport plays a key part in achieving Finland's national climate targets, as it produces some 40 per cent of the Finnish greenhouse gas emissions in the non-ETS sector. The role of the transport sector in reducing emissions will grow as reducing emissions will become even more difficult in other non-ETS sectors (including agriculture). The transport sector is thus preparing to cut its emissions by up to 50 per cent by 2030.

The emissions reduction measures will focus especially on road transport, which presents the greatest potential for emission reductions. The reduction goals for greenhouse gas emissions from international aviation and shipping, and the mechanisms for reducing emissions, are being developed by the ICAO and the IMO. The EU's current emissions reduction systems (incl. aviation emissions trading) will be re-evaluated at the same time. Emission reduction

---

[88] https://tem.fi/documents/1410877/2132096/Suomen+NECP-luonnos+20.12.2018/318af23e-ad07-a984-7fcf-c439966306b7/Suomen+NECP-luonnos+20.12.2018.pdf

[89] https://api.hankeikkuna.fi/asiakirjat/7f574872-8fb8-4ab0-9a2f-235453593d73/942200a3-3e77-4ca9-91fa-74f558b47000/RAPORTTI_20180228105337.pdf

[90] 2108/1999/EU

measures can be divided into three categories: transport system level changes, improvements in vehicle energy efficiency and increased use of renewable fuels. The targets of the transport sector are:

1. Promoting the use of biofuels by replacing oil-based fossil fuels with renewable and/or low emission alternatives. The physical share of biofuel energy content in all fuels sold for road transport will be increased to 30 per cent by 2030.

2. Improving the energy-efficiency of vehicles inter alia by developing engine technology and proceeding to completely new propulsion technologies (including electricity and gas).

3. Improving the energy-efficiency of transport system by promoting the choices of more environmentally friendly mode of transport and curbing the growth of vehicle kilometers.

The Ministry of Transport and Communications appointed a working group in 2018 tasked with examining and assessing methods to facilitate the elimination of transport-related greenhouse gas emissions by 2045. The working group drew up a proposal for an action programme, the implementation of which could mean outlining a transition path towards carbon-free transport. The action programme was released in December 2018 and it has the following objectives:

1. The increase in passenger cars kilometers travelled stops in 2025, after which there would no longer be any increase.

2. The renewal of vehicles would speed up considerably.

3. Liquid biofuels would account for 30 per cent of all fuels by 2030 and 100 per cent by 2045 as far as road transport in Finland is concerned.

The proposal for action plan[91] consists of almost 30 measures and they represent a broad spectrum of different economic policy instruments for investment and guidance based on information.

7.2.6 Sustainable City Program 2017–2022

Sustainable City program is a national interpretation of the sustainable urban development objectives, topics and measures which will be used to strengthen sustainable urban development in Finland. The program will implement the UN's New Urban Agenda which was approved in 2016, the UN's Sustainable Development Goals (Agenda 2030) and the Urban Agenda for the EU[92].

The program will promote both sustainable growth (incl. e.g. low-carbon approach, efficient use of resources, circular economy) and sustainable well-being (incl. e.g. healthy indoor and outdoor air quality). It focuses especially on finding solutions that integrate several sustainability-related themes. The primary objectives include new solutions for sustainable growth and sustainable life-styles for city residents and incorporating sustainability into the city strategy. In the implementation of the program we will utilize new co-operation models, experiments, pilots, and gathering and spreading good practices and lessons.

---

[91] https://api.hankeikkuna.fi/asiakirjat/25f36343-b43d-4a4e-8bd4-83b78fd0188f/257b34a0-8801-401b-8d17-ba0c58e2ca83/KIRJE_20190402065211.pdf

[92] http://www.kestavakaupunki.fi/en-US

The Ministry of the Environment will coordinate the program, facilitate the co-operation and communicate the lessons and good practices. The cities and municipalities are the key actors and the challenges to be tackled are chosen according to their needs. Other ministries, research organizations, companies and the 3-4 sector will also be invited to take part in the program.

7.2.7 Low carbon construction roadmap

Ministry of the Environment started the preparation of a roadmap for low carbon construction in 2016. As buildings and construction account for over third of Finland´s demand-side greenhouse gas emissions, the area is in particular focus. It appears that setting limit values for the greenhouse gas emissions of new buildings would be the most effective approach reduce emissions from buildings and construction. Preliminary impact assessments indicate that with the help of limit values, it would be possible to save from 0.5 to 1 million tonnes of CO_2 eq. annually.

The current government programme states that the efforts of the low carbon construction roadmap are to be increased along with enhancing collaboration with stakeholders. The Government is aiming at regulating the greenhouse gas emissions of new buildings before year 2025. Therefore, the theme is part of the on-going total revision of the Land-Use and Building Act. As similar normative development is taking place in several European countries, Finland is collaborating on the development of assessment methods and calculation approaches with the Nordic countries and the French government.

7.2.8 Climate Policy Programme for Agriculture

The Climate Programme for Finnish Agriculture[93] ("Steps towards environmentally-friendly food", 2014) prepared by the Ministry of Agriculture and Forestry aims to further enhance the sustainability of the Finnish food system, which is founded on profitable food production and responsible consumption. By improving sustainability in a comprehensive way, it is also possible to increase the profitability of production. The objective is to improve the energy and material efficiency and reduce emissions per litre or kilogram of production.

The Climate Programme for Finnish Agriculture presents a total of 76 measures to facilitate the adaptation of food production and consumption to climate change and/or to mitigate the climate change.

7.2.9 2030 Agenda for Sustainable Development and the Society's Commitment to Sustainable Development

Finland's national sustainable development work is carried out in line with the policies of the United Nations and the European Union. The sustainable development work in the Arctic Council and the Nordic Council of Ministers complement and support national policies and measures. The Finnish National Commission on Sustainable Development, led by the Prime Minister, is tasked to follow up the implementation of the global 2030 Agenda and its sustainable development goals (SDGs) and advancing the integration of global agenda into Finland's national policies and strategies.

[93] https://mmm.fi/en/climatefriendlyfood

The Finnish Government adopted a national implementation plan for the 2030 Agenda[94] on 2017. It included two thematic focus areas; "Carbon-neutral and resource-wise Finland" and "Non-discriminating, equal and competent Finland". These focus areas include numerous concrete measures. Implementation plan defines also policy principles and measures for long-term, coherent and inclusive implementation and establishes a follow-up, review and reporting framework for Finland up until 2030. The current Government, Prime Minister Sanna Marin's Government, will renew the implementation plan. The Government's Plan is called 'Inclusive and competent Finland – a socially, economically and ecologically sustainable society'[95] and has strong emphasis and concrete measures that contribute to implementing the 2030 Agenda.

To include sustainability issues in everyday discussions of legislative and budgetary matters, the Government has included the promotion of sustainable development in its Annual Report to the Parliament and established an annual public discussion forum for measuring and taking stock of progress in the implementation of the 2030 Agenda in Finland. Ministries report frequently to the Parliament on their policies and measures to implement the 2030 Agenda, reporting takes place every spring. Finland is among the first countries to incorporate the sustainable development analysis to its budget. In the budget proposal for 2018 texts about putting sustainable development into effect in the different branches of government were included for the first time. In 2019 and 2020 the justifications for the main expenditure titles, the connections between the appropriations and sustainable development were brought out more clearly. The main title justifications cover both of Finland's priority areas of the Agenda 2030 implementation. A new element in the 2019 budget proposal was a separate analysis focusing especially on the appropriation connections relevant to the priority area of a carbon-neutral and resource-wise Finland. The analysis examines which appropriations represent specific advances towards the aims of this priority area. The analysis is included in the rationale section of the budget proposal. The budget proposal and the budget review also examine, on the revenue estimates side, the main taxation questions that are significant in terms of the goal of a carbon-neutral and resource-wise Finland. The rationale also incorporates a qualitative assessment of elements of public funding that are detrimental to the environment, based on earlier studies.

Finland's national strategy for sustainable development 'Society's Commitment to Sustainable Development' was updated in April 2016 in line with the 2030 Agenda for Sustainable Development. The core vision of this national strategy is "A prosperous Finland with global responsibility for sustainability and the carrying capacity of nature". Through the Commitment, the Government and the administration, in collaboration with various societal actors, pledge to promote sustainable development in all their work and operations. The Commitment´s one objective is a carbon-neutral society, which is meant to be achieved by the national roadmap towards a carbon-neutral society by the year 2050. The central measures to be undertaken for reaching this objective are improving energy efficiency, increasing the share of renewable energy sources, and developing the low-carbon sectors of the economy. The results of the sustainable development work will be tracked through a wide and participatory national follow-up and review system. The Society's Commitment also provides an implementation tool for anyone in Finland who wants to participate in the implementation of the 2030 Agenda with concrete action. By now, there are over 1,900 commitments from all spheres of the society. Private companies, cities, NGOs and schools have widely participated.

A new Green Deal agreement[96] was established couple of years ago in order to speed the society's movement into carbon neutral and resource-wise society. The Green Deal is a voluntary agreement between the state and the business

---

[94] http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/79455/VNK_J1117_Government_Report_2030Agenda_KANSILLA_netti.pdf?sequence=1

[95] https://valtioneuvosto.fi/en/rinne/government-programme

[96] https://sitoumus2050.fi/en/tietoa-green-dealista#/

sector. The aim is to promote also widely sustainable development goals. Parties that make an agreement commit to certain shared goals, monitoring these goals and implementing measures for achieving them. The agreement can be used as a steering instrument instead of legislation. Now three Green Deals have been made between the administration and different sectors (trade, automotive, oil refinery industry).

A new service for consumers was launched on December 2018; it enables Finns to pursue a more sustainable everyday life. With the Sustainable Lifestyle Service[97] , users can first calculate their personal carbon footprint and then draw up a personal plan to reduce it by choosing suitable actions from a recommended selection of smart choices. Every individual plan contributes to the national emissions reduction target.

7.2.10 Bioeconomy strategy

The Finnish Bioeconomy Strategy, which was prepared as a collaborative effort between several ministries, administrative branches and other participant aims to advance Finland's potential to enhance bioeconomy.

The strategic goals of the strategy are

- creating a competitive operating environment for the bioeconomy
- creating new business activities through risk financing, experiments, and transcending boundaries between different sectors
- upgrading a strong bioeconomy competence base through developing education and research activities
- securing the accessibility of biomass.

The Bioeconomy Strategy will be updated shortly.

7.2.11 Promoting effective climate solutions in municipalities

The Medium-term Climate Change Policy Plan directed EUR 1 million per year for a four-year programme (2018–2021) that involves more municipalities in goal-oriented climate actions and speeds up effective climate change mitigation solutions in municipalities and regions. The programme enhances smooth co-operation between the state and municipalities and regions across Finland. One of the main aims is to help the implementation and scaling up of the tools developed by municipal networks. So far, Ministry of the Environment has directed 1 million euros for several climate projects in municipalities and for national projects that provide municipalities with tools to start and enhance their climate actions.

[97] https://sitoumus2050.fi/en/lifestyles#/

ANNEX Recommendations in FCCC/ttr.3/FIN

Recommendation in FCCC/TTR.3/FIN	Finland's response in BR4	Where in BR4
The ERT recommends that Finland provide information on factors and activities for the key variables and assumptions for emission projections for all sectors in CTF table 5 or in the text and tables in the BR, including the assumptions for the forest industry and the renewable energy that it produces, to allow readers to gain a better understanding of the trends for all sectors.	Information on key factors and assumptions relevant to the projections have been complemented in comparison with the previous Biennial Report submission, in text and in CTF table 5	Section 2.2.1, Chapter 4 and 5 as well as the CTF Table 5