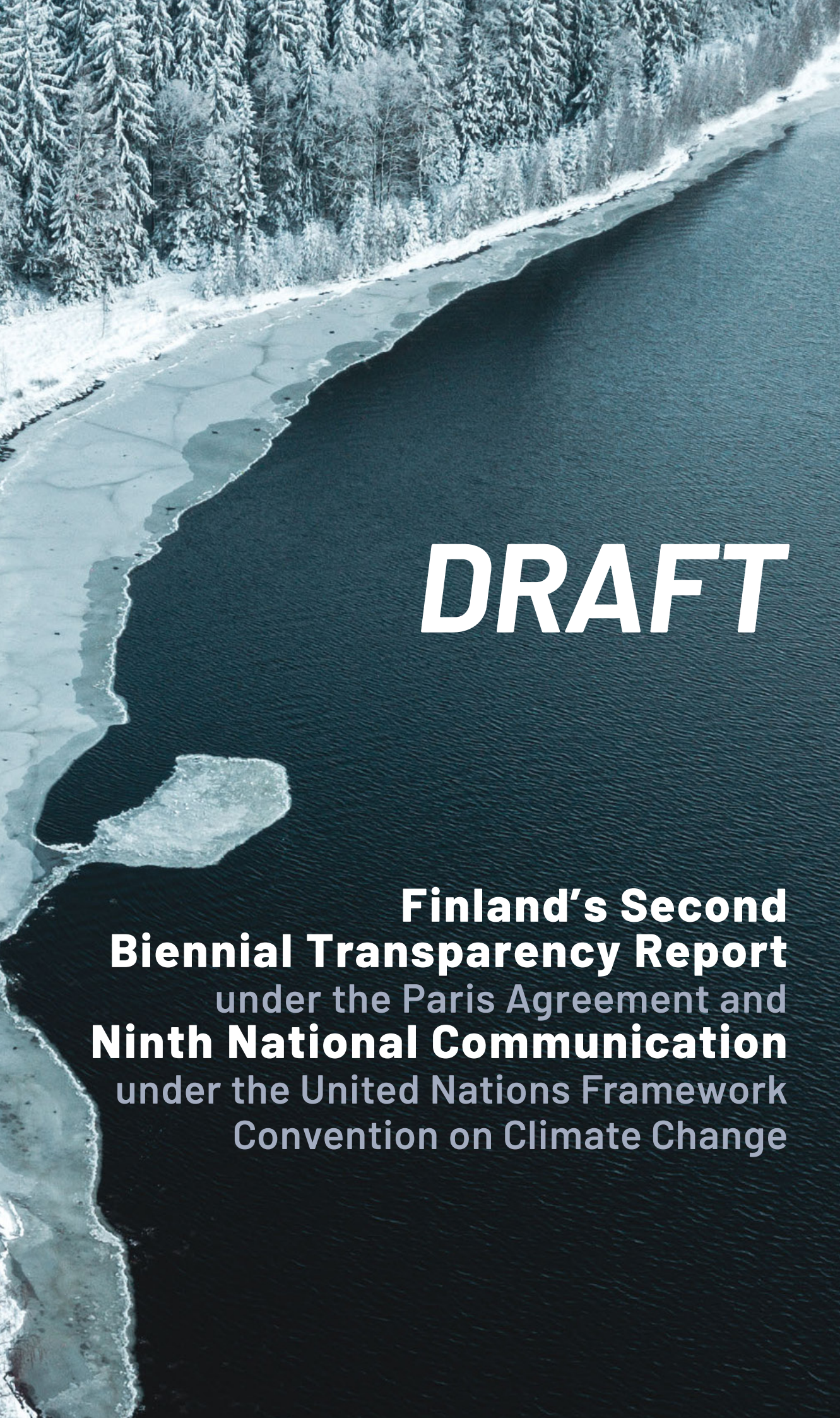


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Finland's Second Biennial Transparency Report under the Paris Agreement and Ninth National Communication under the United Nations Framework Convention on Climate Change

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Foreword



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1 Overview

1 Overview



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2

National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

2 National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

Finland's National Inventory Report containing the national inventory document (NID) and the CRT tables (inventory years 1990–2024) were submitted as a stand-alone report in conjunction with Finland's second biennial transparency report and ninth national communication.



Photo: IStock

3

Information necessary to track progress made in implementing and achieving nationally determined contributions

Ingressi....

3 Information necessary to track progress made in implementing and achieving nationally determined contributions

3.1 National circumstances and institutional arrangements

3.1.1 National circumstances

Finland's national circumstances relevant to progress made in implementing and achieving the joint nationally determined contribution are described in this section, including a description how Finland's national circumstances affect greenhouse gas emissions and removals in different sectors over time. Additional information about national circumstances is available in Finland's Eighth National Communication.

3.1.1.1 Government structure

Finland's government structure and climate policymaking process is briefly described here.

Finland is a representative democracy, with 200 members of Parliament elected every four years. The tasks of the Finnish Parliament include passing laws and approving national budgets. The Government and Parliament make the most important decisions concerning climate policy. In its narrower sense, the Government refers to the Cabinet, which currently has 19 ministers.

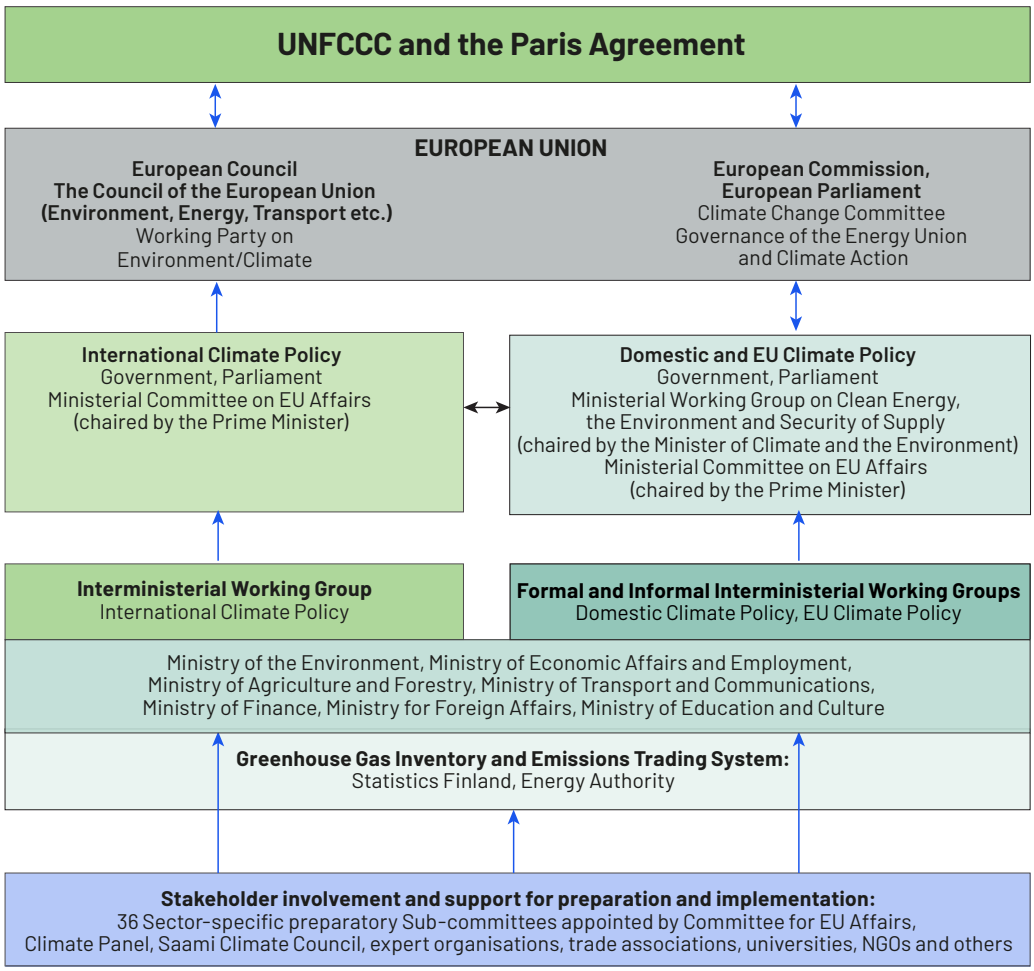
The head of state is the President of the Republic, who directs foreign policy in cooperation with the Government, thus approving Finland's international commitments and deciding on their implementation in accordance with the constitution. However, some major decisions also require approval from Parliament. Parliament also actively participates in the debate on how EU decisions are implemented nationally. The Government must enjoy the confidence of Parliament. It implements parliamentary decisions, presents legislative proposals to Parliament, directs state administrative activities, and represents Finland in the European Union.

The Ministerial Committee on European Union Affairs discusses and decides on Finland's positions on EU and international climate policy issues. Finland participates in the international climate negotiations as part of the European Union and therefore follows the EU's common positions. The Ministry of the Environment bears the responsibility for coordinating the preparatory work for the climate negotiations and is the national focal point for the UNFCCC. The preparatory work for the climate negotiations is conducted in several ministries.

Since 2003, every Finnish government has appointed ministerial working groups responsible for energy and climate policy, with representatives from all government parties. These ministerial working groups have been responsible for preparing and updating the national strategies on energy and climate policy. The ministerial working group has a network of officials acting as its preparatory body, comprising representatives from seven ministries and the Prime Minister's office. The network of officials is led by the Ministry of Economic Affairs and Employment, which oversees the strategy work's overall coordination.

Institutional arrangements related to climate policy and its implementation are summarised in Figure 3.1-1 below. More information can be found in Sections 3.1.2 and 3.1.3/3.1.2.1 and 3.1.2.2, and Finland's Eighth National Communication.

Figure 3.1-1
Institutional arrangements related to climate policy and its implementation in Finland



3.1.1.2 Population profile

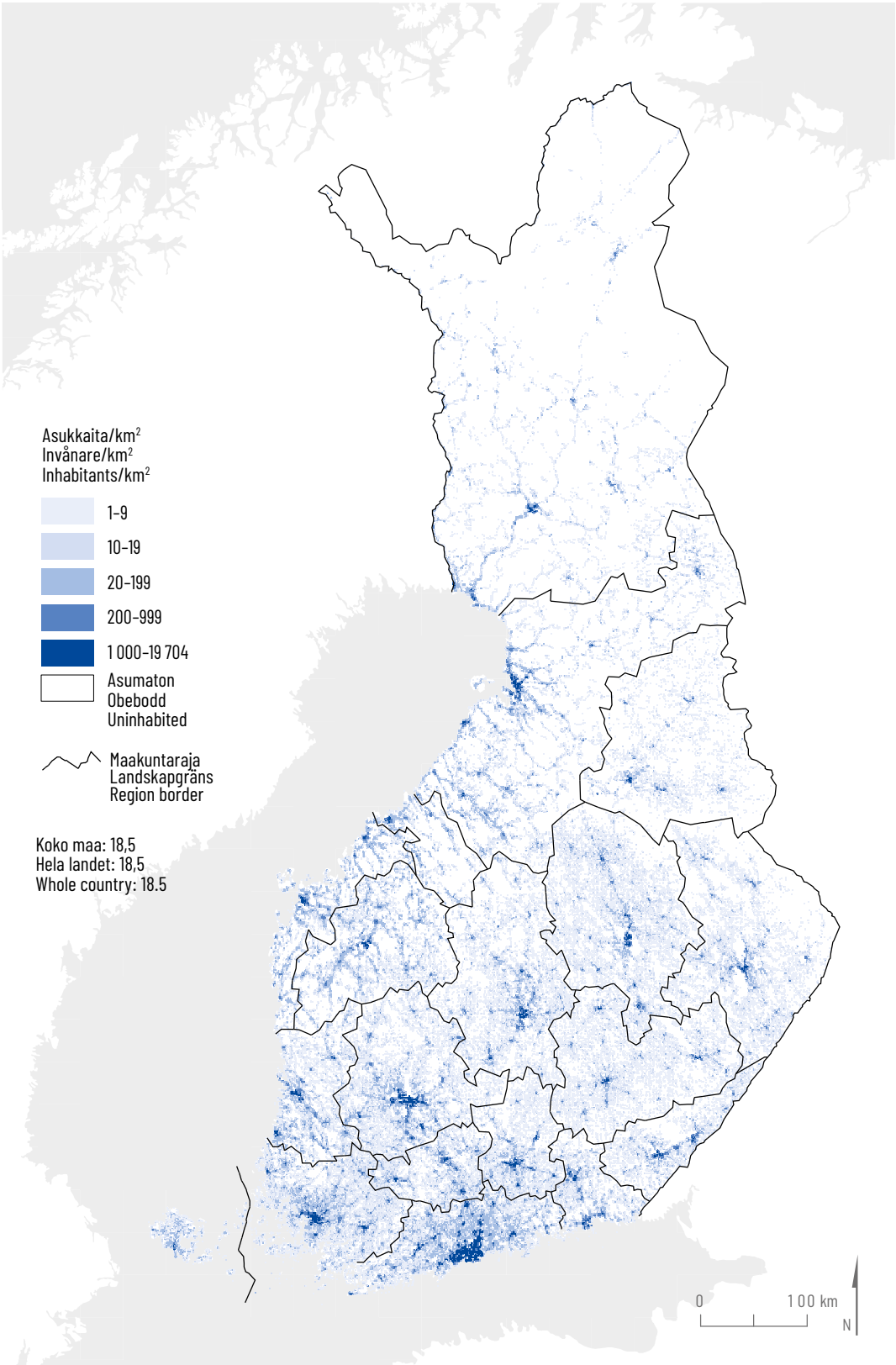
The population of Finland was 5.64 million at the end of 2024, having risen by 0.6 per cent from the previous year. Population growth was 3.5 per cent between 1990 and 1999, 3.3 per cent between 2000 and 2009, and 2.8 per cent between 2010 and 2019. Over the current decade, population growth has averaged 0.40 per cent per year. At the end of 2024, there was a total of 2.9 million households. The average household size was two persons. The population density averages 18.5 inhabitants per km^2 but ranges from two inhabitants per km^2 in Lapland in northern Finland to 196 inhabitants per km^2 in the south of the country in the Helsinki-Uusimaa region (Figure 3.1-2). The country's low population density and geographical extent mean long distances can be travelled for different purposes.

The urban population accounted for 73 per cent of the total population in 2024. The corresponding figure in 1990 was 63 per cent of a total population of 5.0 million. Many rural municipalities have a declining population, especially in northern and eastern Finland. Internal migration from rural to urban areas was strong in the mid and late 1990s, when urban municipalities gained more than 10,000 migrants per year. Internal net migration to urban municipalities declined in the early 2000s but has increased steadily since, reaching an annual average of 9,000 internal migrations between 2015 and 2019. However, during the Covid-19 pandemic, the net urban migration gain fell significantly to 5,400 and 900 in 2020 and 2021, while the net migration losses of semi-urban and rural municipalities decreased. Recently, the trend of increasing net migration to urban municipalities has re-emerged, and the net gain of urban municipalities increased to 6,500 in 2024.

Net migration to Finland increased steadily during the late 1990s and the 2000s. In 1994, net migration to Finland was around 3,000; in 2006, it reached more than 10,000 migrations. Net migration to Finland ranged between 12,000 and 18,000 in the 2010s. Since the beginning of this decade, immigration to Finland has increased, with net immigration reaching 58,000 in 2023. However, net immigration decreased slightly decreased to 47,000 in 2024.

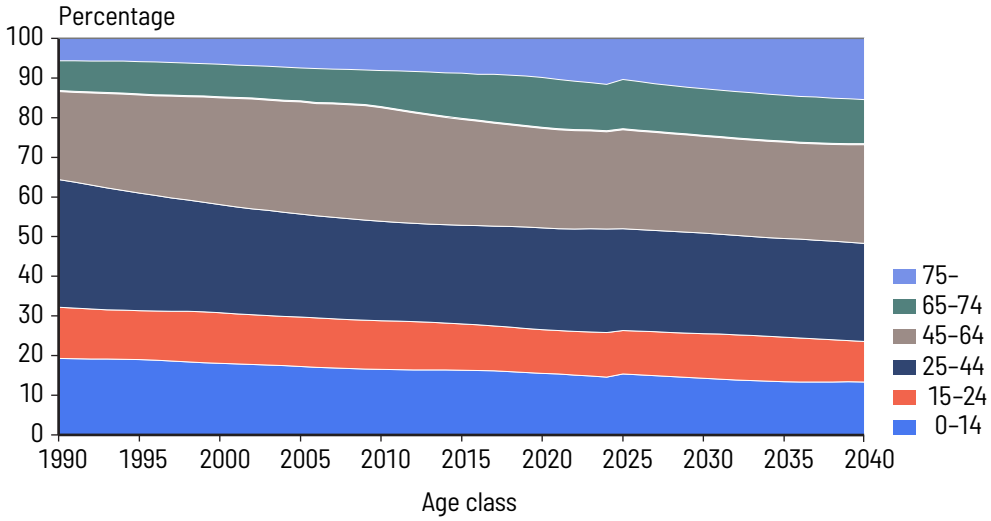
The population is ageing, as life expectancy has risen rapidly over the last 40 years. Currently, baby girls may expect to reach the age of 84.8, and baby boys the age of 79.6. The proportion of the population aged over 65 rose from 13.5 per cent in 1990 to 23.6 per cent in 2024. This increasing trend will continue in the coming years. Natural population growth is expected to decline in the coming decades. A population projection made by Statistics Finland in the autumn of 2021 estimates that the Finnish population will decline from 2033 if fertility rates and the amount of net migration remain at the level observed when the projection was made. By 2040, it is estimated that more than a quarter of

Figure 3.1-2
Population density in Finland, 1 January 2025



Finland's population will be 65 years old or over (Figure 3.1-3). Projections for greenhouse gas emissions in Section 3.6 are based on this population projection because of the scheduling of the preparation of projections. However, a newer population forecast was published by Statistics Finland in 2024.

Figure 3.1-3
Population profile for 1990 to 2040 (1990 to 2024 actual, 2025 to 2040 projected)



3.1.1.3 Geographical profile

Finland is situated at a latitude between 60 and 70 degrees north, with a quarter of the country extending north of the Arctic Circle. In the west and south, Finland has a long coastline, with numerous islands along the Baltic Sea coast. With a total area of 338,400 km^2, it is Europe's seventh largest country.

Finland lies between the Scandinavian mountains and northern Russian plains. The boundary with Sweden is 614 km, with Norway 737 km, and with Russia 1,344 km.

Finland's terrain is a varying mosaic of low hills, broad valleys, and flat, low-lying plains, with higher fells in the north. The landscape is a mixture of forests, lakes, and mires. Much of the country is a gently undulating plateau of mostly ancient bedrock.

Nearly all of Finland is in the boreal coniferous forest zone, and 72 per cent of the total land area is classified as forest land, while only some eight per cent is cropland (Table 3.1-1).

Peatlands cover almost a third of Finland's total land, approximately 9 million hectares. Regional differences in coverage are considerable. The majority of peatlands are in the north. Two thirds of the peatlands, i.e. six million hectares, is forest land, of which a majority has been drained. Approximately 0.3 million

hectares, corresponding to three per cent of peatland, is in agricultural use, i.e. cropland. The area of protected peatlands is approximately 1.3 million hectares, which is 14 per cent of peatlands. In 2024, active peat production covered 40,000 ha, i.e. less than one per cent of the surface area of peatlands. More information about peatlands can be found in Chapter 2 of Finland's Eighth National Communication.

Inland water systems cover 35,500 km^2 which is 10 per cent of Finland's total area. There are some 190,000 lakes and 180,000 islands, with almost half the latter along the Baltic Sea coast. The Baltic Sea is the second largest brackish water basin in the world in terms of water volume. The water of the Baltic Sea is a mixture of ocean water and fresh water brought in by numerous rivers. Eutrophication is a severe problem affecting the Baltic Sea. It is the consequence of more than a century of nutrient loading caused by human activity, i.e. settlements, industry, agriculture, and forestry in the Baltic Sea region.

Changes in land use since 1990 are shown in Table 3.1-1. The area of settlements has increased by 26 per cent, and that of grassland has decreased by 10 per cent, whereas changes in areas of other land-use categories have been small, at one per cent or less.

Table 3.1-1
Land use in 1990 and 2024

Land-use category*	1990	2024 (km^2)	Change, %
Forest land	221,086	218,344	–1.2
Cropland	24,719	25,041	1.3
Grassland	2,663	2,393	–10.2
Wetlands	64,589	64,174	–0.6
of which inland waters	*34,518*	*34,558*	*-0.1*
Settlements	12,239	15,382	25.7
Other land	13,139	13,101	–0.3
Total	**338,435**	**338,435**	**0.0**

* The classification is based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Vol.4. Agriculture, Forestry and Other land Use

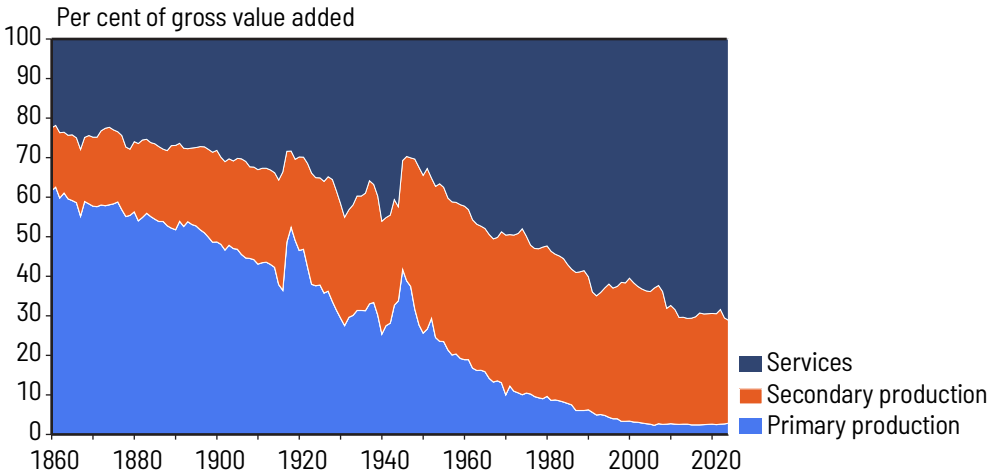
Source: National Resources Institute Finland (Luke), Greenhouse Gas Inventory team

3.1.1.4 Economic profile

Finland has an open economy with prominent service and manufacturing sectors (Figure 3.1-4). The main manufacturing industries include metals, manufacture of electrical and electronic products, chemicals, and the forest industry. Foreign trade is important, with exports accounting for approximately 40 per cent of the gross domestic product (GDP) in recent years. In 2024,

Finland's GDP was EUR 276 billion, and per capita GDP was EUR 49,000. The cold climate, energy-intensive industry structure, and long distances have led to a relatively high energy intensity. In the past, this has also led to high per capita greenhouse gas emissions, but today Finland is below the OECD average (excluding emissions from LULUCF).

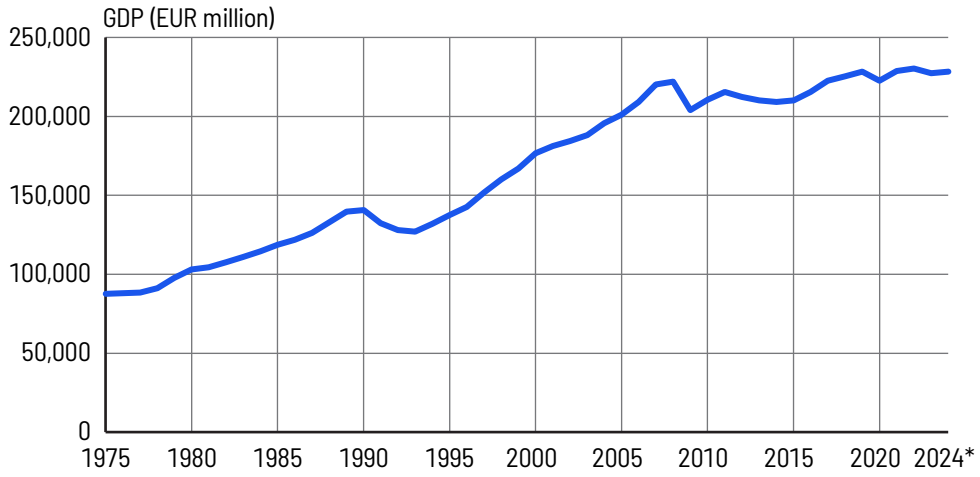
Figure 3.1-4
Structural change in the Finnish economy between 1860 and 2024*



* Preliminary estimate published by the Annual National Accounts at Statistics Finland.

For several decades, the Finnish economy was characterised by rapid growth combined with a vulnerability to international cyclical fluctuations (Figure 3.1-5). Finland underwent severe economic recessions in the early 1990s, but the economy recovered rapidly after this. After the financial crisis of the late 2000s, however, it took nine years for the Finnish economy to reach the same level of real GDP as in 2008 because of the restructuring of the economy in the 2010s. The slow growth was partly due to difficulties in net exports and in the electrical and electronic products industry. After modest economic growth in the late 2010s, the volume of Finland's GDP fell in 2020 by 2.5 per cent because of the Covid-19 pandemic. The economy recovered swiftly from the pandemic and grew by 2.7 per cent in 2021 and by 0.8 per cent in 2022. For various reasons, Finland's GDP contracted by 1.3 per cent in 2023 and grew by only 0.4 per cent in 2024. The acceleration of inflation and the resulting rise in interest rates had a strong impact on the Finnish economy. The effects extended to both households and businesses. The increase in interest rates, combined with rising construction costs, led to a sharp decline in housing prices and a significant reduction in construction activity. The downturn in construction observed in Finland has been deeper and more prolonged than during the global financial crisis.

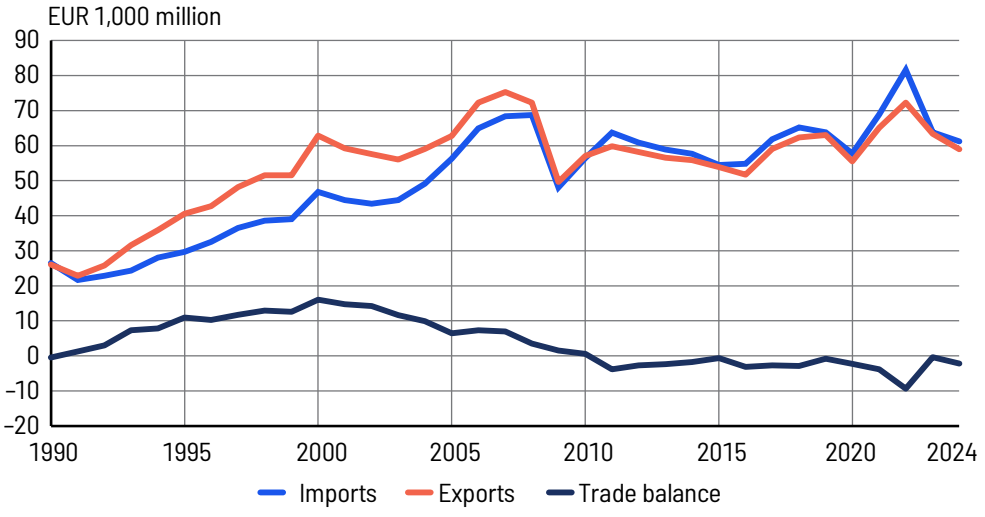
Figure 3.1-5
Finland's gross domestic product, 1975 to 2024 (at 2015 prices)



* Preliminary estimate published by the Annual National Accounts at Statistics Finland.

The volume of Finnish exports of goods has remained below the level achieved before the recession that started in 2008 (Figure 3.1-6). However, after the Covid-19 pandemic, the value of exports increased significantly in 2021 and 2022, but decreased in 2023 and 2024 due to Russia's full-scale invasion of Ukraine in 2022. The volume of goods exported in 2024 was 41 million tonnes, and their total value at current prices was EUR 76.8 billion. More than half the total value was exported to EU countries. Paper and paper products, machinery and equipment, basic metals, and electrical equipment have been the most important groups of exported goods in recent years. The degree of refinement in exported goods is higher than in imported goods.

Figure 3.1-6
Finnish imports, exports, and trade balance of goods, 1990 to 2024 (at 2015 prices)



Sources: Imports and Exports by Finnish Customs, Trade balance by Statistics Finland

The total value of exports of services at current prices was EUR 38.8 billion in 2024. Telecommunications, computer, and information services are the largest item among exported services. The export of services has shown an increasing trend during the last ten years, except for 2020, when the Covid-19 pandemic reduced exports of travel and transport services in particular.

Finland imported almost 46 million tonnes of goods in 2024. The total value of imported goods was EUR 70.8 billion. After the Covid-19 pandemic, the value of imports increased significantly in 2021 and 2022, but decreased again in 2023 and 2024, as did exports (Figure 3.1-6). Industrial products represented 81 per cent of the total value in 2024, with basic metals products, electrical equipment, machinery and equipment, chemicals and chemical products, and motor vehicles being the most significant groups of goods. For imports of services, the most significant item was other business services, which consisted mainly of R&D services, business and management consulting and public relations services, and trade-related services. Imports of services have exceeded exports of services in recent years; this was also the case in 2024, when the value of imports of services (EUR 43.8 billion) was higher than that of exports (EUR 38.8 billion).

3.1.1.5 Climate profile

Finland's climate exhibits characteristics of both maritime and continental climates, depending on prevailing airflow patterns. Considering its northern location, the mean temperature in Finland is several degrees higher than in most other areas at similar latitudes, such as Siberia, northern Canada, most of Alaska, and southern Greenland. This relative warmth is due to the Baltic Sea and inland waters, and above all the airflows from the Atlantic Ocean, which are warmed by the North Atlantic Current.

The annual mean temperature is close to 7 °C in Finland's southwestern archipelago, decreasing towards the northeast. The 0 °C mean limit is reached slightly north of the Arctic Circle. Temperature differences within the country are greatest in January, when it is more than 10 °C colder in northern Finland on average than in the southwestern archipelago. In contrast, during June and July, the temperature difference between southern Finland and northern Lapland is only about 5 °C.

Finland enjoys long periods of daylight around midsummer, when the length of the day, including civil twilight, reaches 22 hours even in southernmost Finland. North of the Arctic Circle (66.5°N), it remains light throughout the night at this time of year, as the sun does not descend below the horizon. Conversely, in winter, the sun does not rise above the horizon in the northernmost region for almost two months.

The Finnish climate is characterised by irregular precipitation and rapid changes in the weather. Average annual precipitation in southern and central Finland ranges mainly between 600 and 750 mm, with slightly lower amounts along the coast. In northern Finland, average annual precipitation ranges from approximately 450 to 650 mm.

Seasonal variation in precipitation is fairly consistent throughout the country, with the driest months being February, March, and April. Precipitation then gradually increases towards the summer, and July or August is, on average, the rainiest month in most of Finland. Precipitation then decreases towards the winter and spring months. Daily precipitation of 40 mm occurs in a certain location on average once every five years. In an average year, more than half the days have some precipitation, although this figure is somewhat less near coastal regions. Long periods without any precipitation are rare.

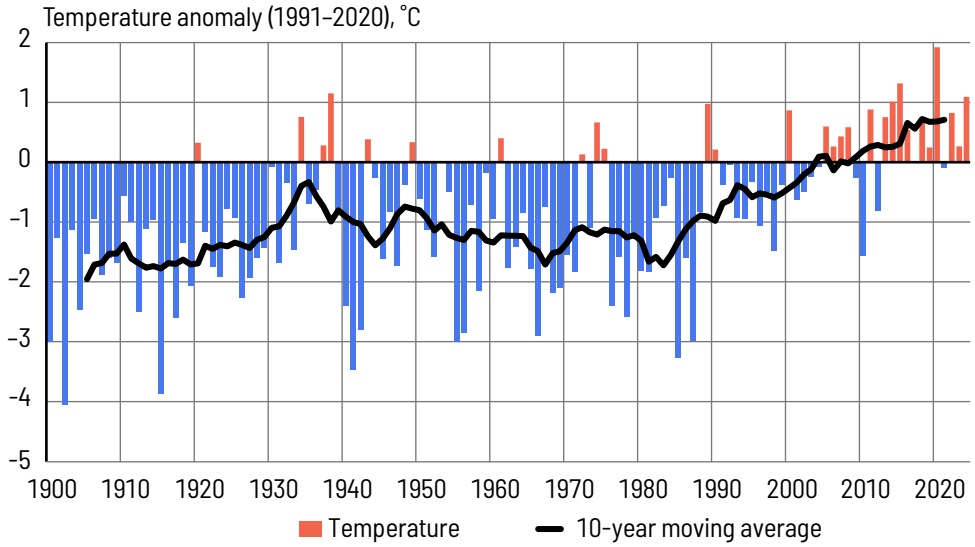
Even in southern Finland, about 20 per cent of annual precipitation falls as snow, which remains on the ground for about three to four months. In Lapland, 35 to 50 per cent of annual precipitation falls as snow, and snow remains on the ground for six to seven months.

Lakes in Finland freeze over in October in Lapland and in early December in southern Finland on average. During severe winters, the Baltic Sea may freeze over almost completely, but in mild winters, it remains mostly open, except for the Bothnian Bay and the eastern part of the Gulf of Finland.

The most common wind direction in Finland is from the south or southwest. The average wind speed is 3–4 m/s inland, slightly higher on the coast, and 5–7 m/s in maritime regions. Damage due to windstorms and strong winds occurs most often during the autumn and winter, but also during the summer in connection with thunderstorms. Cloud cover is especially abundant in the late autumn and winter. The long-term average for the monthly cloud cover ranges from approximately 50 per cent in May to July in the south to more than 80 per cent in many places in November and December.

The annual mean temperature has increased by about two degrees Celsius since the beginning of the 20th century (Figure 3.1-7). The increase has been greatest in the winter and spring, but even in the summer and autumn, the temperature has increased by almost 1.5 °C. Most of the warming has taken place since the 1980s, and the new climatological normal period between 1991 and 2020 was approximately 0.6 °C warmer than the previous period between 1981 and 2010, and almost 1.3 °C warmer than the period between 1961 and 1990. Nevertheless, considerable temperature fluctuations occur between individual years.

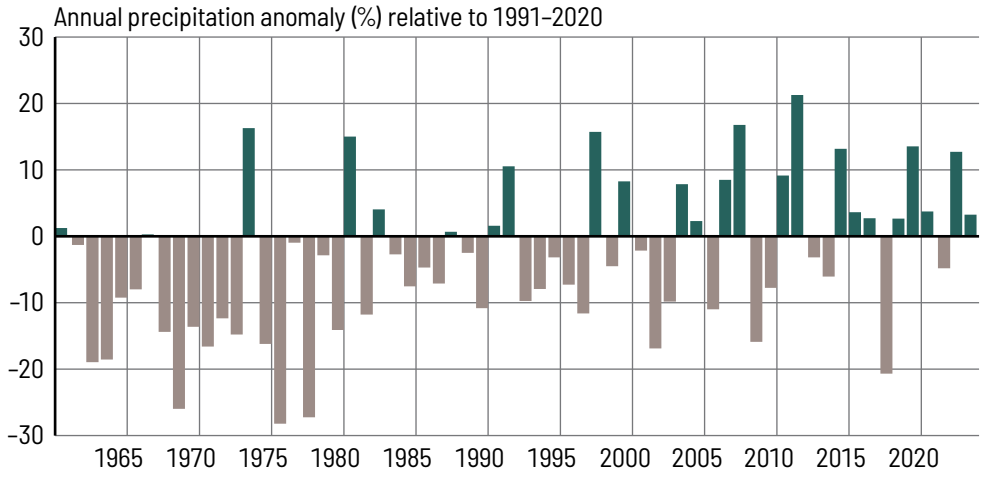
Figure 3.1-7
Annual mean temperature in Finland, 1900 to 2024, presented in anomalies (°C) relative to the 1991 to 2020 reference period. The black line represents the 10-year moving average.



Source: Finnish Meteorological Institute

Average annual precipitation shows significant variations from year to year (Figure 3.1-8). Long-term changes in the precipitation level are thus mainly obscured by the natural variability, but years with above-normal precipitation levels have recently occurred more often than in the 1960s and 1970s. Moreover, the countrywide average precipitation level was almost 10 per cent higher between 1991 and 2020 than between 1961 and 1990. Precipitation has increased most in the winter.

Figure 3.1-8
Annual mean precipitation in Finland, 1961 to 2024, presented as anomalies (%) relative to the 1991 to 2020 reference period.



Source: Finnish Meteorological Institute

Above all, climate change has affected winter conditions in Finland. Shorter winters have resulted in reduced snow cover in the south. Permanent snow cover, that is, the longest uninterrupted winter period with snow cover, has become between one and two weeks shorter in southern and central parts of Finland compared with the 1981 to 2010 reference period. The change is even greater when compared with 1961 to 1990: the duration of permanent snow cover on the southern and western coast is now more than a month shorter.

An increase in the number and intensity of heatwaves has been observed in recent decades. Warm weather and long uninterrupted heatwaves also cause local droughts. Drought is a relatively rare phenomenon in Finland, with no increase in drought periods observed yet. There is no comprehensive research on the topic, however. With the climate warming, the thermal growing season (the period when snow has melted from open areas and the mean daily temperature exceeds +5 °C) has also become longer, and the temperature sum has increased.

Finland's wind and storm climate is characterised by major variation between years and decades. Based on weather observations, average annual wind speeds have fallen slightly in recent decades. No statistically significant long-term trends can be observed in the number of windstorms. By contrast, an increase can be seen in conditions facilitating the occurrence of thunderstorms, but there is uncertainty regarding how this is reflected in changes in gusty winds.

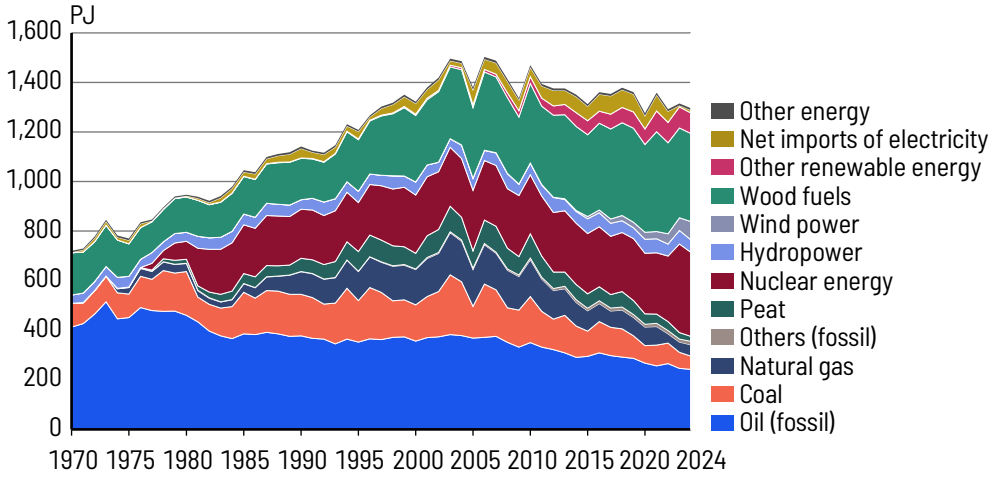
3.1.1.6 Energy, including transport, and industrial processes and product use

This section covers the energy sector, including transport, and industrial processes and product use sector of the greenhouse gas inventory.

Energy supply and consumption

Energy-intensive basic industries, the cold climate, and long distances underline the importance of energy for the wellbeing of Finland's inhabitants and the country's competitiveness. Until the 1960s, Finland's energy supply relied on electricity produced by hydropower stations and the extensive use of wood, after which the use of fossil fuels began to increase. The rapid increase in fossil fuel use levelled off after the energy crises and with the advent of nuclear power. Both total energy consumption and electricity consumption increased for several decades, peaking in 2006 to 2007. Since the 2010s, renewable energy has increasingly replaced fossil fuels (Figure 3.1-9).

Figure 3.1-9
Total energy consumption, 1970 to 2024, PJ



Total energy consumption was 1,296 PJ in 2024. Wood fuels accounted for 27 per cent, nuclear energy 26 per cent, and fossil oil 19 per cent as sources of total energy consumption (Table 3.1-2). Finland's main domestic energy sources are wood-based fuels, hydropower, wind power, solar energy, waste, peat, and heat pumps. In 2023, when Finland's fifth nuclear power plant unit began regular electricity production, nuclear power production increased by 35 per cent from 2022. Before this, electricity production from Finnish nuclear power plants had been very stable between 2000 and 2022 (see Figure 3.1-10). Nuclear power in total energy consumption rose to the second largest energy source for the first time, surpassing fossil oil in 2023 (Figure 3.1-9).

Concerning fossil fuels, Finland depends completely on imports, as it has no resources of oil, natural gas, or coal of its own. Finland's energy import dependency, calculated as the proportion of imported net energy in total primary energy supply, was 33 per cent in 2024. However, Finland relies more on imports than this energy import dependency figure indicates, as the indicator considers nuclear energy to be domestic.

The European Union's Emissions Trading System (EU ETS) was implemented in Finland in 2005. The system incentivises most of the energy sector and industry to cut emissions in the form of an extra cost for CO_2 emissions. In addition, several national measures have been put into action. For example, in 2010, the Government launched an extensive national package of specific targets concerning different renewable energy sources. The package promoted the use of forest chips and other wood-based energy, wind power, transport biofuels, and increased utilisation of heat pumps. Share of renewable energy in total energy consumption has grown from the 18 per cent in 1990 to 43 in 2024, with the most pronounced increase occurring since 2010 (Figure 3.1-10). Other recent trends in Finland's energy production are the future ban on

the use of hard coal, which has been used little since 2025 thanks to additional incentives, and the steady market-based increase of wind power capacity.

Figure 3.1-10
Total energy consumption by fuel groups in PJ and share of renewable sources, 1990 to 2024.

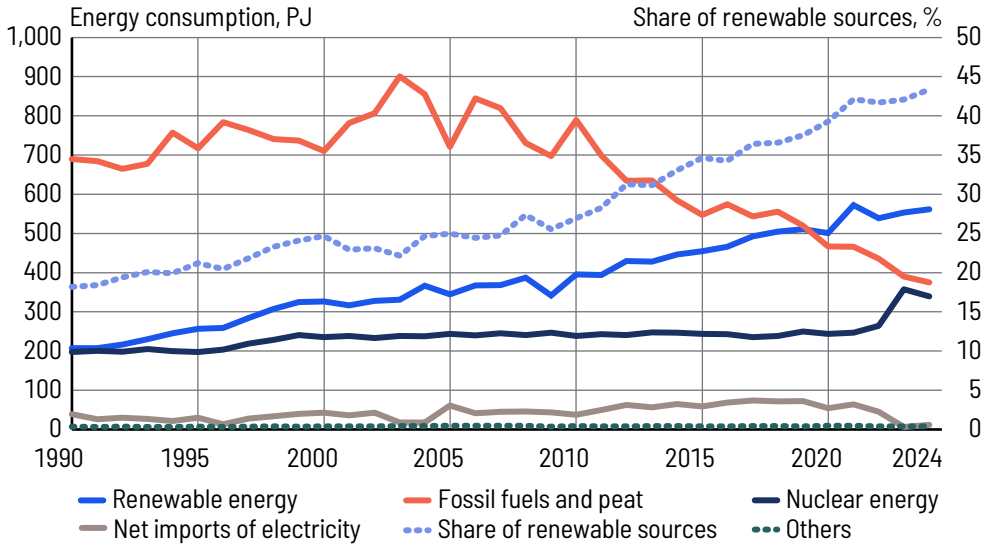


Table 3.1-2
Total energy consumption by sources in 2024, PJ and share of total energy consumption.

2024	Quantity (PJ)	Share of total energy consumption (%)
Wood fuels	356	27
Nuclear energy	340	26
Oil (fossil)	242	19
Oil (bio)	23	2
Coal	53	4
Natural gas	46	4
Peat	20	2
Net imports of electricity	11	1
Wind power	73	6
Hydropower	51	4
Heat pumps	36	3
Other (bio and other renewable)	24	2
Others (fossil)	13	1
Others	8	1
Total	**1,296**	**100**

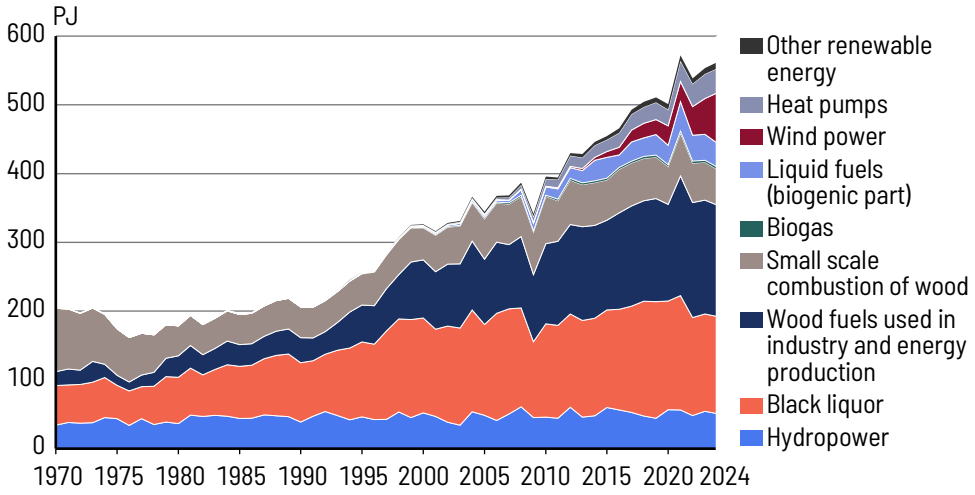
The rise of the emissions allowance price in the EU ETS is accelerating the replacement of fossil fuels with renewable energy, waste heat recovery, and electrification. In addition, an expansion of the EU-wide emissions trading system, called ETS2, has been adopted to cover and address CO_2 emissions from fuel combustion in buildings and road transport, but it is still not in full operation.

Finland significantly exceeded the national target of 38 per cent for the share of renewable energy in gross final energy consumption by 2020 set in the EU's Renewable Energy Directive. In 2024, Finland's 51 per cent share of renewable energy in gross final energy consumption was the second highest in the EU.

In 2024, wood fuels accounted for 27 per cent of total energy consumption (Table 3.1-2), and they have been the most used energy source in Finland since 2012 (Figure 3.1-9). The majority of wood fuels is derived from forest industry by-products such as black liquor from the pulp-making process and bark, sawdust, and other industrial wood residues. Logging residues or other low-value biomass from silvicultural and harvesting operations are also used for energy production. Figure 3.1-11 shows all the renewable energy forms used in Finland in more detail.

Policy measures promoting wind power have been highly successful, resulting in a viable industry and wind power being built in the 2020s fully on a market basis and without economic subsidies. Thanks to investment grants and fiscal support, solar energy has had the fastest relative growth, although the absolute amounts remain modest.

Figure 3.1-11
Total consumption of energy from renewable sources, 1970 to 2024, PJ



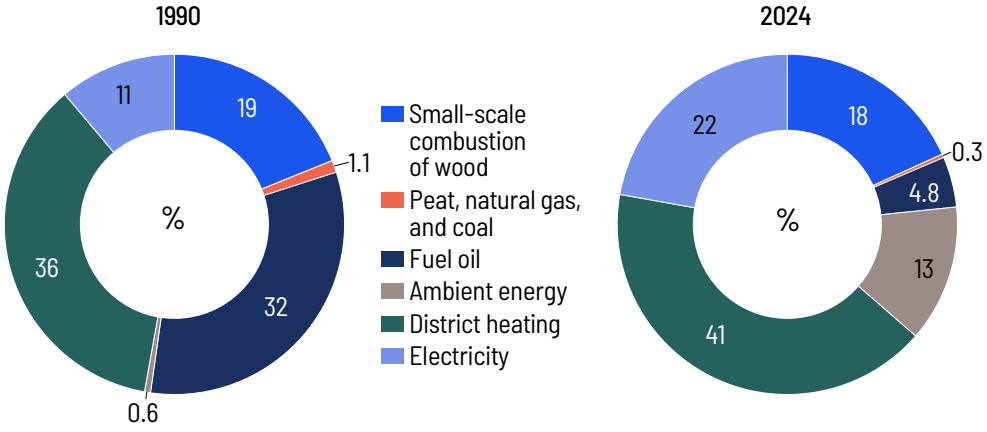
Indoor heating

Because of the country's northern location, a great deal of energy is used for indoor heating in Finland. The building stock is fairly new, with more than 60 per cent of buildings having been constructed since 1970. The total area of heated buildings has increased by more than 50 per cent in the last 30 years. The heating of indoor spaces consumes about two thirds of the energy consumed in households. It is the biggest source of CO_2 emissions by residential sector, as well as within the public and service sectors.

The composition of energy sources used for indoor heating changed significantly between 1990 and 2024 (Figure 3.1-12). The share of district heating in the heating of indoor spaces as well as the use of electricity in heating increased. In turn, the use of oil decreased. The use of electricity in heating doubled. The increase in the use of heat pumps (ambient energy) is due to economic and environmental reasons, as well as to advances in technology. Small-scale combustion of wood is often used as a secondary heating system, but it is also used as the principal heating source in rural areas.

District heating increased considerably, by 50 per cent between 1990 and 2024, and its share was 41 per cent of the total heating energy in 2024 (Figure 3.1-12). District heating is the primary heating system in blocks of flats, and half the country's total building stock relies on it. District heating networks now cover most areas with a cost-effective potential, i.e. relatively or more densely populated areas.

Figure 3.1-12
Energy sources for heating residential, commercial, and public buildings in 1990 and 2024.



A wide range of energy sources is used to produce district heat. The share of renewable energy sources in the production of district heating has increased considerably (Figure 3.1-13). The share of district heat produced by other

energy sources increased from two per cent in 2000 to 21 per cent in 2024 (Figure 3.1-13). The most notable other energy sources are flue gas scrubbers, heat pumps, and electric boilers. The amount of district heat produced by electric boilers has increased significantly since 2022 (Figure 3.1-14).

Combined heat and power (CHP) accounted for 36 per cent of the total heat produced in district heating in 2024. CHP improves efficiency, especially compared with separate condensing power production.

Figure 3.1-13
Energy sources in district heating production in 2000 and 2024.

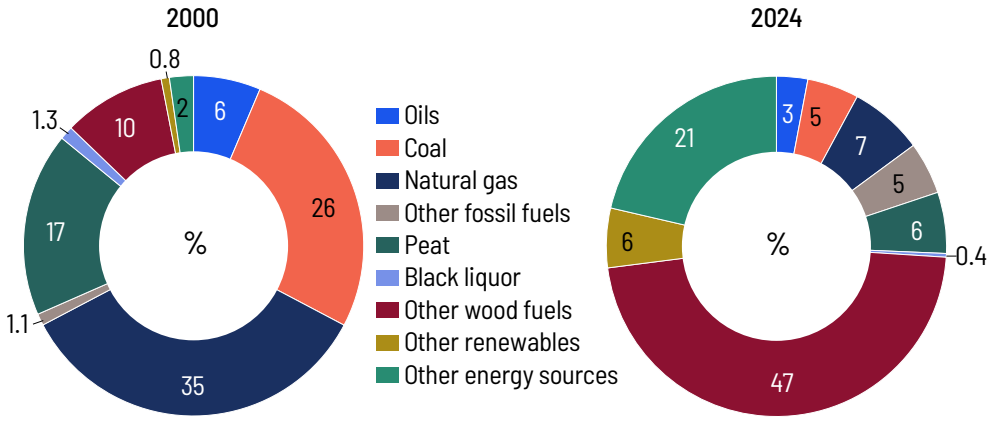
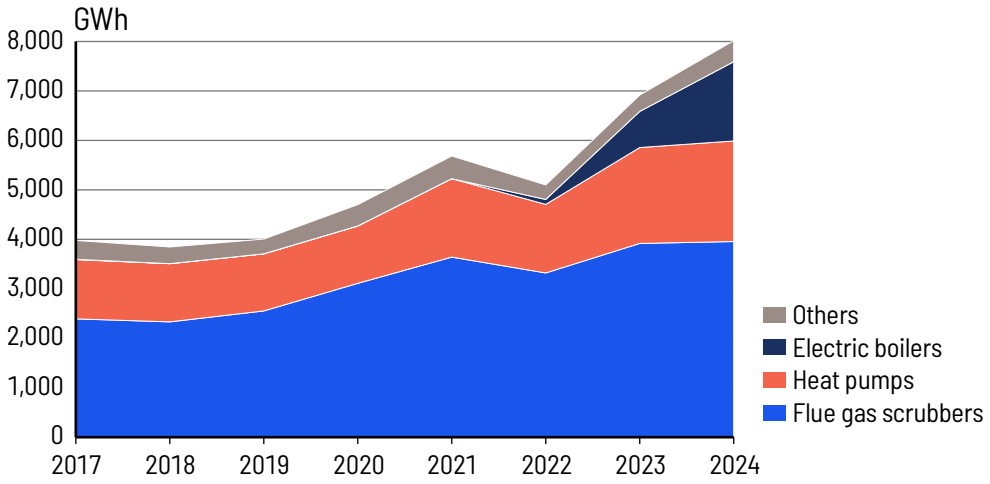


Figure 3.1-14
District heat production by other energy sources, 2017 to 2024.



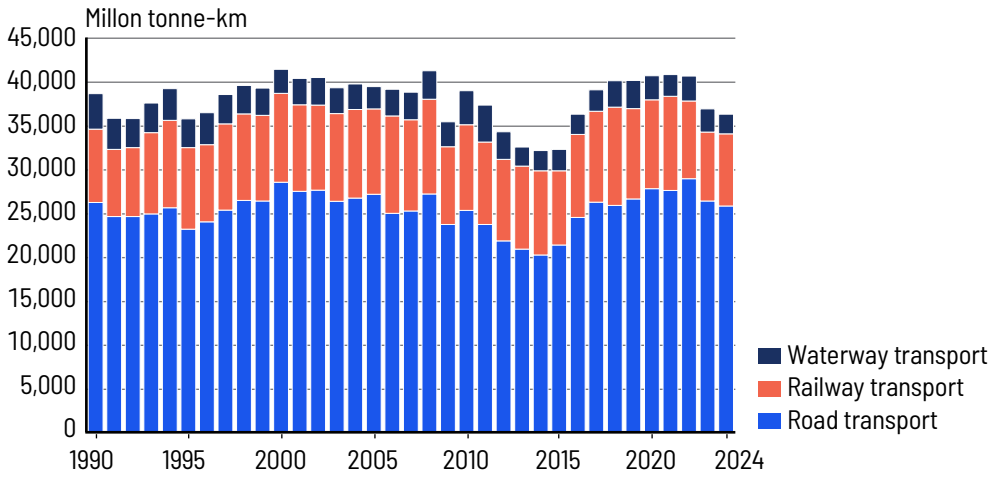
In Finland, the energy efficiency of new buildings has been continuously improved since the energy crises in the 1970s, particularly through building regulations for new construction. Energy conservation in heating has been aided by technical advances in insulation and window designs, as well as by developments in combined heat and power (CHP) production, district heating, heat recovery, and air-conditioning and ventilation systems.

Transport

The Finnish transport network consists of roads, rail transport, waterways, and the air traffic infrastructure, the main elements of which form part of the EU's Trans-European Networks. In 2024, 95 per cent of overseas freight travelled by sea, while three per cent travelled by road, and one per cent by rail. Icebreakers play an important role, because the 27 ports and harbours are kept open all year round. Finland has 24 airports, although approximately 95 per cent of the country's international air traffic operates via Helsinki Vantaa Airport.

The number of freight tonne-kilometres in inland Finland per capita in 2024 was 1.2 times the number of freight tonne-kilometres in the EU, mainly because of the long distances and industrial structure. Heavy industries such as timber, pulp and paper, and metal and engineering have traditionally played a prominent role in the Finnish economy, and these industries all need transport for their raw materials and products. Road haulage is the most important form of transport for domestic goods traffic (Figure 3.1-15).

Figure 3.1-15
Tonne-kilometres in domestic goods transport, 1990 to 2024, million tonne-kilometres

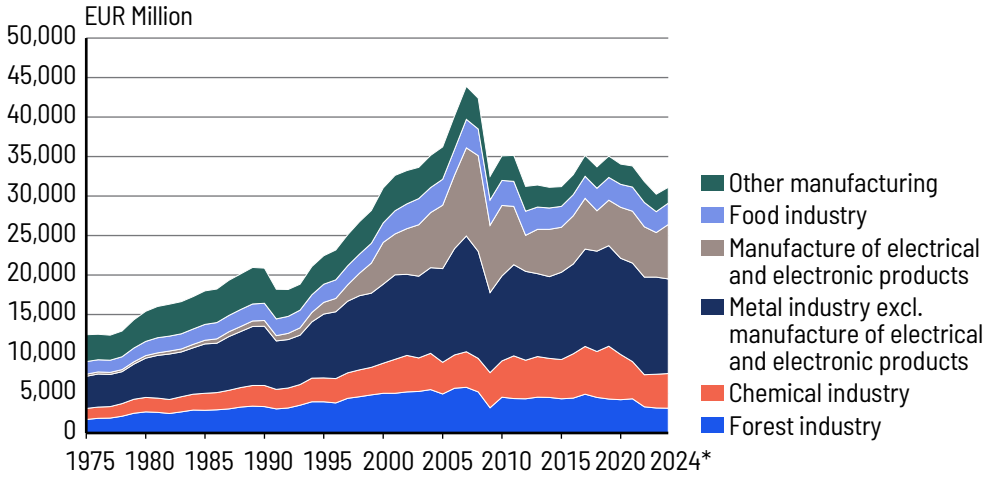


Transport demand and supply are influenced primarily by developments in the economy, demographic factors, employment patterns, and infrastructure provision. Domestic passenger transport, measured in terms of passenger-kilometres, has increased by approximately 18 per cent since 1990. Cars accounted for 82 per cent of total passenger-kilometres in 2024. The number of passenger-kilometres travelled by car was 19 per cent greater, and the number of passenger-kilometres by public transport was 11 per cent greater, than in 1990. The number of electric passenger cars in traffic has increased rapidly in recent years in Finland.

Manufacturing industry

The main manufacturing industries include metal industry, manufacture of electrical and electronic products, chemical industry, and the forest industry. The rapid expansion of the manufacture of electrical and electronic products, especially electronics, has changed the traditional industrial structure since the mid-1990s (Figure 3.1-16). There has been a strong increase in the technology intensity of the country's manufacturing sector. The forest industry has undergone structural change as manufacturers have downsized their capacity in certain paper segments. In general, paper production has declined, while paperboard production has shown an opposite trend. The volume of exported pulp doubled between 2001 and 2024. In the chemical industry, especially in oil refining, the production of renewable fuels is growing.

Figure 3.1-16
Output of manufacturing industries by sector, 1975 to 2024 (at 2015 prices), million euros

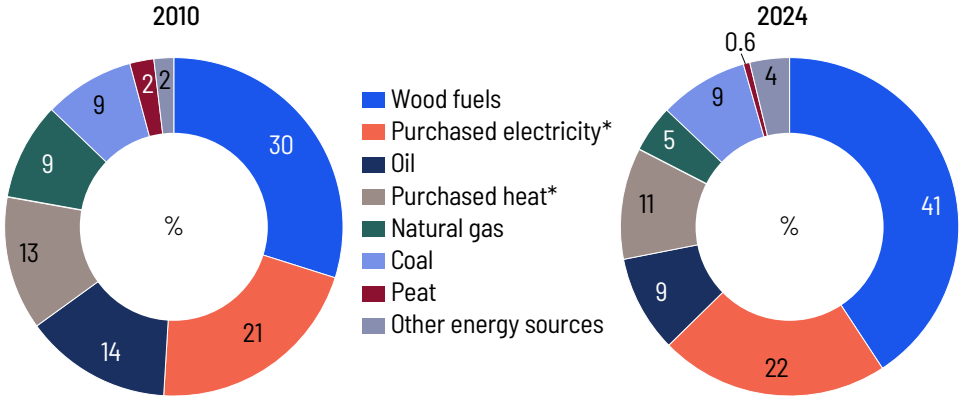


* Preliminary data

In 2024, Finnish manufacturing industries accounted for 43 per cent of final energy consumption and for 42 per cent of electricity consumption. The most significant energy source of the final energy consumption by industrial sector was biomass (41 per cent). The share of biomass as an energy source has risen significantly over the last ten years, while the share of oil, natural gas, and heat has decreased (Figure 3.1-17).

The forest industry uses more energy than any other industrial sub-sector (57 per cent), followed by the chemical industry (17 per cent) and the manufacture of basic metals (15 per cent). A considerable number of energy-intensive industries are export-oriented. More than 90 per cent of paper and board production is exported, and the share of exports is also high in the basic metal industry and in the chemical industry's products.

Figure 3.1-17
Energy use in manufacturing by source in 2010 and 2024.



* Purchased (net), i.e. does not include electricity and heat produced and used by the manufacturing industry

Because of their high energy demand, energy-intensive industries have worked hard to improve their energy efficiency. For example, between 1990 and 2024,[1] industrial output increased by 89 per cent (measured in terms of value added in 2015 prices), while the final consumption of energy rose by only six per cent. All pulp mills produce energy in excess of their own requirements. Currently, the by-product of chemical pulp production, black liquor, is the most significant renewable energy source in Finland. Forest industry bark, sawdust, and wood chips sidestreams are also used elsewhere, especially in district heating. On many industrial sites, the heat left over from the pulping process is channelled to the municipal district heating network. Yet industrial installations have outsourced their electricity generation to the energy industry to some extent.

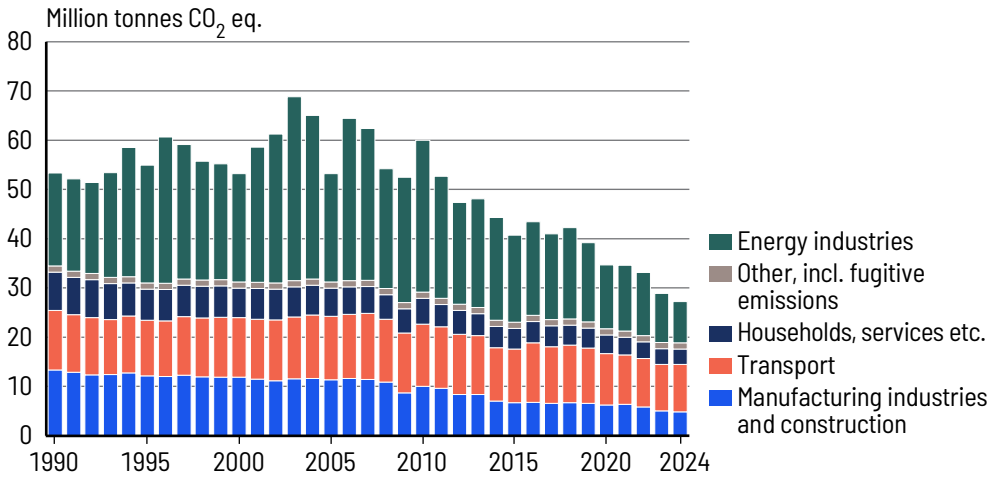
Trends in greenhouse gas emissions

Energy

The energy sector is the main source of greenhouse gas emissions in Finland. In 2024, the sector contributed 68 per cent to total national emissions without the land use, land-use change and forestry (LULUCF) sector, totalling 26.7 million tonnes CO_2 eq. Most of the emissions originate from fuel combustion, as fugitive emissions make up only 0.4 per cent of the sector's total emissions. Energy-related emissions vary greatly from year to year (Figure 3.1-18), mainly following the economic trend, the structure of the energy supply, and climatic conditions. Emissions in the energy sector were 50 per cent lower in 2024 than in 1990.

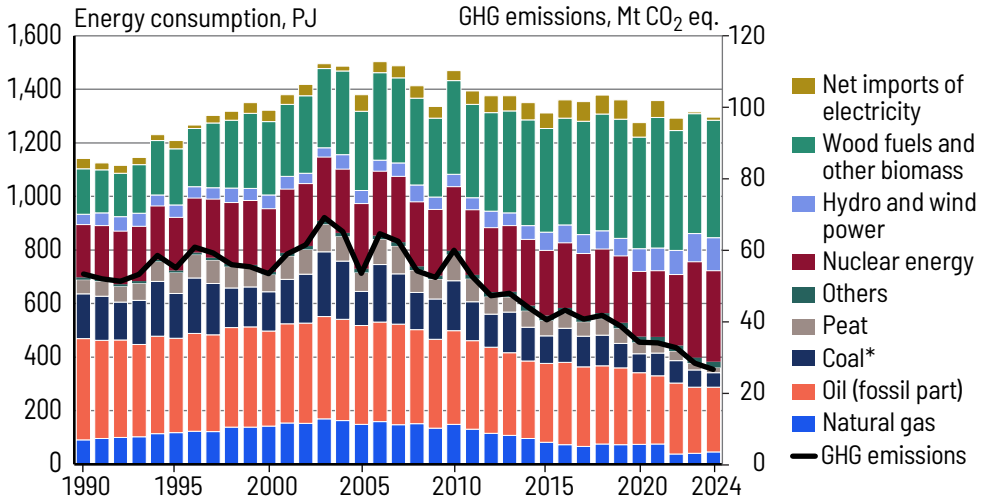
[1] Preliminary data

Figure 3.1-18
Greenhouse gas emissions in the energy sector, 1990 to 2024, including transport, million tonnes CO_2 eq.



The energy industries, mainly electricity and district heat production, caused 31 per cent (8.4 million tonnes CO_2 eq.) of the total emissions in the energy sector in 2024. Emissions from the energy industries were 56 per cent lower in 2024 than in 1990. Manufacturing industries and construction produce a great deal of energy for their own use. Their share of energy-related emissions was 18 per cent in 2024 (4.8 million tonnes CO_2 eq.). These emissions have declined by 64 per cent since 1990. The main reasons for this trend are the increased use of biofuels, i.e. black liquor, in the forest industry and the outsourcing of power plants from the manufacturing industries to energy industries (Figure 3.1-19).

Figure 3.1-19
Development of total energy consumption by energy source and energy sector greenhouse gas emissions in Finland, 1990 to 2024, including transport, PJ and million tonnes CO_2 eq.

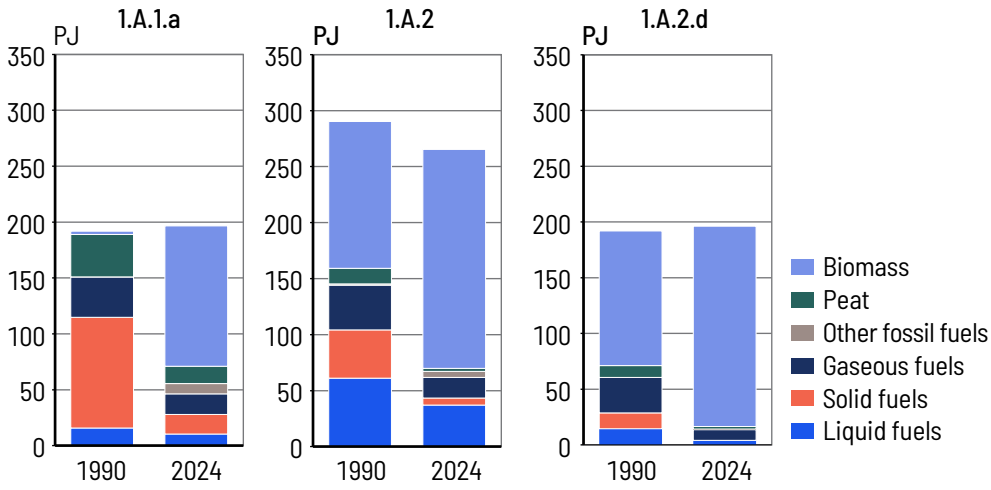


* Coal includes hard coal and coke, blast furnace gas, coke oven gas in manufacturing, and until 1994, town gas.

The important drivers in the energy sector's greenhouse gas emissions trend have previously been the production of energy with fossil-fuel-based condensing power covering up for temporarily reduced electricity imports, as well as the growth in the consumption of renewable energy. The availability of hydropower in the Nordic electricity market has a significant impact on the structure of the electricity supply and therefore on Finland's emissions from fuel combustion during the time series. When the annual precipitation in the Nordic countries is lower than usual, Finland has generated additional electricity using coal- and peat-fired power plants in the past, resulting in higher CO_2 emissions in corresponding years. In recent years, the share of fossil fuels in electricity generation has declined as the share of wind power has grown, and new nuclear power has come online. The ban on the use of hard coal for energy production, which enters into force in 2029, has already practically phased out hard coal consumption. In addition, the CO_2 allowance price in the EU ETS has risen, which is accelerating the replacement of fossil fuels with renewable energy.

The share of biomass as a source of energy grew significantly in public electricity and heat production, as well as in manufacturing industries and construction, between 1990 and 2024 (Figure 3.1-20). Emissions from the residential sector have decreased by 84 per cent and from commercial sectors by 55 per cent compared with 1990 levels. The decrease is mainly due to the substitution of direct oil heating with district heating, heat pumps, and electricity.

Figure 3.1-20
Fuel combustion in public electricity and heat production (1.A.1.a), manufacturing industries and construction (1.A.2), and in its pulp and paper industry sub-sector (1.A.2.d) in 1990 and 2024, PJ

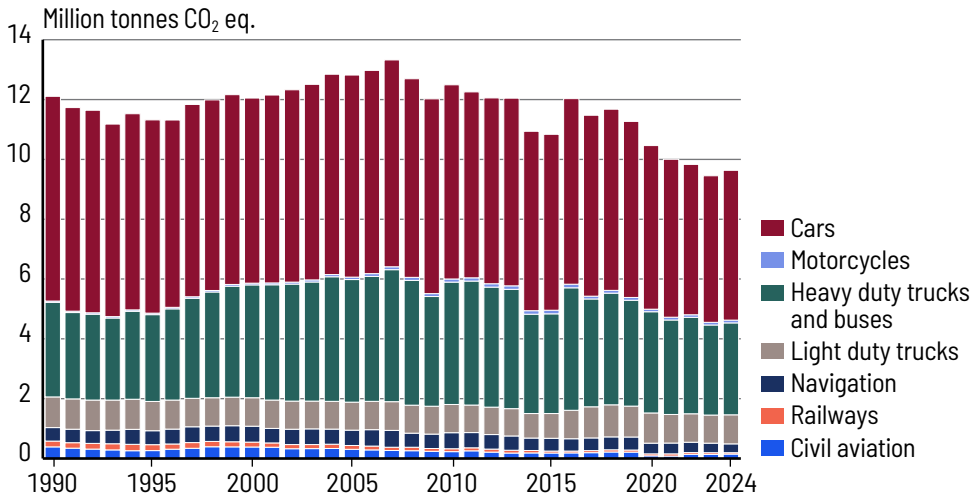


Transport

In 2024, the greenhouse gas emissions from transport, a category of the energy sector in the greenhouse gas inventory, amounted to 9.6 million tonnes of CO_2 equivalent. The share of transport in total greenhouse gas emissions without the LULUCF sector was 17 per cent (12.1 million tonnes CO_2 eq.) in 1990 and 24

per cent (9.6 million tonnes CO_2) in 2024. Road transport is the most important emission source in the transport category (Figure 3.1-21). Road transport emissions were 9.1 million tonnes of CO_2 eq. in 2024; this was 95 per cent of transport emissions and 23 per cent of total emissions. The share of emissions from transport in energy-related emissions was 36 per cent in 2024. Emissions from transport have decreased by 20 per cent since 1990.

Figure 3.1-21
Emissions from transport by sub-category, 1990 to 2024, million tonnes CO_2 eq.



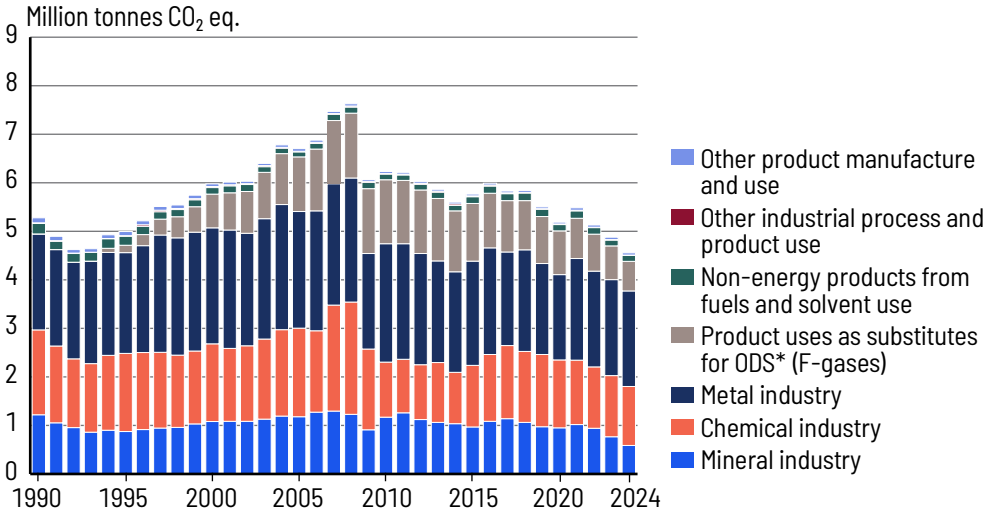
CO_2 emissions from transport decreased considerably in the early 1990s due to the economic depression (Figure 3.1-21). Since 2008, emissions have fluctuated due to many simultaneous different factors, both societal and legislative. In the 2010s, the share of biofuels especially in diesel oil has varied annually and caused fluctuations in annual emissions. Finland's biofuel legislation allows the distributors to fulfil the bioshare obligation flexibly in advance. Transport emissions declined substantially at the beginning of the 2020s because of the decreased kilometrage during and after the Covid-19 pandemic.

Industrial processes and product use

In 2024, greenhouse gas emissions from industrial processes and product use sector contributed 12 per cent to total greenhouse gas emissions in Finland, at 4.6 million tonnes CO_2 eq. The most important emission sources of industrial processes and product use were CO_2 emissions from iron and steel, hydrogen, and cement production. Fluorinated greenhouse gases, or F gases, are also reported under industrial processes and product use. They are used to replace ozone-depleting substances (ODS) in refrigeration and cooling devices, as well as in air-conditioning devices and aerosols, and they accounted for 1.6 per cent of total national greenhouse gas emissions without the LULUCF sector in 2024.

Emissions of industrial processes and product use were 14 per cent lower in 2024 than in 1990. At the beginning of the 1990s, some production plants were closed, which caused a rapid decrease in emissions (Figure 3.1-22). Production outputs and emissions then increased, reaching the 1990 level in 1996. The increase in emissions continued until 2009, when emissions decreased rapidly due to the economic downturn as the demand for industrial products diminished. The implementation of N_2O abatement technology in nitric acid production happened at the same time, which is why emissions remained at a lower level even when production started to grow after the economic downturn in 2010. Since 2010, CO2 mineral industry emissions and F gas emissions have halved, and metal industry CO2 emissions have decreased by almost 20 per cent. Emissions from the chemical industry have remained at the same level as in 2010.

Figure 3.1-22
Greenhouse gas emissions from industrial processes, 1990 to 2024, million tonnes CO_2 eq.

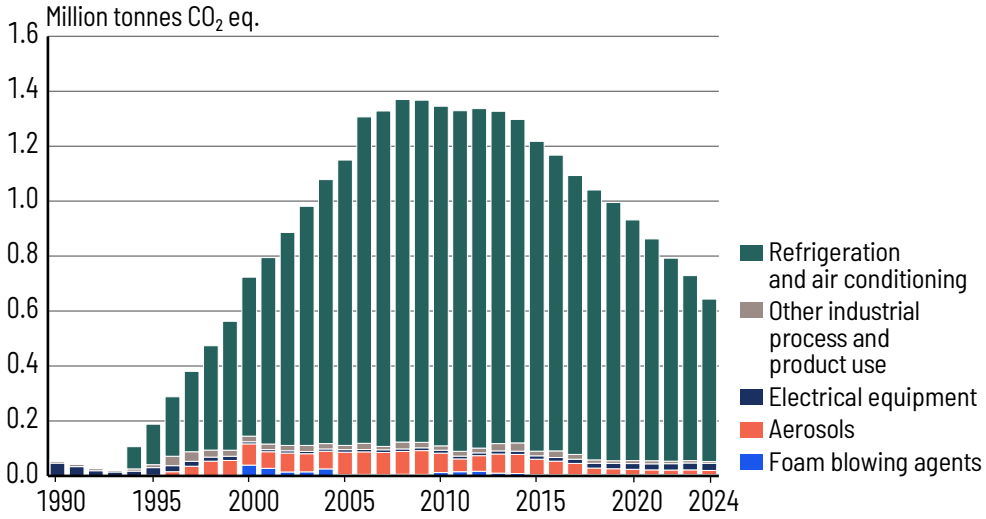


*ozone-depleting substances

In the period between 1990 and 2024, the largest relative change occurred in F gas emissions, which increased rapidly at first, but have begun to decrease (Figure 3.1-23) due to decreased leakage rates and the replacement of high-GWP HFC refrigerants with alternative low-GWP non-HFC refrigerants in many applications.

Please see Finland's NID (2026) for further details on trends in emissions in the energy sector, including transport, and in the industrial processes and product use sector, and how national circumstances affect emissions over time.

Figure 3.1-23
F gas emissions, 1990 to 2024, million tonnes CO_2 eq.



3.1.1.7 Agriculture

Farming in Finland is possible because of the warming effect of the Gulf Stream, which results in temperatures three to four degrees higher than would otherwise be expected at these latitudes. Climatic conditions are a decisive factor affecting the feasibility of crop production. Cultivation of wheat and oilseed plants is limited to southern Finland, whereas barley, oats, grass, and potatoes can be cultivated in most parts of the country. In many parts of Finland, livestock farming, especially dairy farming, is the only profitable form of agricultural production.

Agriculture, forestry, hunting, and fishing together account for 2.8 per cent of Finland's gross domestic product in 2024. The economic importance of the entire food system is much greater than this percentage alone suggests. Transport and processing considerably increase the role of food materials in the national economy. Agriculture is also the most important employer in the countryside, and, alongside forests, is the dominant element of the rural landscape.

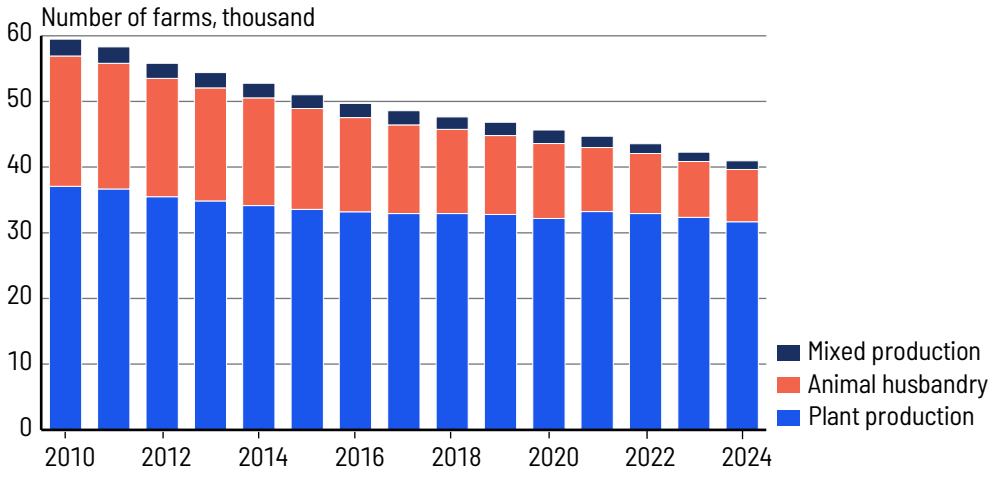
As a member of the EU, Finland follows the Common Agricultural Policy (CAP). CAP is nationally implemented and aims to develop the agricultural production of the European Union in a balanced way, while taking the environment, climate, and animal welfare into account. An important aim of CAP is also to promote the vitality of rural areas.

As it is neither possible nor appropriate to implement all climate change mitigation or adaptation measures in agriculture through the EU's Common Agriculture Policy, other measures are also required. For example, the Nitrates

Directive[2] aims to reduce and optimise fertilizer and manure use on cropland, and improve animal manure management systems. In addition, the national Climate Plan for the Land Use Sector also includes policy measures for agriculture, such as climate-resilient use of peatland fields.

Agricultural production has changed significantly from the early 1990s. The number of active farms fell from 130,000 in 1990 to 41,000 in 2024. At the same time, the average utilised agricultural area increased from 17 to 55 hectares. In 2024, 77 per cent of active farms had crop production as their main line of farming, and only 19 per cent had livestock as their main line of farming (Figure 3.1-24). The total cultivated area has remained at almost the same level since 1990, but the proportions of cultivated crops have varied somewhat over the years. Dairy farming is the main production line of animal husbandry, with more than nine per cent of all farms having it as their main line of farming in 2024.

Figure 3.1-24
Number of farms by production sector, 2010 to 2024



Source: Natural Resources Institute Finland

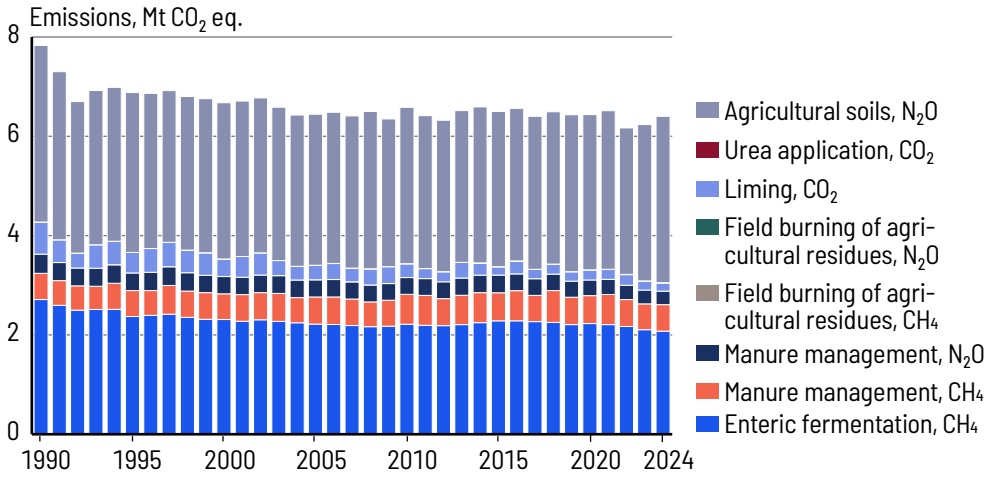
Among other things, structural changes in agriculture have led to a reduction in greenhouse gas emissions from the agriculture sector in Finland (Figure 3.1-25). Between 1990 and 2024, emissions in the sector decreased by 18 per cent. Greenhouse gas emissions from the agriculture sector were 6.4 million tonnes CO_2 eq. in 2024. The sector accounted for 16 per cent of Finland's total greenhouse gas emissions without the LULUCF sector, making it the second largest source of greenhouse gas emissions after the energy sector.

The use of synthetic fertilisers has notably decreased since 1990, making it one of the most important factors contributing to the reduction in the sector's emissions. Emissions originating from the use of synthetic fertilisers were 30 per cent lower in 2024 than in 1990. The decrease in CO_2 emissions from liming

2 (1991/676/EEC)

due to the reduced use of lime is also significant. Fluctuations in livestock numbers and the use of lime and synthetic fertilisers cause some inter-annual variability in emissions from the agriculture sector. Emissions from agricultural activities are also reported in the energy and LULUCF sectors of the greenhouse gas inventory.

Figure 3.1-25
Greenhouse gas emissions from agriculture, 1990 to 2024*



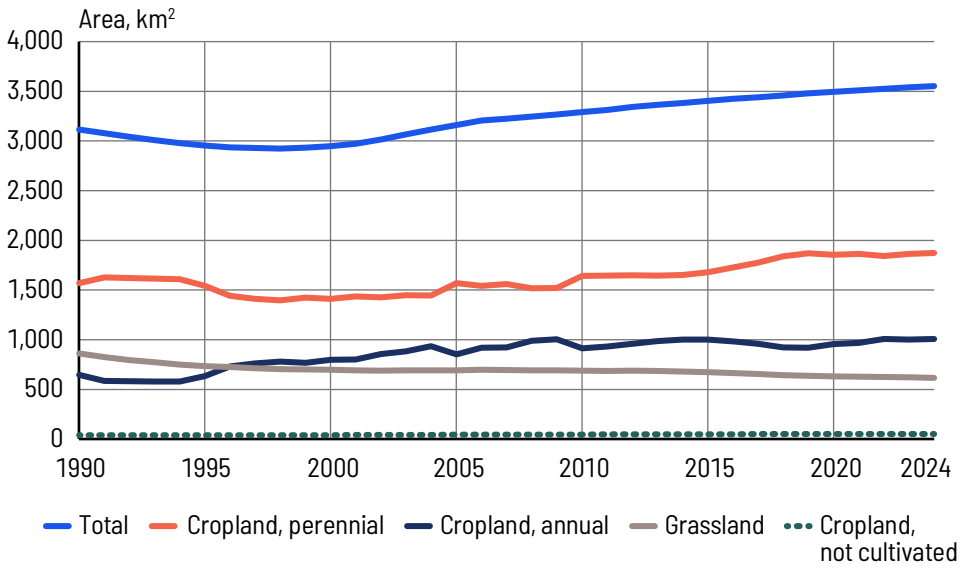
* CH_4 and N_2O emissions from field burning of agricultural residues, as well as CO_2 emissions from urea application, are very small or zero, and are therefore not discernible. Field burning of agricultural residues has been prohibited since 2021.

Methane emissions from enteric fermentation accounted for 32 per cent of total emissions in the agriculture sector in 2024. Emissions decreased by 24 per cent from 1990 to 2024, mainly due to a decline in the number of cattle from 1,360,000 to 794,000. The decrease in cattle numbers over the time series has been counterbalanced by an increase in emission factors due to increased animal weight, size, and milk production.

Methane and nitrous oxide emissions from manure management accounted for eight and four per cent respectively of total emissions in the agriculture sector in 2024. Total emissions from manure management decreased by 12 per cent between 1990 and 2024. The fluctuation in emissions is related to changes in livestock numbers, which are largely dependent on agricultural policies, and changes in the distribution of manure management systems.

Direct and indirect nitrous oxide emissions from agricultural soils are a significant emission source in Finland, accounting for 52 per cent of total agricultural emissions in 2024. The emissions decreased by six per cent between 1990 and 2024. The implementation of measures by farmers as part of CAP's agri-environmental programme aiming to minimise nutrient loads into watercourses has led to a decrease in the use of nitrogen fertilisers. Emissions from cultivated organic soils have increased as a result of the increase in area (Figure 3.1-26).

Figure 3.1-26
Areas of perennial cropland, annual cropland, not cultivated cropland, and grassland on agricultural organic soils, 1990 to 2024



Source: Natural Resources Institute Finland

Carbon dioxide emissions from liming decreased by 74 per cent from 1990 to 2024, as the use of lime decreased, probably because the increased use of soil analysis has reduced excess liming. Urea is applied to agricultural and forest soils at only a small scale, as Finland's short growing season and acid soils are not well suited to urea fertilisation. The EU's Nitrates Directive has tightened the regulation of emissions from fertilisation since the late 1990s.

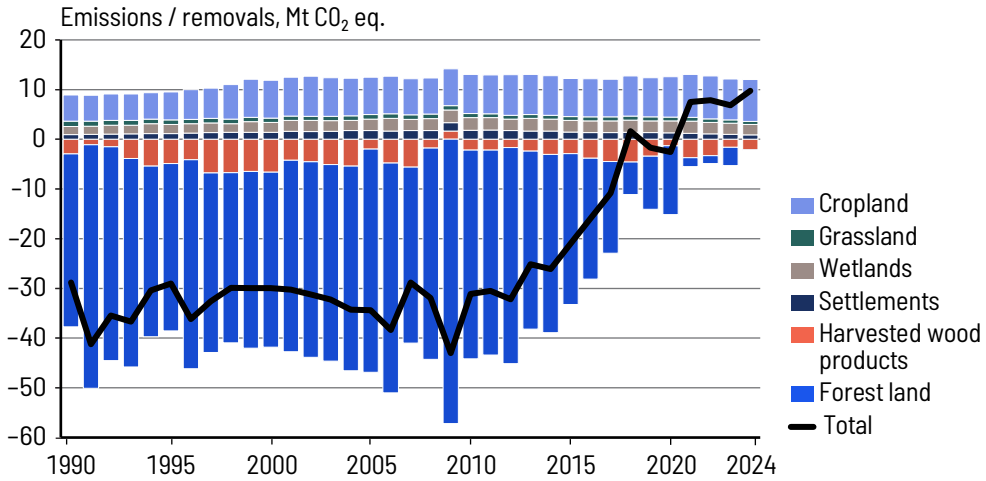
Please see Finland's NID (2026) for further details on trends in emissions in the agriculture sector and how national circumstances affect emissions and removals over time. More information about national circumstances can also be found in Finland's Eighth National Communication (2022), including agriculture (Section 2.10) and peatlands (Box 2.1).

3.1.1.8 Land use, land-use change and forestry

The land use, land-use change and forestry sector (LULUCF) consists of six land-use categories of forest land, cropland, grassland, wetlands, settlements, and other land, as well as the category of harvested wood products. Finland does not report emissions or removals in the other land or "other" categories. The greatest sink of the sector has been forest land, which has, however, decreased considerably in recent years. Harvested wood products have mostly also been a carbon sink. The large proportion of organic soils in the country (see Geographical profile) results in significant greenhouse gas emissions in forest land, cropland, grassland, and wetlands.

The LULUCF sector has been a net sink throughout the time series from 1990 to 2017 (Figure 3.1-27). Since 2018, the sector has been either a net sink or a net source of emissions: a sink in 2019 and 2020, but a source in 2018 and from 2021 to 2024. The decreasing trend in the net removals of forest land has continued for the last decade, so net removals have been too low in recent years to account for the emissions from other land-use categories. The level, trend, and inter-annual variability in the sink or source for the whole LULUCF sector are determined by the forest land.

Figure 3.1-27
Net emissions and removals in the LULUCF sector by land-use category and harvested wood products, million tonnes CO_2 eq.



Forest land and harvested wood products

Forest land covers some 72 per cent of the total area without inland waters according to the 2024 national greenhouse gas inventory. The forest industry is one of the country's main manufacturing industries (see Economic profile). Its products have corresponded to approximately 17 per cent of the export of goods in recent years.

Around half the forest land area is owned by private individuals, meaning some 10 per cent of Finns own forest land. Roughly a third of forests is owned by the state; the rest is owned by private companies and other owners. The average size of a forest holding owned by private individuals is small, at approximately 30 hectares.

Sustainable forest management is the basis of Finland's forest policy. The aim is to ensure welfare founded on the use of forests and the diversity of forest nature. Policy measures for sustainable management include the Forest Act[3] and other legislation, Finland's National Forest Strategy 2035 (2023)[4], financing,

[3] 1093/1996 (amendment 1085/2013)

[4] http://urn.fi/URN:ISBN:978-952-366-748-8

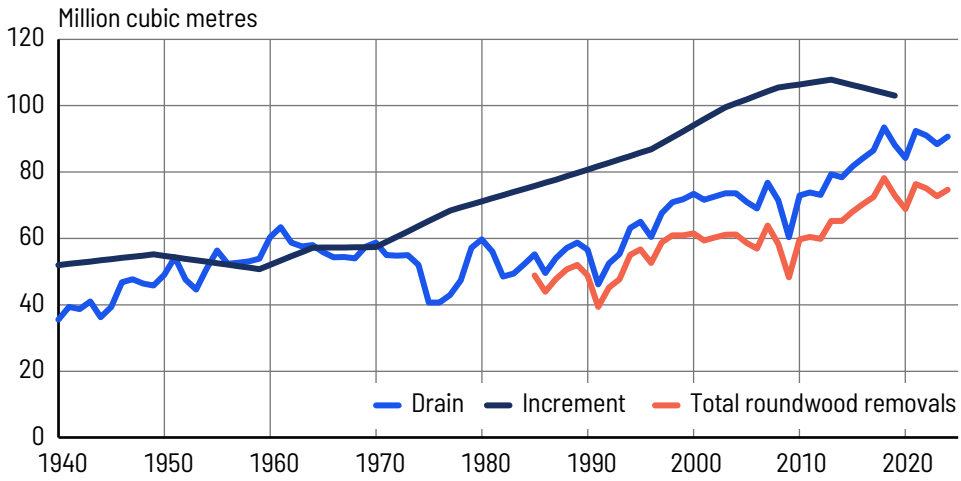
and public forestry extension organisations. For example, according to the Forest Act, measures for the establishment of a new seedling stand must be completed within three years of the end of regeneration felling to ensure regeneration and avoid deforestation. Research-based forest management recommendations are available to everyone via the web service. In addition, many organisations such as forest management associations provide forest owners with forest management advisory services.

The most common species in forests are Scots pine, Norway spruce, and silver and pubescent birches, all of which are indigenous. About 45 per cent of the forest land area consists of mixed stands. About 40 per cent of the area under regeneration is regenerated naturally, while the rest is regenerated artificially, using indigenous tree species with local provenance. Almost a third of forests are situated on organic soils.

In recent decades, forest protection and biodiversity have received special attention. Numerous protection programmes and decisions have contributed to a threefold increase in the area of protected forests since the 1970s. Currently, some 13 per cent of forests are protected.

The total volume of Finland's forest stock amounts to 2,550 million m^3 according to the latest national forest inventory. The growing stock volume has been increasing for a long time, mainly because of the active and sustainable management of forests, in which the growth in forest volume has exceeded harvesting volumes and natural drain (Figure 3.1-28).

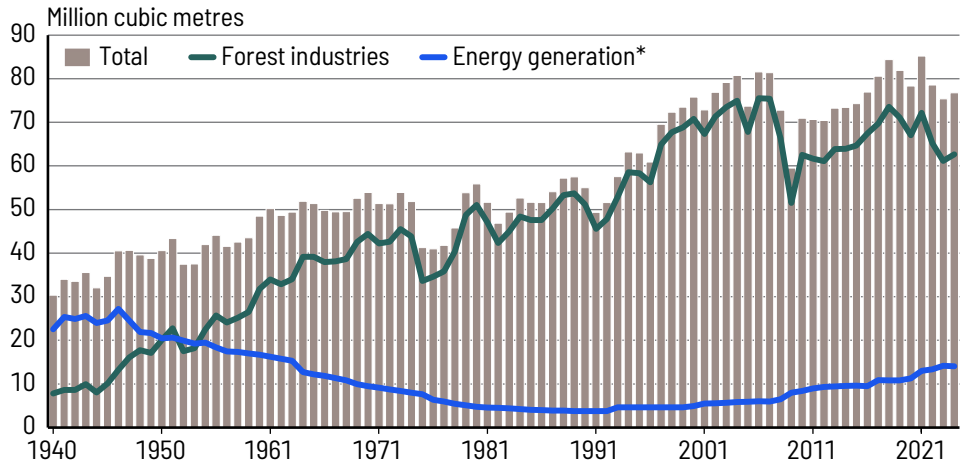
Figure 3.1-28
Total roundwood removals, increment, and drain of growing stock, 1940 to 2024



Source: Natural Resources Institute Finland

In the 2020s, the total use of roundwood has been 78.8 million m^3 on average. The great majority, that is, 83 per cent, was used in the forest industry, and 17 per cent was used for energy production (Figure 3.1-29).

Figure 3.1-29
Total roundwood consumption, 1940 to 2024



* Includes only roundwood consumption. Energy use of by- and waste products such as sawdust, bark, and black liquor is not included.

Source: Natural Resources Institute Finland

The forest land net sink decreased significantly from 1990 to 2024 to a small sink of 0.1 million tonnes of CO_2 eq. (Figure 3.1-27). The high fluctuation in net removals in forest land is mainly caused by the changes in the international market for forest industry products and in the global timber trade, which affects the amount of domestic commercial roundwood felling. Roundwood removals have remained at a high level in recent years compared with historical levels, reducing the net removals by the biomass (Figure 3.1-28).

The other significant factor affecting the trend in forest land sink is the annual volume increment. Forest growth has increased steadily since 1990 because of factors such as the large proportion of young forest at a strong growth phase and silvicultural measures. However, the annual increment has decreased in more recent years because of the change in age structure. Other reasons such as dry years decreasing tree growth have also been identified[5].

Living biomass and combined pools of dead organic matter and soil organic matter on mineral soil have been a net sink since 1990, whereas organic soils have been a net source. The carbon sink in mineral soil and dead organic matter is affected by litter input patterns following the development of the growing stock and harvests, as well as by weather conditions. CO_2 emissions from organic forest soils, i.e. from drained peatland soils, show an increasing trend. The main factor has been the increase in mean air temperature in the snow-free period, which has significantly increased emissions in drained peatlands by increasing the decomposition of litter and soil organic matter. Since 1990, N_2O emissions from drained peatland forest soils have increased, but CH_4 emissions have decreased.

[5] Henttonen et al. (2024) and Korhonen et al. (2024)

Harvested wood products were a carbon sink from 1990 to 2024, except for 2009. The sink was 27 per cent smaller in 2024 than in 1990. Factors affecting the production volumes of the forest industry, such as the economic situation and the demand for harvested wood products, cause fluctuations in the net removals of this category over time.

Cropland and grassland

For cropland and grassland, carbon stock changes in different carbon pools and N_2O emissions from nitrogen mineralization associated with land conversions to cropland and grassland are reported in the LULUCF sector, whereas as other N_2O emissions are reported in the agriculture sector. A description of the national circumstances for agriculture can be found in the previous section on the agriculture sector.

Cropland is a source of emissions. Emissions increased by 60 per cent from 1990 to 2024. Organic soils are the greatest source of emissions. Due to a 30 per cent increase in the area of cropland on organic soil, emissions from organic soils increased by a third from 1990 to 2024 (Figures 3.1-26 and 3.1-27). Mineral soils have been a net source of CO_2 since the early 1990s. Emissions from mineral soils fluctuate according to annual yields and weather conditions. Emissions from biomass depend on the annual rate of land conversion from forest land to cropland.

The grassland category is also a source, but notably smaller than the source in cropland. Emissions from organic soils exceed small removals by mineral soils and living biomass. The area of grassland consists mostly of abandoned fields that are slowly gaining tree biomass and becoming forest land. There are no large grazing land areas or permanent grasslands in Finland.

Emissions from grassland decreased by 37 per cent from 1990 to 2024. Organic soils are the dominant source of emissions. Emissions from organic soils have decreased over time because of the conversion of grassland to cropland. The trend in biomass has varied depending on the clearance of new grassland from forest land.

Wetlands

Wetlands consist of a diverse group of land such as open bogs, swamps, peat extraction areas, and constructed waterbodies. They are characterised by a lack of or little biomass cover. They are a source of CO_2, CH_4, and N_2O emissions. Total emissions increased by 27 per cent from 1990 to 2024. Peat extraction areas are the most significant source of emissions. As peatlands cover almost a third of Finland's land area, peat is a domestic and local energy source, but it is also used in horticulture and as a bedding material, for

example. In the most recent years, a slight decline in emissions has been seen because the area of peat production sites is currently decreasing.

Settlements

Settlements comprise nationally defined built-up land, roads, railroads, gravel collection sites, and power lines. Emissions in the settlements category are nine per cent lower in 2022 than they were in 1990. Recently, there has been a declining trend in emissions due to declining annual areas converted to settlements. The greatest source of emissions is land conversions from forest land to settlements. The high proportion of forest land in the country is the major factor explaining why land conversions to settlements most often occur on forest land.

Please see Finland's NID (2026) for further details on trends in emissions and removals in the LULUCF sector, and how national circumstances affect emissions and removals over time. More information about national circumstances can also be found in Finland's Eighth National Communication (2022), including agriculture and forestry (Sections 2.10 and 2.11) and peatlands (Box 2.1).

3.1.1.9 Waste

In 2024, 122 million tonnes of waste were generated in Finland (Table 3.1-3). The largest quantities came from mining and quarrying (96 million tonnes), construction (11 million tonnes), and manufacturing (10 million tonnes). Households and services generated three million tonnes of waste. Waste volumes in water supply (sewerage, waste management and remediation activities), and in electricity, gas, steam, and air-conditioning supply were significantly lower than in other industries (both one million tonnes).

Mineral waste accounted for 94 per cent of all waste in 2024 (115 million tonnes). The amount of wood waste was one million tonne, and chemical waste was 0.6 million tonnes. The rest of the total amount of waste includes metallic waste, paper and cardboard, animal and vegetable waste, household and mixed waste, sludges, and other waste. In 2024, the total amount of this waste category was five million tonnes (Table 3.1-3).

The amount of municipal solid waste was 2.6 million tonnes in 2024. Although accounting for only 2.6 per cent of the country's total waste, municipal solid waste is responsible for most of the greenhouse gas emissions from the waste sector. The quantity of municipal solid waste has ranged between 2.4 and 3.5 million tonnes per year since 2000. In 2024, total municipal solid waste generation in Finland was 457 kg per capita, close to the EU average of 517 kg.

Table 3.1-3
Waste generation by source and waste category in 2024, 1,000 tonnes

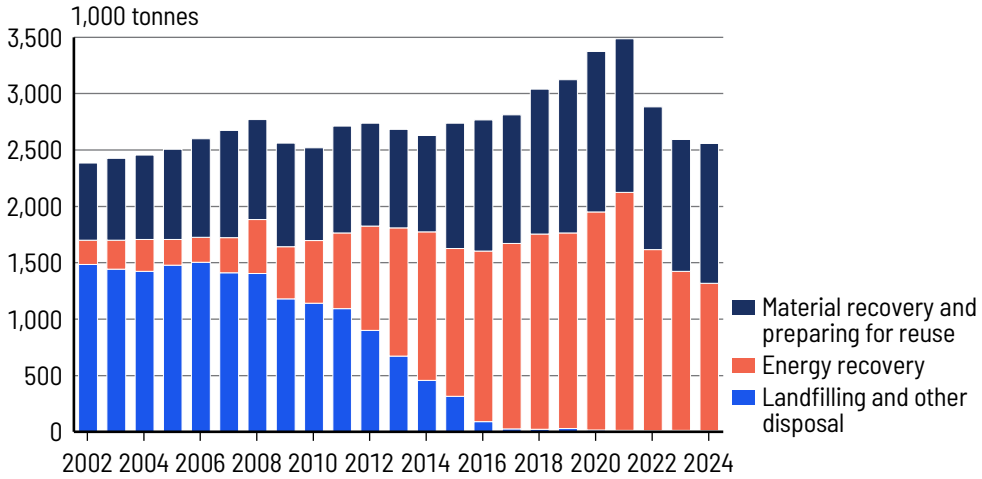
2024	Chemical waste	Wood waste	Mineral waste*	Other waste**	Total
	Amount of waste 1,000 tonnes				
Mining and quarrying	2	2	95,697	617	96,318
Electricity, gas, steam and air conditioning supply	6	16	722	70	814
Water supply; sewerage, waste management and remediation activities	19	53	930	510	1,512
Construction	0	193	10,513	88	10,794
Manufacturing	492	988	7,236	1,505	10,221
Households and services	43	92	30	2,546	2,711
Total	**562**	**1,344**	**115,128**	**5,336**	**122,370**

* Excludes gangue and stamp sand used by mines and quarries.
** Includes household and mixed waste (45%), animal and vegetal waste (15%), other waste (14%), sludges (12%), paper and cardboard (8%) and metallic waste (6%). The percentage in brackets is the share of the waste category in the total amount of Other waste category.

The amount of waste deposited in landfill sites has been significantly reduced by effective waste regulation. Finland's waste policy aims to prevent waste, increase reuse and recycling, and reduce landfilling and the environmental impact of various forms of waste management. In 2024, 13.7 million tonnes of waste were recovered as material, and 4.3 million tonnes as energy. The latter figure comprises 37 per cent of wood waste. Wood waste was especially comprehensively recovered as material in addition to its high recovery rate as energy.

In 2024, 99 per cent of all municipal solid waste was recovered by recycling or through preparation for reuse (48 per cent), or as energy (51 per cent) (Figure 3.1-30). At the end of the 1990s, approximately 65 per cent of all municipal solid waste was disposed of in landfills. The proportion of municipal solid waste sent to landfills has decreased every year since 2002 as a result of the increased waste recovery rate. In 2002, the proportion of municipal solid waste disposed of in landfills was 62 per cent, and in 2015, it amounted to 11 per cent. Due to the prohibition of organic landfill waste that came into force in 2016, biodegradable municipal solid waste has no longer been deposited in landfills. In 2024, less than half a per cent of the total amount of municipal solid waste was deposited in landfills.

Figure 3.1-30
Municipal solid waste treatment in Finland, 2002 to 2024, 1,000 tonnes

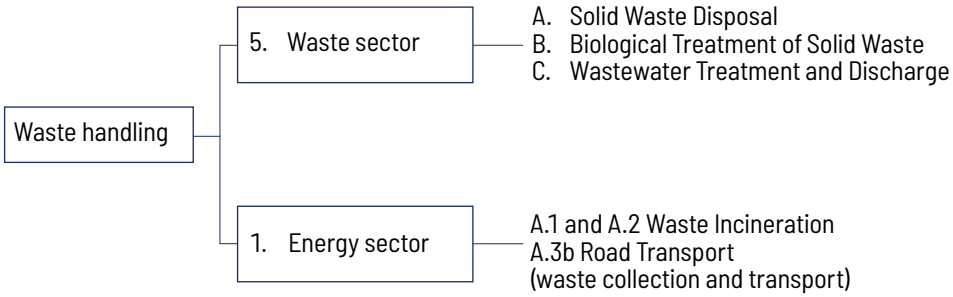


Initially, in the early 1990s, the focus of waste policy was on waste prevention and recycling. Since 2006, waste incineration has started to become more important in municipal waste management, and there have been many investments in waste incineration plants. The amount of incinerated municipal waste has more than doubled since 2010. A total of twelve waste incineration plants were in operation, and 51 per cent of the total amount of municipal waste was incinerated in 2024. All waste incineration plants produce heat and electricity. In addition to waste incineration plans, there are more than 20 co-incineration plants in Finland in which waste is incinerated in addition to other fuels.

Development of greenhouse gas emissions

Methane emissions from landfills and methane and nitrous oxide emissions from composting and wastewater treatment are reported under the waste sector (Figure 3.1-31). Greenhouse gas emissions from the waste sector emissions amounted to 1.6 million tonnes CO_2 eq. in 2024, which was three per cent of Finland's total emissions. Solid waste disposal on land accounted for

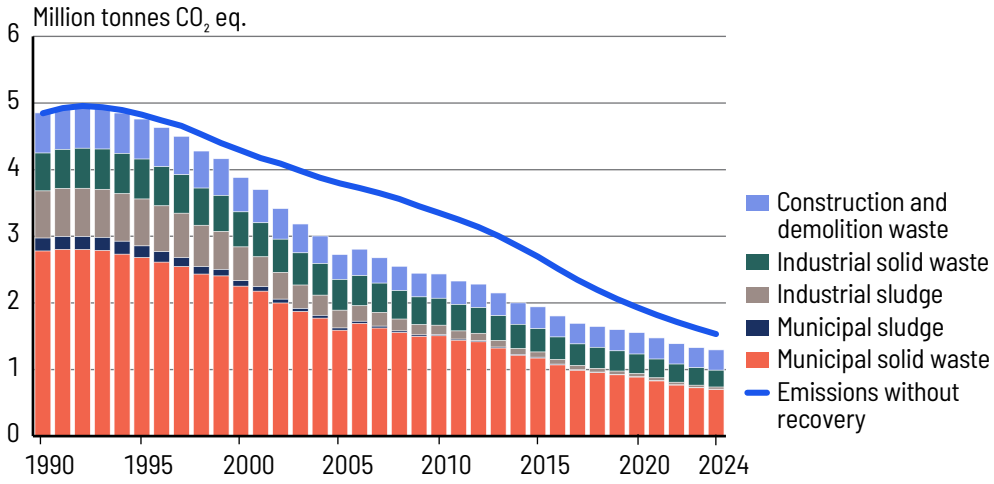
Figure 3.1-31
Reporting categories of emissions from waste handling in the national greenhouse gas inventory



79 per cent, wastewater treatment for 14 per cent, and biological treatment of solid waste for six per cent of the sector's total emissions. Since 1990, these emissions have decreased by 69 per cent. Greenhouse gas emissions from the combustion of waste are reported in the energy sector, as waste incineration without energy recovery is almost non-existent (Figure 3.1-32).

Methane emissions from landfill sites have decreased since the adoption of a new Waste Act[6] in 1994 (Figure 3.1-32). The Act has reduced the volume of waste deposited in landfills by promoting recycling and reuse, as well as the energy use of waste materials. The Waste Tax Act[7], which entered into force in 2011 has also contributed to reducing the landfilling of waste. The great increase in the amounts of recovered methane at the beginning of 2000 is a result of the regulations for landfill gas recovery.[8] The amount of recovered methane in recent years has decreased due to the great decrease in waste amounts in landfills since the ban of organic waste deposits in landfills.[9]

Figure 3.1-32
Methane emissions from solid waste disposal on land, 1990 to 2024, including the amount of methane generated (emission without recovery) at solid waste disposal sites, million tonnes CO2 eq.



Emissions from wastewater treatment have also been successfully reduced by 27 per cent compared with 1990. The reduction in emissions has been driven by increasingly efficient wastewater treatment, including in sparsely populated areas, as well as a lower nitrogen burden released from industrial wastewaters into waterbodies.

Emissions from composting have increased 1990, being six per cent of the waste sector's emissions in 2024. This is due to increased composting of

6 Waste Act 1072/1993

7 Waste Tax Act 1126/2010

8 Council of State Decree on Landfills 861/1997

9 The ban on organic waste in landfills came into force in 2016.

waste, especially in semi-urban areas, as a result of separate collection of organic waste. Biowaste recycling doubled between 2006 and 2015, and the amount of separately collected biodegradable waste has varied only slightly since. In 2016, the prohibition of organic landfill waste came into force. In 2024, 0.4 million tonnes of biodegradable waste were collected. Emissions from anaerobic digestion have also increased significantly in recent years for the same reason as the increase in emissions from composting. Yet this emission source is very small, accounting for one per cent of the waste sector's total emissions in 2024.

Please see Finland's NID (2024) for further details on trends in emissions in the waste sector, and how national circumstances affect emissions over time. More information about national circumstances can also be found in Finland's Eighth National Communication (2022).

3.1.2 Institutional arrangements

3.1.2.1 Institutional arrangements for tracking progress

This section also contains common text for the BTRs of the EU and the Member States.

The EU's governance regulation[10] establishes a mechanism to track the progress of the EU and its Member States towards the EU's climate and energy targets and commitments under the UNFCCC and the Paris Agreement. The mechanism includes the monitoring and projections of GHG emissions and removals, the reporting of policies and measures and progress on adaptation to climate change.

The main domestic tool for tracking progress is the Climate Action Progress Report[11]. It is published every year by the European Commission and reviews how the EU and its Member States are progressing on climate policies and meeting their climate targets.

The progress is tracked across three main policy areas:

- the EU Emissions Trading System (EU ETS), which covers emissions from power generation, energy intensive industries and aviation and maritime transport,
- the Effort Sharing Regulation (ESR), which include transport, buildings, agriculture, waste and small industry not covered by the EU ETS,

[10] http://data.europa.eu/eli/reg/2018/1999/oj

[11] https://climate.ec.europa.eu/areas-action/climate-strategies-targets/progress-climate-action/eu-climate-action-progress-report-2025_en

- the land-use, land-use change and forestry (LULUCF) which covers both emissions and removals from land use.

The report uses information and data from three main sources:

- GHG inventory,
- national energy and climate progress reports,
- policies, measures and projections.

The Climate Action Progress Report is part of a larger package of reports released together with the State of the Energy Union report.[12]

GHG inventory

The EU has set up its inventory system to ensure that data reported by the EU and its Member States are timely, transparent, accurate, consistent, comparable and complete. This inventory system includes a quality assurance and quality control programme, common procedures for estimating emissions, and comprehensive reviews of national inventory data to assess the progress towards climate goals. GHG inventory covers all emissions and removals from the following sectors:

- energy
- industrial processes
- agriculture
- land use, land use change and forestry
- waste
- other and indirect CO_2 emissions.

Each EU Member State prepares its GHG inventory in line with the reporting guidelines under the Paris Agreement and the 2006 Intergovernmental Panel on Climate Change guidelines[13]. GHG inventory data on anthropogenic GHG emissions and removals, including information on methods, are then sent electronically to the European Environment Agency, where they are checked for quality and combined into one EU GHG inventory. The full details are provided in the GHG inventory 2026 of the EU[14].

National energy and climate progress reports

Every two years, each Member State reports to the European Commission on the implementation progress of its national energy and climate plan (NECPs). These plans are setting national targets, policies and measures for climate

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[12] State of the Energy Union Report 2025 https://managenergy.ec.europa.eu/publications/read-2025-state-energy-union-report_en

[13] https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

[14] EU 1990-2024 GHG Inventory, https://www.eea.europa.eu/en/analysis/publications/annual-european-union-greenhouse-gas-inventory-2026

mitigation, renewable energy, energy efficiency, adaptation, and related areas up to 2030. This is done through the National Energy and Climate Progress Reports (NECPRs), which allows the European Commission to monitor progress towards the 2030 intermediary target, climate neutrality and climate change adaptation objectives.

Policies, measures and projections

Member States also operate national systems for policies and measures and projections. They submit standardised data to the European Environment Agency by 15 March. The European Environment Agency checks the quality and completeness of data and compiles projections of total GHG emissions and removals for the EU.

Both the Union and the national systems are subject to continuous improvements.

> National energy and climate plans were introduced by the Governance Regulation. They are a key planning tool for Member States to outline how each Member State intends to reach and track progress towards the climate and energy targets from 2021 to 2030.
>
> Member States set out in these 10-year strategic documents their national targets, contributions and policies and the measures needed to reach EU climate and energy goals. These plans were first submitted in 2019 and updated in 2024–2025 to reflect the higher ambition of Fit for 55 package[15] and REPowerEU[16].
>
> This update allowed Members States to review their progress, identify gaps and revise existing policies or plan new ones where needed.
>
> In May 2025, after the updated plans were submitted, the European Commission concluded in its EU-wide assessment that, if fully implemented, the plans would reduce net greenhouse gas emissions up to 54 per cent, close to its 2030 legally binding 55 per cent reduction target. Overall, Member States are encouraged to implement additional measures in the transport and building sectors to meet their ESR targets, and to continue stepping up action in reducing emissions from aviation, the maritime sector, and to increase removals, or reduce emissions, in the LULUCF sector.

In Finland, the revised Climate Act[17] entered into force on 1 July 2022. The Act sets out several plans that aim to reduce greenhouse gas emissions and adapt to climate change in Finland. It also obliges the central government authorities to monitor the trends in emissions and achievement of climate targets and report on them to Parliament. The Annual Climate Reports to the Parliament

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15 The Fit for 55 legislative package, https://commission.europa.eu/publications/legal-documents-delivering-european-green-deal_en

16 REPowerEU, https://commission.europa.eu/topics/energy/repowereu_en

17 423/2022

are prepared each year under the lead of the Ministry of the Environment. The reports examine the general development of greenhouse gas emissions and removals and the sufficiency of the planned measures in relation to the national climate targets and Finland's EU obligations.

The Ministry of the Environment is Finland's focal point to the UNFCCC and Paris Agreement. Statistics Finland is the national entity responsible for compiling the Finnish greenhouse gas inventory since the beginning of 2005, enforced in Climate Acts in 2015 and 2022. The national system for the greenhouse gas inventory is described in detail in Finland's National Inventory Document 2026, submitted as a part the second biennial transparency report. 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. National greenhouse gas inventory is submitted to the UNFCCC and European Commission annually – and biannually to the Paris Agreement as a part of the biennial transparency report. The Energy Authority is the competent authority and the registry administrator for the national emissions trading registry under the EU ETS.

Finland's national system for policies and measures and projections is described in detail in compliance with reporting on national systems for policies and measures and projections pursuant to Article 36 of the Commission Implementing Regulation (EU) 2020/1208[18]. Generally, arrangements for preparation of reports and reporting on policies and measures and projections have been stable in Finland for several years.

As previously mentioned, the Government and Parliament make all major decisions concerning Finland's energy and climate policy. Since 2003, the Finnish governments have appointed a ministerial working group on energy and climate policy with representatives from all government parties.

The roles and responsibilities of the ministries and other authorities are determined in a Government Resolution on the Obligations of Climate Policy Activities of Government Authorities approved in 2003. According to the government resolution, the ministerial working group has a network of senior officials acting as its preparatory body. The Ministry of Economic Affairs and Employment chairs the network of senior officials and is in charge of the overall coordination and compilation of the energy and climate strategy work. Each sectoral ministry is responsible for the preparation concerning its respective remit. The network of senior officials comprises representatives from the Ministry of Economic Affairs and Employment, the Ministry of the Environment, the Ministry of Transport and Communications, the Ministry of

[18] European Union, Reportnet 3, GovReg: National systems for policies and measures and projections, https://reportnet.europa.eu/public/dataflow/111

Agriculture and Forestry, the Ministry of Education and Culture, the Ministry for Foreign Affairs, the Ministry of Finance and the Prime Minister's Office.

In terms of the reporting on policies and measures and projections referred to in Article 18 of the EU Regulation on Governance of the Energy Union and Climate Action[19], the Ministry of Economic Affairs and Employment is responsible for overall co-ordination, compilation of information and submission it to the European Commission. The sectoral ministries are responsible for policies and measures, the projections and impact assessments concerning their own field. The network of senior officials gives the final approval concerning the information in the reporting tools to be submitted. A specific working group is established for each round of the reporting to carry out the work. The working group consists of experts from the Ministry of Economic Affairs and Employment, Ministry of the Environment, Ministry of Transport and Communications, Ministry of Agriculture and Forestry and Ministry of Finance.

3.1.2.2 Institutional arrangements for implementation of the NDC

This section also contains common text for the BTRs of the EU and the Member States.

The EU and its Member States have set up a comprehensive system for the implementation of the EU climate change mitigation targets. The European Climate Law[20] sets the goal of climate neutrality by 2050 and the intermediate target of reducing net greenhouse gas emissions by at least 55 per cent by 2030 and by 90 per cent by 2040 compared to 1990 levels. These targets cover emissions and removals regulated under EU law.

As described in the EU's updated 2030 NDC submitted in October 2023, The EU has outlined three main policies to ensure it meets its target of reducing emissions by 55 per cent by 2030:

- The EU Emissions Trading System (ETS) aims to cut emissions by 62 per cent compared to 2005 levels
- The Effort Sharing Regulation (ESR) sets a target of 40 per cent reduction compared to 2005 levels
- The Land Use, Land Use Change and Forestry (LULUCF) Regulation provides for an additional 42 $MtCO_2$-eq land-based net removal compared to the 2016-2018 average.

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[19] 2018/1999

[20] Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), http://data.europa.eu/eli/reg/2021/1119/oj.

The ESR is supported by additional sectoral policies and measures. More details are provided in the chapter on mitigation policies and measures.

The 'Fit for 55' legislative package adopted in 2023, significantly deepens and broadens the decarbonisation of the EU and Member States' economy to achieve the 2030 targets and climate neutrality by 2050. This package strengthens the EU Emissions Trading System (EU ETS)[21], which caps GHG emissions in energy, industry, aviation and maritime transport; the LULUCF Regulation which includes national net removal targets for the LULUCF sector; and the Effort Sharing Regulation (ESR) which establishes national reduction targets for GHG emissions not covered by the EU ETS or the LULUCF Regulation i.e. domestic transport (excluding aviation), buildings, agriculture, small industry and waste. These main instruments are supported by additional legislations like the ETS2 for buildings, transport and small industries. Also, comprehensive measures to deepen renewables, energy efficiency, and sustainable mobility have been introduced, aiming at companies, households, public administrations while supporting investments into clean and decarbonization technologies.

This architecture ensures effective emissions reductions through the combined, reinforcing effect of overlapping policies, requiring all sectors of the economy to contribute. The European Commission's impact assessments demonstrate that the 2030 climate targets are best achieved through this integrated policy scenario, rather than through individual measures. This interconnected approach ensures a fair, cost-effective, and competitive transition across all member states.

Progress in the implementation of these policies and measures is monitored under the Governance Regulation. Relevant information which is reported regularly and archived at the EEA include GHG inventories, approximated GHG inventories for the previous year, information on policies and measures, projections, and progress towards the implementation of integrated National Energy and Climate Plans (NECPs). This information helps the EU and its Member States to correct their course if progress towards the targets of the 2030 is behind schedule. As an example, the European Commission assesses the drafts of new or updated NECPs and provides recommendations for improved planning and implementation. In addition, the reported information is subject to quality checks, and the GHG inventories reported by EU Member States are subject to comprehensive reviews in 2025, 2027 and 2032.

Details can be found in EU's BTR2 in the section on mitigation policies and measures.

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[21] This refers to the ETS1, i.e. the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (chapter II of the ETS Directive). Note that the 'Emissions trading system for buildings, road transport and additional sectors' (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

The revised EU ETS Directive increases the level of ambition in the existing system from 43 per cent to 62 per cent emissions reductions by 2030, compared to 2005 levels and extend the system to also apply to international maritime transport. A separate carbon pricing system will apply to fuel combustion in road transport and buildings and small-emitting sectors (ETS2) with a 42 per cent emission reduction target compared to 2005 across the sectors covered. The amended Effort Sharing Regulation (ESR) increased, for the sectors that it covers, the EU-level GHG emission reduction target from 29 per cent to 40 per cent by 2030, compared to 2005, which translates in updated 2030 targets for each Member State.

The new LULUCF Regulation sets an overall EU-level objective for an additional 42 $MtCO_2$ eq. land-based net removal in 2030 compared to the 2016–2018 average. This is broken down in net carbon removal targets for the EU and each Member State, where Member States' commitments are implemented in two distinct periods:

The ESR sets national targets for the reduction of GHG emissions in the Member States by 2030. Member States are also subject to gradually decreasing annual emission limits for each year from 2021 to 2030. The annual progress towards the national targets under the Effort Sharing Legislation is assessed by comparing GHG emission levels from the sectors covered by the ESR with the relevant annual emission allocations under the legislation (AEAs). To achieve compliance under the ESR, Member States are permitted to use flexibility options to a certain extent.

All EU legislation, including the legislation under the 2030 Climate and Energy Framework, is subject to a stakeholder engagement process. The EU's better regulation tools ensure that policy is based on evidence and the best available practice.[22] During the preparation of legislative proposals, the European Commission invites citizens, businesses and stakeholder organisations to provide their views about the new legislation. When preparing a legislative proposal, the European Commission invites individuals, businesses and stakeholder organisations to share their views. These comments are published on a dedicated portal,[23] and the European Commission explains how it has taken them into account when developing its proposal. Furthermore, the Governance Regulation sets requirements for Member States to ensure that the public is given early and effective opportunities to participate in the preparation of the NECPs.

In the EU Effort Sharing Regulation (ESR), Finland's target for emissions reductions in 2030 compared to the 2005 level is 50 per cent. Member States are subject to gradually decreasing annual emission limits for each year from 2021 to 2030. Finland's annual emission allocations under the ESR for 2021–2025 are presented in Table 3.3-3 in Section 3.3.3.

[22] Decision-making process, https://ec.europa.eu/info/strategy/decision-making-process/how-decisions-are-made_en.

[23] Have your say – Public consultation and feedback, https://ec.europa.eu/info/law/better-regulation/have-your-say_en.

Finland's revised ***Climate Act***[24] sets out several plans that aim to reduce greenhouse gas emissions and adapt to climate change in Finland. It also obliges the central government authorities to monitor the trends in emissions and achievement of climate targets and report on them to Parliament. Procedures included in the Climate Act enable annual assessment of the implementation of the EU's NDC regarding Finland's contribution under the EU Effort Sharing Regulation and LULUCF regulation. Also, the European Commission monitors that the EU Member States, including Finland, are in compliance with their emission reductions targets (see above).

The Government regularly prepares strategies and plans for achieving climate targets. The most significant ones are discussed below (also in Section 3.4.2). In addition, climate policy is increasingly being integrated with the decision making processes in energy production, transport, agriculture, forestry and land use and other planning in Finland. Sectoral policies and measures are presented in Section 3.4.

National energy and climate strategies have been prepared since 2001 by each Government i.e. the cabinet of ministers and submitted to the Parliament as a Government Reports. The latest strategy[25] was published in December 2025 and assesses impacts of the latest policy measures and gaps in the energy and climate targets, including the EU 2030 targets. Ministry of Economic Affairs and Employment oversees the overall coordination of the strategy work

The relevant ministries are responsible for implementing the measures set out in the National Energy and Climate Strategy and for their monitoring and evaluation. In some cases, this responsibility has been delegated to specialised government entities such as Motiva Oy, an entirely state-owned sustainable development company in Finland that promotes the efficient and sustainable use of energy and materials. A sectoral example of monitoring of progress are the summary reports on the impact of energy efficiency agreements published by Motiva Oy.

In reporting on policies and measures, including their implementation and effects on emissions, and projections to the European Commission (see above) and to the UNFCCC and Paris Agreement, the Ministry of Economic Affairs and Employment is responsible or the overall coordination and compilation of information from different sectors. The sectoral ministries are responsible for the projections and impact assessments concerning their own field. Several expert organisations assist in acquiring data and in the assessments of policies and measures and modelling sector-specific projections. The biennial report on policies and measures and projections has been thus compiled in cooperation with the Ministry of Economic Affairs and Employment, the

[24] 423/2022

[25] National Energy and Climate Strategy (in Finnish), 2025. Publications of the Ministry of Economic Affairs and Employment 2026:4. https://urn.fi/URN:ISBN:978-952-327-952-0

Ministry of the Environment, the Ministry of Transport and Communications, the Ministry of Agriculture and Forestry, the Ministry of Finance, Statistics Finland, the Finnish Environment Institute (Syke), state owned sustainable development company Motiva Oy, and Natural Resources Institute Finland (Luke).

The recent EU regulation on the Governance of the Energy Union and Climate Action requires every EU Member State to regularly prepare ***an integrated national energy and climate plan (NECP)*** and ***a Long-term Strategy (LTS)*** for low-carbon development. Finland submitted its first NECP to the EU in 2019 and its first LTS[26] in 2020. An update of the NECP was submitted in June 2024.[27] The regulation also includes an obligation to biennially prepare the national energy and climate plan progress report (NECPR). The first progress report was submitted in March 2023, followed by the second in March 2025.

The Climate Act contains a provision on a climate change policy planning system that includes ***a Medium-term Climate Plan*** adopted by the Government once every government term. The Medium-term Climate Plan includes an action plan that contains measures for the reduction of anthropogenic greenhouse gas emissions and the mitigation of climate change in the effort sharing sector (sectors outside emissions trading and land-use) and projections of greenhouse gas emissions and the effects of policy measures on the emissions.

The third Medium-term Climate Plan was adopted in 2025[28]. It specifies the key measures for achieving the binding emissions reduction targets in the effort sharing sector by 2030 and outlines progress beyond 2030. The preparation of the Medium-term Climate Plan is coordinated by the Ministry of the Environment, and all the relevant ministries are involved in the work. The Annual Climate Report, which is submitted to Parliament every year, contains information on the implementation of the policy measures contained in the Medium-term Climate Plan. Preparation for the fourth Medium-term Climate Plan has started.

The Climate Plan for the Land Use Sector (LULUCF)[29] was prepared from 2021 to 2022 for the first time. It is one of the key elements of the planning system under the revised Climate Act. According to the revised Climate Act a new Climate Plan for the Land Use Sector will be prepared every other

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[26] Finland's long-term strategy to reduce greenhouse gases. Ministry of Economic Affairs and Employment, 1 April 2020. https://tem.fi/eulle-toimitettavat-suunnitelmat-ja-raportit

[27] Finland's Integrated National Energy and Climate Plan Update, 28 June 2024. Publications of the Ministry of Economic Affairs and Employment 2024:30. http://urn.fi/URN:ISBN:978-952-327-527-0

[28] Medium-term Climate Policy Plan, 5 December 2025. Publications of the Ministry of the Environment 2025:33. https://urn.fi/URN:ISBN:978-952-361-738-4

[29] Government Report on the Climate Plan for the Land Use Sector, 5 May 2023. Publications of the Ministry of Agriculture and Forestry 2023:12. http://urn.fi/URN:ISBN:978-952-366-592-7

governmental term. The purpose of the Plan is to promote the reduction of emissions from land use, forestry, and agriculture, the strengthening of carbon sequestration and carbon storage, and adaptation to climate change in accordance with the Sustainable Development Goals. The first plan was coordinated by a working group, which included members from the Ministry of Agriculture and Forestry and other relevant ministries, as well as two experts from the Finnish Climate Change Panel. The Annual Climate Reports to the Parliament contain information on the implementation of the policy measures included in the Climate Plan for the Land Use Sector. In accordance with the Climate Act, during those governmental terms in which there is no obligation to prepare new plan, an assessment must be made of whether the existing plan remains up to date and whether new measures are needed. The first assessment of the Climate Plan for the Land Use Sector was completed in January 2026.[30]

The National Climate Change Adaptation Plan 2030[31] was adopted in December 2022 and it is the second national adaptation plan in Finland. A preparatory group consisting of representatives of nine ministries was responsible for the preparation of the current Plan. The group was led by the Ministry of Agriculture and Forestry, the ministry coordinating climate change adaptation at the Government level. The preparatory group was supported by an expert secretariat and informed by consultations with a broad range of stakeholder representatives. The Plan presents a climate change risk and vulnerability assessment and sets out the vision, aims, targets and actions for national adaptation work in Finland. The Plan, which is ought to be updated at least every second parliamentary term, is part of Finland's climate policy planning system as stated by the Climate Act. The monitoring system for the Plan was developed and implemented in 2025. The implementation of the Plan is reported in the Annual Climate Reports to the Parliament. In accordance with the Climate Act, during those governmental terms in which there is no obligation to prepare new plan, an assessment must be made of whether the existing plan remains up to date and whether new measures are needed. The mid-term evaluation of the current adaptation plan will be published in late 2026.

Stakeholders are engaged in several ways related to the Finland's contribution to the implementation and achievement of the EU's NDC. Preparation of the Government's climate related strategies and plans includes different participatory approaches with various stakeholders - in addition to which stakeholders together with the general public are invited to submit comments before the finalization of the strategies and plans.

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[30] Assessment of the Climate Plan for the Land Use Sector (2026). Ministry of Agriculture and Forestry 2026:5. https://urn.fi/URN:ISBN:978-952-366-120-2

[31] The National Climate Change Adaptation Plan 2030, 2 April 2024. Publications of the Finnish Government 2024:11. http://urn.fi/URN:ISBN:978-952-383-814-7

Based the Climate Act, t*he* ***Finnish Climate Change Panel*** *acts* as an independent body to support climate policy planning and decision making. The Panel's members represent different branches of science from social sciences to atmospheric sciences. The Panel gives its opinion on climate policy plans and produces reports to support the preparation and implementation of climate policy and legislation in Finland. Panellists have been invited to comment the National Energy and Climate Strategy and the Medium-term Climate Plan. As a part of the assessment of the Climate Plan for the Land Use Sector, the Climate Change Panel was invited to compile a summary of its recommendations it has issued regarding the plan and its measures. The summary was incorporated into the assessment report.

The Climate Act also mandates the ***Saami Climate Council,*** which is a globally unique scientific panel tasked with producing information about climate change from the perspective of both Saami traditional knowledge and scientific research. This information is directed to both authorities and the Saami community for decision-making purposes and to raise awareness about the impacts of climate change on Saami culture.

3.2 Description of a Party's nationally determined contribution

This section contains common text for the BTRs of the EU and the Member States.

In its updated 2030 nationally determined contribution (2030 NDC)[32], the EU commits to reducing net greenhouse gas emissions by at least 55 per cent by 2030 compared with 1990 levels.

The NDC submitted in November 2025 includes an indicative contribution for 2035[33] of a 66.25–72.5 per cent net reduction in GHG emissions compared to 1990. This is backed since April 2026, by the amended Climate Law,[34] establishing a legally binding target of a 90 per cent net greenhouse gas reduction by 2040 compared to 1990, of which at least 85 per cent must be achieved through domestic action, with a limited contribution from high-quality international credits possible from 2036. The 2040 target bridges the 2030 objective and the climate neutrality.

[32] https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17 EU submission NDC update.pdf

[33] UNFCCC NDC registry, https://unfccc.int/sites/default/files/2025-11/DK-2025-11-05 EU NDC.pdf

[34] https://eur-lex.europa.eu/eli/reg/2021/1119/oj/eng

This new submission is an important step in the EU's long-term climate action. It raises the EU's ambition on the paths towards climate neutrality by 2050 and builds on continued emissions reductions and the revised European Climate Law.

This BTR2 and the relevant Common Tabular (CTF) Tables are tracking progress only towards the 2030 NDC, as the implementation period of the 2035 NDC has not yet begun.

3.2.1 EU 2030 NDC

The EU and Member States 2030 NDC is described in the EU submission of 17 October 2023 to the UNFCCC secretariat.

The NDC consists of a single-year target, and the target type is 'economy-wide absolute emission reduction'. The scope of the NDC covers the 27 Member States of the EU.

The scope of the 2030 NDC is supplemented by additional information to clarify the precise amount of international aviation and maritime emissions which are covered under the EU 2030 NDC. Details can be found in the NDC description below.

International aviation

International aviatiotn under the scope of the NDC comprises CO2 emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive for 2030 and only from flights subject to effective carbon pricing through the EU ETS (Table 3.2-1).

Table 3.2-1
Aviation emissions covered by the EU 2030 NDC scope

Flights		Example	2030 NDC scope
Domestic aviation	Domestic flights in EU countries	Palermo–Rome	Yes
	Domestic flights to/from outermost regions	Canary Islands–Madrid	Yes
International aviation	Flights between two EU countries	Brussels–Prague	Yes
	Flights from Iceland and Norway to the EU	Oslo–Brussels	No
	Flights from the EU to Iceland and Norway	Brussels–Oslo	Yes
	Flights between the EU and outermost regions*	Paris–Canary Islands	Yes (since 01/2024)
	Flights from the EU to the UK and Switzerland	Prague–London	Yes
	Flights from the UK and Switzerland to the EU	London–Prague	No
	Flights between the EU and other countries	Rome–New York	No

International maritime navigation

Maritime navigation is included in respect of emissions from domestic navigation activities and emissions subject to effective carbon pricing through the EU ETS. The extension of the EU ETS to maritime emissions covers carbon dioxide emissions, from ships above 5000 gross tonnage, as well as methane and nitrous oxide emissions as from 1 January 2026. It applies to 50 per cent of emissions from voyages starting or ending outside the EU, and all emissions from voyages within the EU and emissions from ships within EU ports.

Unlike aviation, maritime transport has a different and narrower scope compared to the scope of the EU ETS scope. The latter also covers half of the emissions from voyages between the EU and countries outside the EU.

Table 3.2-2
Emissions from international navigation covered by the EU 2030 NDC

Flights		Example	2030 NDC scope
Domestic navigation	Voyages in EU countries	Valencia-Barcelona	Yes
International navigation	Voyages between two EU countries	Valencia-Rotterdam	Yes
	Voyages between an EU country and Norway/ Iceland	Rotterdam-Oslo	No
	Voyages between an EU country and other country	Rotterdam-Houston	No
	Voyages between Norway/ Iceland and other country	Oslo-Houston	No
	'Within port' emissions in an EU port	Marseille	Yes
	'Within port' emissions in a port in Norway / Iceland / other country	Oslo	No

The EU set out its 2030 NDC in its submission to the UNFCCC on 17 October 2023.

Table 3.2-3
Description of the EU's 2030 NDC

Information	Example
Target and description	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term 'domestic' means without the use of international credits.
Target type	Economy-wide absolute emission reduction.
Target year	2030 (single-year target)
Base year	1990
Base year value	Net greenhouse gas emissions level in 1990: 4 662 620 kt CO_2eq.
Implementation period	2021–2030
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)).

Table 3.2-3 Continued

Information	Example
Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. **International Aviation:** Emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO_2 emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC these comprise emissions in 2024–26 from flights between the EU Member States and departing flights to Norway, Iceland, Switzerland and the United Kingdom. **International navigation:** waterborne navigation is included in respect of CO_2, methane (CH_4) and nitrous oxide (N_2O) emissions from maritime transport voyages between the EU Member States.
Gases	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3)
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Source: Updated NDC of the EU[35]

Note: This table is identical to CTF table "Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates," which was submitted electronically as a part of EU's BTR2.

3.2.2 EU 2035 NDC

The EU set out its 2035 NDC in its submission[36] to the UNFCCC on 5 November 2025.

In April 2026, the amendment to the EU Climate Law entered into force, establishing a legally binding 2040 target of 90 per cent net greenhouse gas (GHG) emissions reduction against 1990 levels. Of this, at least 85 per cent

[35] The update of the nationally determined contribution of the European Union and its Member States, https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf.

[36] https://unfccc.int/sites/default/files/2025-11/DK-2025-11-05 EU NDC.pdf

must be achieved through domestic action, while up to 5 per cent may be met using high-quality international carbon credits, available only from 2036 (with an earlier 2031–2035 pilot phase to help build market capacity). The revision is designed to bridge the EU's 2030 target (55 per cent reduction) and its 2050 climate-neutrality objective.

Table 3.2-4
Description of the EU's 2035 NDC

Information	Description
Target and description	Economy-wide, single year net emissions reduction target by 90% in 2040 compared to 1990, including an adequate contribution of high-quality international credits under Article 6 of the Paris Agreement in a way that is both ambitious and cost-efficient. In response to decision 6/CMA.3 on common time frames for NDCs and 1/CMA.5 on GST, the EU and its Member States, acting jointly, aim to achieve an indicative contribution of a reduction of net GHG emissions of between 66.25-72.5% compared to 1990 by 2035. This is based on indicative linear trajectories from, on the one hand, the EU's climate targets for 2030 and 2050, and, on the other hand, the EU's climate target for 2030 and the 2040 climate target from the position of the Council of the European Union.
Target type	Economy-wide absolute emission reduction.
Target year	2035 (single-year target)
Base year	1990
Implementation period	2031-2035
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions • Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), • Canary Islands (Spain), • Azores and Madeira (Portugal).

Information	Description
Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. **International aviation:** Emissions from civil aviation are included in respect of CO_2 emissions from flights subject to effective carbon pricing through the EU ETS which, up to 31 December 2026, comprises flights within the European Economic Area, departing flights to Switzerland and departing flights to the United Kingdom. **International navigation:** International navigation is included in respect of emissions from domestic navigation activities and emissions subject to effective carbon pricing through the EU ETS. The extension of the EU ETS to maritime emissions covers CO_2 emissions, from ships above 5000 gross tonnage, as well as methane and nitrous oxide emissions as from 1 January 2026. It applies to 50% of emissions from voyages starting or ending outside the EU, and all emissions from voyages within the EU and emissions from ships within EU ports.
Gases	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3)
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	Of the 2040 90% reduction target, up to 5% may be met using high-quality international carbon credits, available only from 2036. Therefore, the adequate contribution from international credits will be reflected as of 2036. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable	N/A

3.2.4 What are the next steps with regards the 2035 NDC

The agreement on the legally binding 2040 target has been enshrined in the amended European Climate Law, formally adopted by the Council in March 2026. This enables the Commission to proceed with the development of a new, simpler climate and energy policy framework for the post-2030 period. This framework will draw on the experience with the current policy architecture and will address the unique challenges that arise during the more advanced stages of the transition to a cleaner economy. This work is currently in progress and publication of the proposals implementing the 2040 climate target by the Commission is expected by the end of 2026.

3.2.4 Arrangements for assessing progress towards the EU and its Member States Joint NDC

The technical review of information necessary for tracking progress towards the EU and its 27 Member States joint NDC is based on the information reported in the EU's BTR. Therefore, the conclusions of the meetings of lead reviewers of BTRs provide guidance on:

- Assessing progress towards the joint 2030 NDC: Because the EU and its 27 Member States have a single joint NDC target, assess progress towards the EU and its Member States single joint NDC target, progress towards that target is assessed only during the review of the EU's BTR. For individual Member States BTRs, the reviewers should conduct a non-technical check that Member States refer to the EU's BTR and/or relevant CTF tables.
- Institutional arrangements: Each Member States BTRs need to report its national institutional arrangements for domestic implementation of the NDC, while also providing information on or referencing to the EU level institutional arrangements; and
- Projections of key indicators: Member State must provide projections for the relevant key indicator based on the EU economy-wide emissions or refer to the EU BTR and /or CTF table 10.

3.3 Tracking progress: Indicator, definitions, methodologies, and progress

This section contains common text for the BTRs of the EU and the Member States. Please see also CTF Tables of the EU's BTR2.

3.3.1 Indicator

For the tracking of progress towards implementing and achieving the NDC of the EU, an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen indicator is 'annual total net GHG emissions consistent with the scope of the NDC in CO_2 eq'. Table 3.3-1 provides more information on this indicator.

Table 3.3-1
Indicator for tracking progress

Information	Description
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO_2eq and the unit which we use for reporting is kt CO_2eq.
Reference level and base year	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 662 620 kt CO_2eq.
Updates in accordance with any recalculation of the GHG inventory, as appropriate	The reference level was changed from 4,699,405 kt CO_2 equivalent to 4,662,620 kt CO_2 equivalent, in accordance with recalculations for the 2026 submission of the EU GHG inventory.
Relation to the NDC	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.
Definitions	Definition of the indicator 'annual total net GHG emissions in CO_2eq': Total net GHG emissions correspond to the annual total of emissions and removals reported in CO_2 equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled 'Reporting format for the description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates.' Indirect CO_2 emissions are included from those Member States that report these emissions.

Note: The information in this table is identical to the information in Common Tabular Format (CTF) tables 1 ('Description of selected indicators') and 2 ('Definitions needed to understand the NDC'), which were submitted electronically as a part of EU's BTR2.

Source: The reference level is based on the Annual European Union GHG inventory 1990–2024.

3.3.2 Methodologies and accounting approach

The EU use the following accounting approach for tracking progress towards the joint EU NDC: annual GHG data from the national GHG inventory of the EU is complemented for international aviation and navigation with estimations from the Joint Research Centre's Integrated Database of the European Energy System[37]. The total net GHG emissions are provided in the scope of the EU NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. The EU will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

[37] European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Gea Bermudez, J. et al., JRC-IDEES-2023 – The integrated database of the European energy system – Data update and technical documentation (2026) https://data.europa.eu/doi/10.2760/6945021

3.3.3 Structured summary – status of progress

This section contains common text for the BTRs of the EU and the Member States.

The most recent data on GHG emissions and removals in the scope of the NDC constitute the key information for tracking this progress. Table 3.3-2 summarises the current status of progress.

Table 3.3-2
Summary of progress towards implementing and achieving the NDC

	Unit	Base year value	Values in the implementation period					Target level	Target year	Progress made towards the NDC
			2021	2022	2023	2024	2030			
Indicator: total net GHG emissions consistent with the scope of the EU NDC	kt CO_2eq	4,662,620	3,283,198	3,221,663	2,356,310	2,872,818	NA	At least 55% below base year level	2030	The most recent level of the indicator is 38.4% below the base year level.

NA: not applicable.

Note that an annual emissions balance consistent with chapter III.B (Application of the corresponding adjustment) will be provided in a subsequent BTR after the CMA finalises further relevant guidance, based on the annual information reported under Article 6.2.

More detailed information can be found in the EU CTF Table 4 ('Structured summary: tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement'), which has been submitted electronically together with the EU's BTR2.

Source: the indicator values are based on the annual European Union GHG inventory 1990–2024.

Based on the GHG inventory data in the scope of the NDC for 2024, the EU and its Member States have reduced net GHG emissions by 38.4 per cent compared to 1990. This shows that the EU and its Member States have made progress in implementing and achieving their NDC. The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030.

Finland's contribution to the progress towards achieving the joint EU NDC can be illustrated in part by the development of the emissions under the EU Effort Sharing Regulation (ESR) compared to the annual emission allocation that are presented in Table 3.3-3. Achievement of the member-state specific emissions reduction defined by the annual emission allocations in 2021–2025 will be assessed based on the final figures after the comprehensive EU review in 2027.

Table 3.3-3
Finland's annual emissions allocations for the effort sharing sector for 2021–2025, corresponding emissions for 2021 to 2024 and their difference to emissions allocations

	2021	2022	2023	2024	2025
	kilotonnes CO_2 eq.				
Annual emission allocation	28,840	27,970	26,626	25,283	23,939
Effort sharing sector	27,558	26,641	25,727	25,872	
Difference between AEA allocation and reported total ESR emissions	–1,282	–1,329	–899	589	

In addition, Finland takes part in the EU Emissions Trading System. Finland also contributes to the overall EU-level objective of 310 million tonnes CO_2 equivalent of net removals in the LULUCF sector in 2030 defined by the EU's LULUCF Regulation.

3.4 Mitigation policies and measures

3.4.1 Introduction

Finland's climate policy is based both on international agreements and national targets such as the UNFCCC, the Paris Agreement, and the common policies of the European Union mentioned above. These agreements and targets drive the process of preparing the actual mitigation policies and measures, and laying them out in different strategies, which are both described in this chapter.

At the time of writing, the Government term is soon coming to an end, which is why no major policy measures are being planned. However, the following sections present some individual policy measures that are based on earlier political decisions or discussions but are still in their early stages and therefore considered additional measures.

3.4.2 Strategies and plans

3.4.2.1 National Energy and Climate Strategies

The national Energy and Climate Strategy is not part of the planning system of the Climate Act,[38] which lays out the national climate policy goals, for example. However, the strategy is usually prepared once per parliamentary term, and its impact assessed in a coordinated manner using data in common with the Medium-term Climate Plan. As an overarching energy and climate policy

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planning document that covers the emissions reduction and increasing of carbon sinks, the energy and climate strategy also includes other energy policy themes: renewable energy, energy efficiency, energy market, energy security and research, innovation, and competitiveness.

Finland has prepared seven national strategies on energy and climate policy, which were completed and submitted to Parliament as Government Reports in 2001, 2005, 2008, 2013, 2016, 2022, and 2025. The focus of the 2008 and 2013 strategies was on policy measures for achieving the European Union's (EU) 2020 energy and climate targets. The 2016 strategy – National Energy and Climate Strategy for 2030 – outlined the actions enabling Finland to attain the targets specified in the Government Programme of the then Prime Minister Sipilä (May 2015) and in the EU legislation for 2030, and to systematically set the course for achieving an 80 to 95 per cent reduction in greenhouse gas emissions by 2050. The 2022 strategy, called "Carbon Neutral Finland 2035 – National Climate and Energy Strategy", set out the key starting points and objectives of the then Government Programme goals, including the EU 2030 targets and national carbon neutrality target by 2035.

The current Government of Prime Minister Petteri Orpo prepared the latest energy and climate strategy in 2025. It assesses the impacts of the latest policy measures and gaps in the energy and climate targets. The condensed conclusion is that Finland is on track to attain its EU targets and direct national emissions reduction goals, but the Climate Act's 2035 target of carbon neutrality will require more policy measures to strengthen carbon sinks in the land use sector (LULUCF) and further reduce emissions.

3.4.2.2 Long-term Strategy (LTS)

In 2020, Finland submitted its Long-term Strategy (LTS) to the UN and EU. It replaces the former Energy and Climate Roadmap 2050, published in 2014. The preparation of an LTS is stipulated in Article 4, Paragraph 19 of the Paris Agreement and in Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action, also known as the "Governance Regulation". It was the first strategy to take Finland's carbon neutrality target into account before the National Climate and Energy Strategy in 2022.

The next LTS is to be submitted to the EU only by the beginning of 2029. However, the Government issued the latest national LTS in 2025 in line with the Climate Act.[39]

The latest Long-term Strategy lays out projections concerning the national carbon neutrality target set for 2035 and developments in greenhouse gas

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emissions and removals by 2050. The strategy explores four projections alongside the base projection. The LTS does not indicate how likely or realistic an individual projection is but presents effects of different trends, which are reflected in the projections. One of the projections is based on national security; the others' main focus is on free markets, environmental issues, and society.

The direct emissions reduction targets of the Climate Act are achieved in almost all projections. Nevertheless, the total net emissions of only one projection are sufficiently low to meet the target of carbon neutrality by 2035, which is based on significantly lower forest logging than the present level.

3.4.2.3 Medium-term Climate Policy Plan

The Climate Act[40] contains a provision on a climate change policy planning system that includes a Medium-term Climate Plan adopted by the Government once every government term. The Medium-term Climate Plan includes an action plan that contains measures for the reduction of anthropogenic greenhouse gas emissions and the mitigation of climate change in the effort sharing sector (sectors outside the EU's emissions trading (ETS)). It also presents projections of greenhouse gas emissions and the effects of policy measures on emissions. The preparation of the Plan is coordinated by the Ministry of the Environment, and all the relevant ministries are involved in the work. The Annual Climate Report, which is submitted to Parliament every year, contains information about the implementation of the policy measures contained in the Medium-term Climate Plan.

The third Medium-term Climate Plan was finalised in December 2025. Alongside the National Energy and Climate Strategy, this plan outlines the Government's climate policy objectives and actions. It specifies and complements the emissions reduction measures outlined in the National Climate and Energy Strategy and the Climate Plan for the Land Use Sector from 2022. The Plan takes the energy policy measures included in the strategy into account because they will have an impact on the development of emissions in the effort sharing sector.

The third Medium-term Climate Plan was updated to meet the increasingly stringent EU obligations for 2030 and the Government's target of achieving carbon neutrality by 2035. The Plan sets a target for reducing greenhouse gas (GHG) emissions by 50 per cent in the effort sharing sector by 2030 compared with the 2005 level and the annual emission allocations for each year between 2021 and 2030. It also determines the measures for achieving the target. Finland's target is based on the European Union's (EU) 2030 overall target of reducing emissions by at least 55 per cent compared with 1990 levels.

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According to estimates presented in the Medium-term Climate Plan, the measures contained in the action plan will generate net additional emissions reductions of 0.5 million tonnes CO_2 eq. in the effort sharing sector by 2030 relative to the baseline scenario. This leads to an emissions level of 18.9 million tonnes, which exceeds the target of 17.2 million tonnes for 2030. Surplus annual emission allocations carried over from previous years may be used to meet the target, as well as the flexibility mechanism from the ETS sector. Finland's 2030 obligation to reduce emissions by 50 per cent is therefore likely to be achieved, provided that the available flexibilities can be fully utilised. The final outcome, however, will depend decisively on the number of banked surplus units remaining in 2030.

3.4.2.4 Climate Plan for the Land Use Sector

The Climate Plan for the Land Use Sector (LULUCF) was first prepared in 2022, and it is one of the key elements of the planning system under the revised national Climate Act. In line with the UN Framework Convention on Climate Change and the Paris Agreement, the land use sector comprises land use, land use change, and forestry (LULUCF). The Climate Plan for the Land Use Sector is drawn up every second government term.

The purpose of the Plan is to promote the reduction of emissions from land use, land use change, forestry, and agriculture, strengthen carbon sequestration and carbon storage, and to adapt to climate change in accordance with the Sustainable Development Goals. The annual net impact, that is, the decrease in emissions and increase in removals for which the additional climate measures in the land use sector aim is at least three million tonnes of CO_2 eq. by 2035.

The Climate Plan for the Land Use Sector brings together ongoing measures in the entire land use sector. The measures and their climate impact are presented in detail in Section 3.4.6. The Plan also outlines additional measures in four categories: resource-efficient land use and land use change; climate-resilient use of peatlands; other measures to promote carbon sequestration and carbon storage; and crosscutting measures. In addition to the ongoing measures, the new measures focus on actions in peatland fields and forests, the development of carbon markets, swift and timely forest regeneration, increasing the amount of dead wood for climate and biodiversity perspectives, promoting training and expertise, and communication, for example. The most effective measures have been identified in halting deforestation and promoting actions in peatlands. However, there is currently no national funding outside the EU's Common Agricultural Policy (CAP) measures for paludiculture/rewetting peatlands. Moreover, the national funding for fixed-term support for afforestation ended in December 2023.

A mid-term assessment of the Climate Plan for the Land Use Sector was carried out in 2025 and published in 2026. To support the assessment carried out by public officials, a background study was commissioned through competitive tendering. Its recommendations emphasise a focus on more effective implementation of the current measures rather than introducing completely new measures. According to the assessment, the measures of the Climate Plan for the Land Use Sector are effective and up to date, and they enable the achievement of the additional target of three million tonnes of CO_2 eq. by 2035, provided that the actions are successfully put into practice, and the successful implementation of other strategies linked to the Plan is ensured. The achievement of Finland's carbon neutrality target by 2035 would require significant additional measures in all sectors, including in the land use sector. Based on the assessment, recommendations are given for the preparation of the Climate Plan for the Land Use Sector during the next government term.

3.4.2.5 National Forest Legislation and Programmes

The sustainable management of forests in Finland is based on normative steering, high-level scientific knowledge, and good practices. The means for steering the use of forests include legislation, Finland's National Forest Strategy 2035, financing, and public forestry extension organisations.

Forest legislation is the most important forest policy means for ensuring sustainable forestry. The key acts include the Forest Act[41] and the Act on a Temporary Forestry Incentive Scheme.[42] There is also legislation dealing with the prevention of forest damage and the trade in forest reproductive material, timber measurement, jointly owned forests, and organisations in the forestry sector.

The Forest Act sets requirements for the regeneration and conservation of certain key habitats. For example, a new seedling stand must be established within three years of the end of felling. The Forest Act is complemented by guidelines for good forest management and silviculture, which have been compiled and promoted by public forestry extension organisations. The current law allows more diversified management methods such as uneven aged forest management. The amendments to the Forest Act increase forest owners' freedom of choice in managing their own forest property, improve the profitability of forestry and operating conditions of the wood-producing industry, and enhance forests' biodiversity. Best Practices for Sustainable Forest Management in Finland are continuously updated to reflect the most recent scientific knowledge and societal values among key stakeholders, as well as the main targets set by the Finnish national forest policy. The Ministry of Agriculture and Forestry finances the development work related to the Best Practices.

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[41] 1093/1996

[42] 71/2023

Finland's new National Forest Strategy (NFS2035) contains the key guidelines of Finland's forest policy, acting as a statutory forest programme. A new national Forest Strategy 2035 was adopted in December 2022, on which the Government made a resolution in October 2023. The process to reform the strategy was based on the rapid changes in the operating environment, both in Finland and internationally. The new strategy to 2035 considers comprehensive sustainable development proactively and in a timely manner, taking the role of forests in climate change mitigation and adaptation into account by strengthening forests' climate resilience and controlling the risks of damage. It describes the key objectives and priorities for the forest sector's development. Among other things, the revised strategy aims to promote active, sustainable, and diverse use of forests and to strengthen their vitality, diversity, and adaptability. The strategy also has numerous interlinkages to other national and international strategies.

The three key projects to achieve the strategy's objectives are concerned with increasing forest growth, carbon sequestration and timber output, improving biodiversity in commercial forests, and creating a competitive environment for a responsible forest sector that is capable of renewal. Climate change mitigation and adaptation in forests are supported by diversifying forest management. Forests' viability, that is, growth and health, are 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 both the growth of growing stock and its resistance to damage, while safeguarding the ecosystem services of forests and producing wood biomass sustainably. Forests as a carbon sink have been a significant means of mitigating climate change in Finland.

The NFS2035 is implemented and monitored in broad cooperation between the public and private sectors. The Ministry of Agriculture and Forestry, supported by the Forest Council, has overall responsibility for the programme. The Forest Council includes representatives from different administrative sectors, industries, NGOs, and specialist organisations.

The NFS2035 is also implemented through Regional Forest Programmes, in which the special regional characteristics are duly considered. Regarding the contribution to the conservation of biodiversity and the sustainable use of natural resources, the most important instruments are the Forest Act (on preserving diversity and habitats of special importance) and the policies and measures outlined in the Forest Biodiversity Programme for Southern Finland 2014 to 2025 (the METSO programme), both of which are integral parts of the range of instruments in the NFS to protect biological diversity in the future.

Forestry is a significant income source for forest owners and provides benefits to society at large. Private and public organisations provide guidance and consultation services for forest owners. The provision of these services has been liberalised by a new act on forest management associations. A private forest owner may also receive assistance from the State for forest management and improvement work. State support encourages measures with long-term impacts. Managing the natural environment in commercial forests is promoted through environmental support and forest nature management projects. Public funding for forestry is based on the Act on a Temporary Forestry Incentive Scheme.

The Act aims to 1) increase forest growth, 2) protect and increase forest biodiversity, 3) promote water protection in forestry, 4) mitigate climate change and promote the adaptation of forests to climate change, and 5) maintain the forestry road network. The Act includes multiple measures, some of which are also included in the Climate Plan for the Land Use Sector, such as comprehensive planning of peatland forest management and promoting ash fertilisation in peatland forests.

Under the Act, environmental aid may be granted for additional costs and income losses due to the preservation and management of habitats of special value. The State also finances forest nature management projects. The works to be designed and implemented in these projects are defined in further detail in the legislation. Most forest nature management projects have special regional importance. Apart from habitats of special value, the projects may concern landscape management, preventing damage to waters, and the restoration of drained areas.

3.4.3 Sectoral policies and measures

Finnish regulations, policies, and measures are strongly affected by the increasing number of EU directives, policies, and measures. This chapter provides information about the most important policies and measures related to the reduction of greenhouse gas emissions. Both existing and some planned measures are described, though no WAM projection is presented. The most important mitigation actions, or policies and measures, and their effects (to the extent available) are described by sector in the sections below, and a summary of all measures is presented in CTF Table 5.

Finland is continuously seeking to improve the quality of data on the effects of the policies and measures. Nevertheless, for some individual measures, Finland has been unable to provide quantified estimates of impacts on national emissions. These are marked with the notation key NE (not estimated) in the table. For various reasons, it has not been possible to obtain estimates such as complexity and the overlaps with other measures (for example, the EU ETS),

whether the measure is still in a phase in which the details of implementation are unknown, the policy or measure targets heterogenous groups and/or many actors with different responses to the measure, or where the quantification of the effect is difficult (for example, measures providing customer advice and information). Annex 3 lists in more detail the reasons for not reporting expected emissions reductions for policies and measures.

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 improve the accuracy of the estimated effects. The impacts of the individual measures are marked with IE (included elsewhere) in the tables, and the aggregated estimates are provided for the group of measures. The notation "Partly IE", partly included elsewhere, is used in the table for the emissions reduction impact of the investment aid for new energy technology demonstration projects. The emissions reduction has not been estimated separately for this measure because of the wide scope of possible projects being supported. The impact may partly be covered by the emissions reduction figures for the measures promoting different renewable energy sources. In other words, the total emissions reduction figures for the renewable energy measures are presumed to be somewhat on the low side. The notation key IE is also used for the emissions reduction impact of the “Advice to users on heating and air-conditioning systems” measure, as the impact overlaps with the “Energy Efficiency Agreements/Customer energy advice” measure.

Concerning the costs of the policies and measures, Section 3.4.4 lists a high-level cost aggregation of some of the measures in line with the General Government Fiscal Plan. No statistics are available on more detailed cost breakdowns or costs of individual measures.

3.4.3.1 Energy

Adopted and implemented policies and measures

The general objective of Finland’s energy policy is to ensure cost-competitive energy security with the lowest possible environmental impacts. Finland uses a diversity of energy sources, more than 40 per cent of which (including energy for transport) are domestic. The major trend is a steady increase in the use of renewable energy in both absolute and relative terms. Direct government intervention to guide the choice of energy sources is rare in Finland. However, economic instruments, mainly taxation and subsidies, are used to improve energy efficiency and to promote the development of domestic energy sources such as biomass, hydro, wind, and solar. For example, new wind power projects established between 2011 and 2017 were eligible for substantial subsidies in the form of a feed-in tariff scheme. The feed-in tariff was also granted to biomass power plants until the end of 2018. The energy market has since undergone

and is still undergoing a significant turning point in the investment climate. It is illustrated by new wind power projects, which have become profitable without subsidies, for example. In addition to actual energy taxes, the EU ETS acts as one sort of tax on carbon, which directs new investments from fossil fuels to renewables. In addition, the disruption to the global energy market because of Russia's attack on Ukraine has accelerated the structural changes even further by underlining the need to advance domestic renewables from the energy security angle.

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

The main policies and measures in the energy sector include the EU Emissions Trading System (ETS), energy taxation, other measures to increase the share of renewable energy, and energy conservation measures.

The EU ETS is an EU-wide measure, while renewable energy sources are more directly supported by various national measures: investment grants; taxation; support for research; and feed-in tariffs. Energy conservation measures are relevant in all sectors of the economy. Energy efficiency agreements, a voluntary scheme for industries and municipalities, have proved to be efficient measures, along with taxes and subsidies. As 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 is presented in CTF Table 5. Energy taxation and tax-related subsidies are described in Section 3.4.4.

EU Emissions Trading System

The EU ETS continues to be the most important economic policy instrument for reducing emissions in the EU and its Member States. Under the system, emissions are limited under an EU-wide cap, which sets the maximum amount of emissions for all operators obliged to participate in the system. The system is divided into periods for which the emissions reduction target and the representative cap are established. In addition, more significant rule changes usually occur as the period changes.

The EU ETS covers operators from power production, industrial processes, and aviation limited to flights within the European Economic Area (EEA). The coverage was expanded to maritime vessels of or above 5,000 gross tonnage in 2024. The ETS covers 100 per cent of maritime emissions from the voyages of those vessels within the EEA and 50 per cent of emissions from voyages

between the EEA and third countries. The GHG gases covered in the ETS are CO_2 and N_2O, and PFC emissions from certain industries. For maritime, the EU ETS also covers CH_4 emissions.

EU-wide, some 11,000 installations are included in the EU ETS, of which more than 500 are in Finland. At the beginning of 2020, the EU ETS was linked with Switzerland's trading system, allowing more flexibility for the use of allowances for both entities.

Over the years, the EU ETS has undergone several reforms such as increasingly harmonised EU-wide rules, more ambitious emissions reduction targets, the introduction of auctioning as the primary allocation method, and the establishment of the Market Stability Reserve (MSR). The MSR is a mechanism that aims to decrease the allowance surplus in the market and improve its resilience to future recessions.

During Phase 4, that is, between 2021 and 2030, 57 per cent of allowances are allocated in auctions, and the rest is granted directly to installations as free allocation. Most Member States, including Finland, auction their allowance shares in joint auctions organised by the European Energy Exchange (EEX). During Phase 3, Finland's appointed auctioneer, the Energy Authority, accounted for a total EUR 1.10 billion of state revenues.

All sectors except electricity production, maritime and carbon capture, transport, and storage are entitled to apply for a free allocation. Sectors considered to have the highest risk of carbon leakage will continue to receive full free allocation; sectors considered to be less exposed will get 30 per cent compared with their demand. Starting from 2026, free allocation is gradually being phased out for the less exposed sectors, with the exception of district heating. For the aviation sector, free allocation has been removed as of 2026.

In 2025, an expansion of the EU ETS, but technically a separate emissions trading system for buildings, road transport, and additional sectors (ETS2), commenced in the EU. The new ETS2 is an upstream system where the entity that releases fossil fuels for consumption must hold an emission permit and surrender the allowances covering the CO_2 emissions from the amount of fuel released annually from 2028 onwards. The emission allowances are auctioned. For the final consumer of fossil fuel, the ETS2 system will mean higher fuel prices from 2028. The ETS2 is a complementary measure to reduce GHG emissions in the ESR (Effort Sharing Regulation, i.e. outside the current EU ETS) sector. It is estimated that in Finland the new ETS2 would cover about 50 per cent of the total emissions from the ESR sector. Finland is unilaterally expanding the scope of ETS2 to cover emissions from fuel combustion from agriculture and forestry, as well as non-commercial navigation.

The ETS2 will also have an emissions reduction target and a cap for emissions. The cap will be set first for 2028 in 2027, and it will be adjusted annually by a Linear Reduction Factor of 5.38 per cent from 2028 onwards. Due to the ETS2 being a European Union-wide and market-based system, the national reduction of emissions may differ from the union-wide reductions driven by the cap. According to estimates made in Finland, the new emissions trading system would reduce emissions from the ESR sectors by approximately 0.33 million tonnes of CO_2 eq. in 2030 but could lead to more substantial annual reductions in later years, when the prices for allowances are expected to be higher.

Unlike the current EU ETS, the new ETS2 will not include free allocation, and all the emission allowances will therefore be released to the market by auctioning from the beginning of 2028. The Commission and the Member States will jointly organise a tender for the organisation of the auctions.

The historical division of emissions between the ETS and ESR sectors is presented in Table 3.4-1.

Table 3.4-1
Greenhouse gas emissions in the emissions trading (ETS) sector and non-emissions trading sector in Finland in 2005, 2010, 2015, 2020, and 2024, in million tonnes CO_2 eq. The ETS figures do not include emissions from aviation in the EU ETS, as their coverage under the trading system is inconsistent with the national greenhouse gas inventory. Total national emissions (also for 1990) without the LULUCF sector and emissions from domestic aviation are also presented.

	1990	2005	2010	2015	2020	2024
EU ETS	NA	35.30	41.85	25.35	19.58	13.27
of which energy	NA	30.34	37.60	21.43	15.91	9.79
industrial processes	NA	5.01	4.29	3.96	3.66	3.51
Non-ETS	NA	34.34	33.71	29.65	28.17	25.87
CO_2 emissions from domestic civil aviation	NA	0.30	0.23	0.18	0.09	0.15
Total	**71.84**	**69.94**	**75.79**	**55.17**	**47.84**	**39.28**

Due to a statistical difference between the greenhouse gas inventory and ETS data, sums may not add up.
The scope of the EU ETS in trading period from 2013 to 2024 has been used.

Phasing out coal

Finland has committed to phasing out coal in the energy sector. Achieving this consists of two measures. One is setting a legally-binding deadline; the other is an additional financial incentive to act sooner.

In 2019, Parliament passed an act prohibiting the use of coal in energy production from 1 May 2029. The prohibition was estimated to reduce the use of coal by 3 TWh compared with market-based development without the prohibition. The avoided greenhouse gas emissions equal 0.65 million tonnes of CO_2 eq. in 2030.

To accelerate the coal phase-out, a special incentive package to support replacement investments was introduced for those energy utilities that undertook to give up the use of coal by 2025.

The Ministry of Economic Affairs and Employment therefore opened a call for investment subsidies for projects accelerating the replacement of coal in energy production. In 2021, the ministry granted almost EUR 23 million for this purpose in the energy aid mandate. The aid was granted to projects that promoted production or use of renewable energy, energy saving, or more efficient generation and energy use. Projects based on technologies other than combustion were prioritised. After these projects, combined heat and power production before separate heat production was prioritised. The projects' novelty and demonstration potential were also considered. The projects were completed by 2025, meaning that coal has already been almost completely removed from the fuel mix in the energy sector.

Carbon capture, storage, and utilization

The Government has decided to promote the capture of biogenic carbon dioxide through investment grants for the construction of new capture capacity. The investment grant's objective is to enable the launch of the first projects for industrial biogenic carbon dioxide capture and to support the scalability of the same solutions in future projects. Investment grants will be awarded through a competitive bidding process. The total budget is 90 million euros. The selection criterion for awarding the grant is the amount of support required per unit of biogenic carbon dioxide capture capacity. Projects that offer the lowest bids will be selected within the limits of the available budget. In addition, projects must meet the eligibility criteria defined in the Government Decree[43] on grants for the promotion of industrial biogenic carbon dioxide capture for 2026 to 2032.

Under the decree, the investment grant may be awarded to projects that establish a biogenic carbon dioxide capture capacity of at least 15,000 tonnes per year, ensuring that the captured carbon dioxide is either permanently stored or utilised. The projects' feasibility must be at a level that makes the start of carbon dioxide capture operations by the end of 2030 likely. The capture capacity must remain in operation at least until the end of 2035. Additional eligibility conditions are specified in the decree.

[43] 1174/2025

Low-carbon roadmaps

In 2020, 14 Finnish sectors produced their own sectoral roadmaps, or pathways for the sectors' decarbonisation. This work was updated in 2024, in line with the Government Programme of Prime Minister Orpo. All 14 sectors committed to updating their roadmaps. The Ministry of Economic Affairs and Employment supported the sectors by coordinating the whole project, offering guidance, and arranging regular discussions. All sectors voluntarily prepared the updated 2024 roadmaps and were responsible for funding the work themselves.
The sectors mostly used consultants as support in the scenario work. The roadmaps include a comprehensive description of the current situation, an evaluation of emissions reduction technologies and measures, and an estimate of achievable reductions. The roadmaps also use scenario analysis to assess coming developments. The scenarios include a baseline that depicts the effect of the current operating environment, and nearly all roadmaps included one or two low-carbon scenarios.

Low-carbon roadmaps were prepared for the following sectors:

- Agriculture
- Bioenergy industry
- Chemical industry
- Commerce
- Construction industry
- Energy industry
- Food industry
- Forest industry
- Hospitality industry
- Property owners and developers
- Sawmill industry
- Service sector
- Technology industries
- Textile industry.

The roadmaps show that the changes in the operating environment in the past four years (before 2024) have been fast and surprising, underlining the central role of clean energy in all roadmaps. In addition, they show that Finland's electricity demand will rise significantly compared with the 2020 roadmaps, with speedy electrification of different processes. Furthermore, the need for skilled labour has emerged as an interesting theme, underlining that there will be a significant need for an educated workforce to proceed with the green transition. The results of the roadmap project were used as a direct input for the Government's Energy and Climate Strategy, which the Ministry of Economic Affairs and Employment published in 2025, as well as the industrial policy strategy prepared by the same ministry in 2024.

In Finland, engaging the sectors in the work on a voluntary basis has produced proven results. In particular, for smaller sectors, it has been important to keep the threshold to participation quite low. It has also been important to have different sectors of different size involved. This has contributed to mutual knowledge sharing and further understanding of the linkages between the sectors' low-emission pathways. The roadmaps increase the sectors' commitment to emissions reduction efforts, offering the Finnish Government valuable assessments of the opportunities, development, and potential actions for emissions reductions.

The Ministry of Economic Affairs and Employment published a summary of the findings in October 2024.[44] More information about the roadmaps can be found on the webpage of the Ministry of Economic Affairs and Employment.[45]

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 shifted significantly towards less energy-intensive industries, Finland still has a considerable number and volume 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, the relatively large geographical area and sparse population are factors that increase energy intensity.

In terms of the efficiency of energy use and improving energy efficiency, Finland is among the world's leading countries. Co-generation of heat and electricity, a long history of building codes and regulations, the broad coverage of energy efficiency agreements (the first agreement period started as early as 1997; the fourth period, 2026 to 2035, is ongoing), and the systematic implementation of energy audits since the early 1990s are good examples of successful energy efficiency measures. Ecodesign requirements and energy labelling of products are effective EU-wide measures.

Energy Efficiency Directive

The EU's Energy Efficiency Directive[46] (EED) has been implemented mainly with the Energy Efficiency Act, which entered into force at the beginning of 2015. The act was amended in 2025 after the Energy Efficiency Directive (EED)

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[44] Summary of Sectoral Low-Carbon Roadmaps (2024), 30 October 2024. Publications of the Ministry of Economic Affairs and Employment (2024):46. http://urn.fi/URN:ISBN:978-952-327-845-5

[45] https://tem.fi/en/low-carbon-roadmaps-2035

[46] EU/2023/1791

Recast[47] (2023) entered into force. In addition to the comprehensive voluntary Energy Efficiency Agreement scheme, most 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 competences, whereas fiscal solutions emphasise motivating energy savings while ensuring the conditions required for industry to operate solidly.

Energy efficiency requirements have designated the public sector as liable for setting an example in promoting energy conservation. Other focus areas 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 EU's Energy Efficiency Directive made the energy audits mandatory for large companies. Thus, for the subsidised energy audit programme, which started in the 1990s, annual CO_2 emissions reductions have been declining and are estimated to be 0.12 million tonnes in 2025 and 0.03 million tonnes in 2040. Correspondingly, the annual CO_2 emissions reductions related to mandatory energy audits are estimated to be 0.11 million tonnes in 2025 and 0.08 million tonnes in 2040. The majority of emissions reductions, around 90 per cent, is estimated to occur in the emissions trading sector due to the large share of electricity and district heat in energy savings.

Voluntary Energy Efficiency Agreements

Voluntary Energy Efficiency Agreements have played a central role since 1997 in increasing energy efficiency in Finnish energy policy. The three first periods (1997–2006, 2007–2016, and 2017–2025) covered industries, private services, and municipalities, as well as oil-heated buildings, well over 60 per cent of the total energy consumption in Finland. The fourth agreement period (2026–2035) expanded the scope from municipalities to the whole public sector. At the same time, the agreement for oil-heated buildings expired at the end of 2025. The agreements have played a central role in implementing both national energy policy and EU energy efficiency obligations. The role of the agreements has been especially important in achieving Finland's binding cumulative energy savings target under EED 2018/2002 Article 7. They will continue to play a significant role in the implementation of EED recast (2023) and in meeting the new binding cumulative energy saving targets in its Article 8.

The estimated annual CO_2 emissions reductions achieved by the Energy Efficiency Agreement measure is 7.2 million tonnes of CO_2 eq. in 2025, and 7.9 million tonnes in 2040. Most of the emissions reductions, well over 95 per cent, are expected to occur in the emissions trading sector due to the large share of electricity and district heat in energy savings. The estimates reported for 2040

[47] EU/2023/1791

are calculated based on assumptions that the current agreement period from 2026 to 2035 will continue.

Ecodesign and energy labelling

The EU Ecodesign Regulation[48] provides consistent EU-wide rules for improving the environmental performance of physical goods through ecological design. It imposes requirements on products and components to improve their energy efficiency and reduce their environmental impact. If a product does not meet the applicable ecological design requirements, it cannot be marketed or used within the EU.

The EU Energy Labelling Regulation[49] lays down a framework that applies to energy-related products. It provides for the labelling of products and the provision of standard product information regarding energy efficiency, and the consumption of energy and of other resources, thereby enabling consumers to choose appliances based on their energy efficiency.

The ecodesign requirements for the energy efficiency of energy-consuming products are estimated to lead to a 24.0 TWh annual saving of energy in 2030, corresponding to CO_2 emissions reductions of 1.2 million tonnes of CO_2 eq. The estimation of energy savings is based on the results from the Nordcrawl calculation tool,[50] which has been developed for the calculation of energy savings of ecodesign and energy labelling policies in the Nordic countries.

Renewable energy

Finland is one of the world's leading users of renewable energy sources. Recent development in the renewable energy sector has been excellent, and the trend is expected to continue. The most important renewable energy sources include bioenergy – wood and wood-based fuels, and especially the side-products of the forest industry – hydropower, wind power, ground and air heat pump energy, and solar energy. In 2024, the share of renewable energy sources increased to 52 per cent of gross final energy consumption. The growth of the share of renewable energy in recent years is mainly due to the growth of onshore wind capacity. The capacity of onshore wind power has grown rapidly, from 2,600 MW in 2020 to 9,400 MW in 2025.

Finland has set a target of 62 per cent for the share of renewable energy (gross final consumption) in 2030, in compliance with the EU Renewable Energy

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[48] Ecodesign Regulation EU 2024/1781, https://eur-lex.europa.eu/eli/reg/2024/1781/oj

[49] Energy Labelling Regulation EU 2017/1369, https://eur-lex.europa.eu/eli/reg/2017/1369/oj

[50] 2024 Nordcrawl report https://pub.norden.org/nordicenergyresearch2024-03/

Directive. The pipelines of wind power (both onshore and offshore) and solar PV[51] projects at different planning stages are high.

Today, onshore wind power is built market-based, without state aid. Solar PV is also becoming market-based. However, offshore wind power is still facing some challenges with economic feasibility of the projects, but project developers show high interest in offshore wind in Finnish sea areas.

Policies and measures in the field of renewable energy focus on promoting new energy technology demonstration projects and promoting renewable energy production from various renewable sources such as wind power, woodchips, solar, biogas, and bioliquids. However, the objective is that the majority of the renewable energy investments in Finland are funded without state aid. Due to high EU ETS prices and high energy taxes for fossil fuels, new investments in renewables are in most cases more competitive than investments in new fossil fuel plants. For example, the majority of all new electricity generation capacity is currently wind power, which is being built in Finland without state aid. Finland has therefore been able to phase out operating aid schemes and is not planning new state aid auctions or other operating aid schemes.

Renewable energy is currently promoted through the Energy Aid Scheme, which is an investment subsidy,[52] It is primarily targeted at the commercialisation of new technologies and for the non-ETS sector. The aid is paid at up to 30 per cent for mature technologies and up to 40 per cent for new technology projects. However, aid levels are typically much lower, especially for mature technologies. The objective is that the aid for a given technology will be phased out as the technology develops, the costs decrease, and competitiveness improves. The annual budget for 2026 is EUR 9.9 million for small-scale projects, including energy efficiency projects, and EUR 48 million for large-scale demonstration projects. Decisions concerning the state budget are made annually. Finland also allocated EUR 537.17 million of the European Union Recovery and Resilience Funds to renewable energy, energy infrastructure, and electrification projects.

Some instruments have been phased out for new installations but still deliver emissions reductions. The sliding feed-in tariff system for the production of electricity from renewable energy sources came into force in Finland in March 2011. The aid scheme concerns government support for electricity production based on wind power, biogas, and small-scale combined heat and power production, CHP (wood fuels). The aid scheme has been phased out. It was closed for new wind power plants from 1 November 2017 and for new biogas and small-scale CHP plants from 1 January 2019. However, the plants under the scheme will receive aid for up to 12 years from the start of production.

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51 Photovoltaic system

51 Government Decree 262/2023

In May 2018, Parliament approved the Act on the Amendment of the Act on Production Aid for Electricity from Renewable Energy Sources[53], which lays down provisions on the premium system. The premium system was based on a competitive tendering process in which renewable energy technologies competed with each other based on cost-effectiveness. The only auction was held in 2018, and the decisions were made in March 2019. The aid was granted for seven projects within a total of 1.4 TWh worth of annual electricity production. All of the awarded projects were onshore wind projects.

Finland introduced an operating aid for electricity generation from forest chips in combined heat and power generation (CHP) in 2011. The aid is to compensate for the higher production costs of generating electricity from forest chips than of using fossil fuels. The maximum aid for electricity produced from forest chips has been EUR 18/MWh. However, the aid depends on the price of the EU ETS emission allowance and has thus been in decline since the beginning of 2018. When the price of the allowance is above EUR 23.7/t CO_2, no aid is paid, which has recently been the case. The aid scheme was closed for new power plants in March 2021. The aid is paid for up to 12 years from the start of production.

Other measures that have been implemented to promote renewable energy include an electricity tax exemption for small-scale production, information measures, and in terms of wind power, the development of land use planning and creating a clearer regulatory framework for offshore wind power located in the exclusive economic zone. The production of renewable energy is generally promoted by streamlining permit granting processes and accelerating appeal proceedings.

The emissions reduction effect of promoting wind power and solar PV is estimated based on the assumption that wind power and solar PV replace the electricity unit that in merit-order is produced last, that is, marginal production at each moment. The marginal production changes over time along with the green transition, and the emission factor thus also decreases and is lower for newer installations. A lifetime of 25 years is assumed for wind power plants and solar PV installations. The promotion of wind power is estimated to reduce emissions by 5.7 million tonnes CO_2 eq. in 2030 and by 4.9 million tonnes in 2040. Corresponding figures for solar PV are 0.4 million tonnes CO_2 in 2030 and 0.5 million tonnes CO_2 in 2040. The reduction will occur entirely in the ETS sector. The estimates include the impact of all policy instruments promoting wind power and solar PV. For more information about the IMPAKTI calculation tool, assessment methods, and emission factors used to estimate the emissions reduction impacts of renewables, see Annex 2.

The historical use of and WM projection for renewable energy in Finland is shown in Figure 3.4-1 and Table 3.4-2.

[53] Government Decree 441/2018

Figure 3.4-1
Historical development and WM projection for renewable energy, TWh

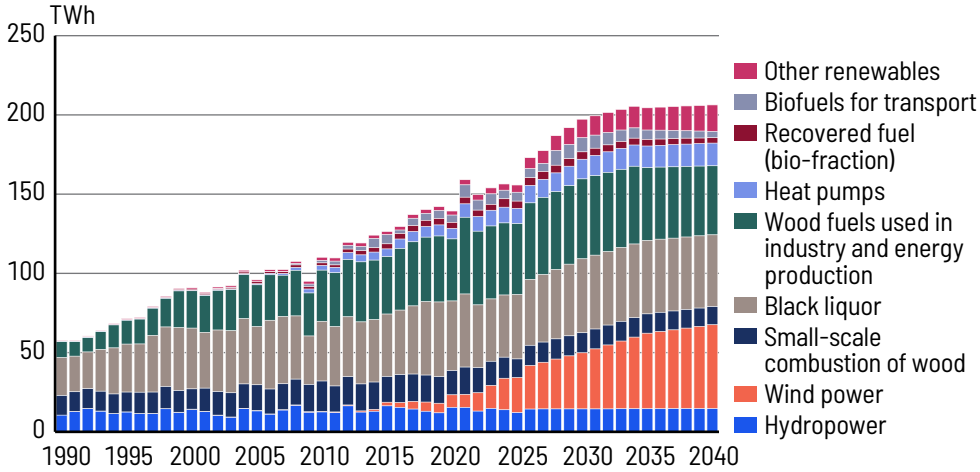


Table 3.4-2
Historical development and WM projection for renewable energy, TWh

					WM projection			
	2010	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
	TWh							
Black liquor	37.7	39.5	43.9	39.2	40.7	46.6	46.3	45.3
Wood fuels used in industry and energy production	32.3	36.2	39.1	45.0	44.8	50.4	46.0	43.5
Small-scale combustion of wood	19.2	16.2	15.3	14.5	11.7	12.6	12.2	11.5
Hydropower	12.7	16.6	15.7	14.1	12.3	14.7	14.8	14.9
Heat pumps	2.9	4.8	6.6	9.9	9.5	12.4	13.6	14.3
Wind power	0.3	2.3	7.9	20.2	22.2	35.5	47.6	52.9
Biofuels for transport	1.6	5.8	4.7	5.5	5.5	8.9	6.0	4.0
Recovered fuel (bio-fraction)	1.7	3.2	3.8	3.9	4.7	4.7	4.2	3.4
Other renewables	1.5	1.6	2.2	3.7	4.2	11.3	13.6	16.3
Total	**109.9**	**126.3**	**139.2**	**156.1**	**155.6**	**197.1**	**204.3**	**206.1**

Energy use in residential and other buildings

Policies and measures for buildings and housing aim to improve energy efficiency, make energy use in buildings smarter, reduce ETS and non-ETS emissions, and increase 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 the existing building stock, including the use and maintenance of the building stock. In addition to policy measures specifically aimed at the building sector,

energy use is affected by the EU emissions trading system (ETS) through the district heat and electricity prices.

Finland has some specific conditions in the heating and cooling of buildings. The most common heating source in Finland in 2024 was district heating (41 per cent of heat energy use). The second most common heating source in Finland in 2024 was electricity (22 per cent). The share of small-scale combustion of wood in heating energy consumption was 18 per cent. The number of heat pumps is continuously increasing, especially in detached housing, and their share of heat energy use was 13 per cent in 2024. The use of natural gas in building-level heating systems is negligible in Finland, but oil boilers were still relatively common in 2024 (5 per cent). Demand for cooling remains low in Finland, but it is expected to increase due to climate change.

CO_2 emissions from the energy use in buildings are mainly covered by the EU ETS, as most district heating and electricity production falls within its scope. Non-ETS emissions originate mainly from house-specific oil heating and CH_4 emissions from wood energy use. The total space heating energy use in residential, commercial, and public buildings was 76 TWh in 2024, which equates to 27 per cent of the total end use of energy in Finland.

In addition to the national standards, the EU's Directive on the Energy Performance of Buildings (EPBD) aims to reduce CO_2 emissions by improving buildings' energy efficiency. The directive was first implemented in Finland by a regulation that came into force at the beginning of 2008. The legislation on the energy efficiency of buildings includes the following:

- The Act on Energy Certification of Buildings
- The Ministry of the Environment Decree on Energy Certification of Buildings
- The Act on inspection of air-conditioning systems
- Amendments to the Land Use and Building Act, which was expanded to cover energy efficiency requirements, and details on how energy efficiency should be calculated.

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 with 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. The building regulation came into force in July 2012, and it is based on the overall energy consumption, which considers, among other things, air conditioning, cooling, lighting and heating, washing water, and heating energy. The regulation favours the utilisation of district heating and renewable energy in defining a building's overall energy performance. In addition, energy

regulations were again revised in 2017, and nearly zero-energy regulations for new buildings were given, and new regulations entered into force, on 1 January 2018. The Energy Performance of Buildings Directive was revised again in 2024, and its national implementation is ongoing.

The Ministry of the Environment is responsible for legislation and guidelines for energy performance certificates, energy performance certificate templates, and other instructions concerning the issuance of certificates. All new buildings need an energy certificate when applying for a building permit. For existing buildings, energy performance certificates are needed when the building (or part of it, for example, an apartment) is sold or rented. The Centre for State-Subsidised Housing Construction (Varke), which assumed the statutory duties of the former Housing Finance and Development Centre of Finland (ARA) in March 2025, is the administrative authority responsible for ensuring the quality of energy performance certificates, the qualifications of experts, and the proper preparation and use of the certificates.

The regulation for the energy performance of new buildings entails about 3.9 million tonnes of annual emissions reductions of CO_2 eq. by 2030. Almost all the emissions reductions will occur in the EU ETS sector through the reduced use of electricity and district heat.

Based on the amendment to the decree of the national building code for sewage and freshwater 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 to heat it. The water measurement instruments provide information about the use of water in each apartment and ensure invoicing is done according to 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. Currently, activities exist for giving internet-based informational guidance in repair, energy efficiency, and building maintenance issues, for example.

Finland submitted its Long-term Renovation Strategy (LTRS) to the EU in 2020. It follows the 2018 revision[54] of the Energy Performance of Buildings Directive (EPBD) and covers the 2020 existing building stock. The strategy's main goals are to decrease the energy use of the existing building stock by 51 per cent by 2050 and the related CO_2 emissions by 92 per cent by 2050. The factors affecting the decrease in energy use and emissions are climate change, removals of buildings from the building stock, retrofitting and building

[54] 2018/844/EU

maintenance, the change of heating sources in buildings, and decreasing the emission intensity of electricity and heating production. The improvements of energy performance in renovations and alterations through both regulation and subsidies, the phase-out of oil use in heating and related policies, and retrofitting subsidies are policy measures that support the Finnish LTRS. Under the recast EPBD,[55] Finland has submitted a draft National Renovation Plan (NBRP),[56] which updates the LTRS.

Figure 3.4-2
Heating and cooling use of buildings by building type (TWh)

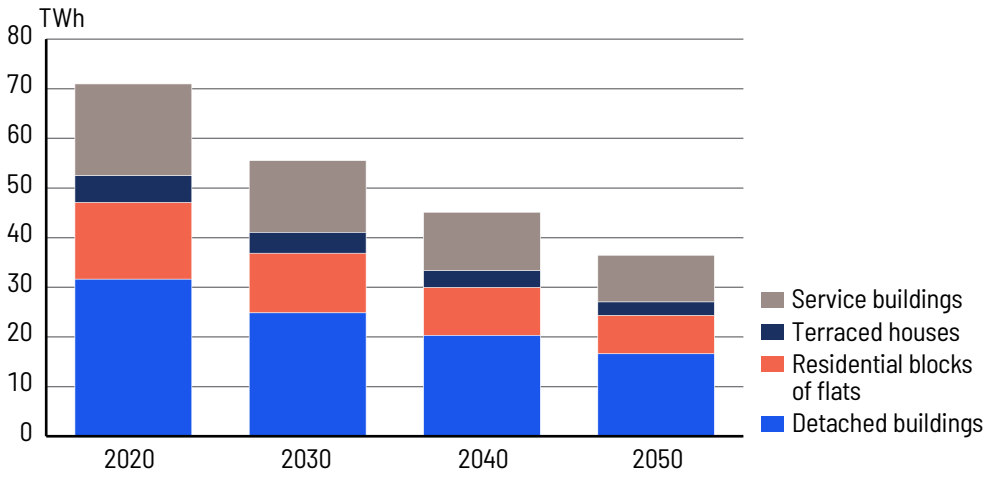
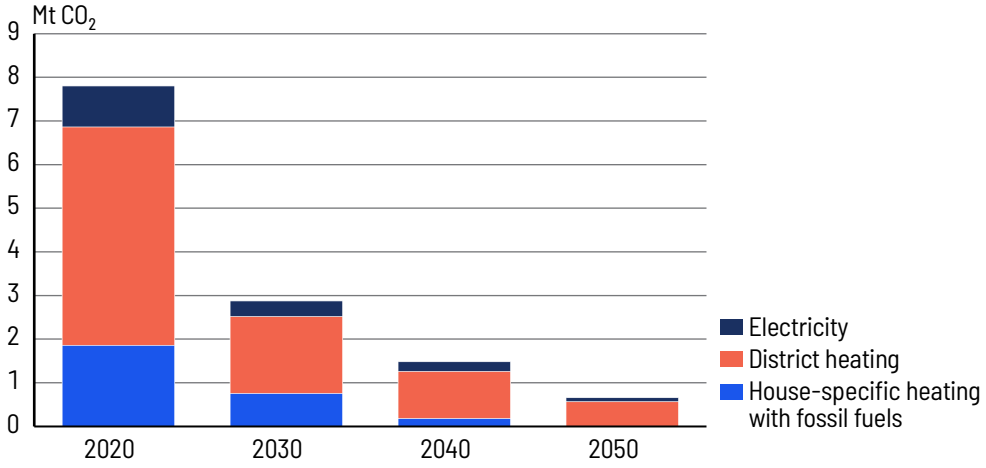


Figure 3.4-3
Heating and cooling energy use emissions (million tonnes CO_2)



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 in February 2013. It is estimated that the emissions reductions due to improvements in energy performance in renovations and alterations will be 0.07 million tonnes of CO_2 annually in 2030. Most of the emissions reductions will occur in the EU ETS sector. However,

[55] 2024/1275/EU

[56] Finland's National Building Renovation Plan (Draft) (2026).

non-ETS emissions reductions are expected from oil fuel boiler replacements, especially in detached houses.

Emissions from building-specific heating have been declining in recent years, but annual variation occurs due to heating needs, for example. The main reasons for the declining trend in emissions from separate heating are the decrease in oil heating and improvements in the energy efficiency of buildings. The majority of emissions from separate heating results from oil heating. In 2024, emissions from separate heating amounted to 1.2 million tonnes of CO_2 eq. Residential buildings accounted for a third of emissions from building-specific heating, and commercial and service buildings for two thirds. Emissions from building-specific heating have decreased by 67 per cent from the 2005 level.

Emissions are expected to decrease further as a result of the gradual renewal of the building stock, renovations, and changes in heating systems. The obligation to distribute biofuel oil and the replacement of fossil oil heating with other forms of heating will have a significant impact on reducing emissions. From 2028, the Emissions Trading System for distributors, ETS2 (see above EU Emissions Trading System), will significantly affect building heating by making fossil fuel heating more expensive, encouraging a shift to low-emission alternatives.

The phasing out of oil in residential properties has been promoted with subsidies for detached houses, which may be granted for costs arising from the removal and modification of the oil heating system and replacement with other heating systems. In the summer of 2022, the subsidy system for detached houses was extended to apply to phasing out natural gas heating, though its role is almost insignificant in Finland. The subsidy system will end in 2026.

The subsidy for phasing out oil heating has significantly activated the replacement of heating systems. At the end of 2025, 32,877 owners of detached houses had applied for the aid for switching from oil heating and had received a favourable decision. A total of 1,209 owners of detached houses had applied for grants for phasing out gas heating with a favourable decision. The estimated impact of the measure on annual emissions is approximately 0.21 million tonnes of CO_2 eq, as all available grants are expected to be used by the end of May 2026, when the application period for the aid expires. The impacts of the measure's final months can be reliably assessed based on the trends observed in the implementation of approved applications from previous years.

An alternative form of support for owners of detached houses to renew their heating system is an income tax credit for household expenses, which applies to the labour costs of phasing out oil heating. Since 2022, the credit has been up to EUR 3,500 per person per year, or EUR 7,000 per household with two adults.

The phasing out of oil heating in municipality-owned buildings and the transition to other forms of heating have been accelerated with grants since October 2020. Around 9,300 oil-heated buildings were owned by municipalities and municipal enterprises in Finland at the time of assessment, of which around 4,300 were in use, and around 5,000 were empty. However, even empty buildings often have to be heated. The grant accounts for 30 per cent of the costs approved and incurred in the grant decision. The grant will be increased by five percentage points if the municipality has acceded to a Voluntary Energy Efficiency Agreement.

Finland has decided to take measures of advice as an alternative to obligatory inspections of heating and air-conditioning systems laid down in article 23 of the EPBD. The coordinating advice programme (advice forum) covers almost all buildings and gathers actors in energy efficiency agreements in the building sector. The annual impact is estimated to be 0.081 million tonnes of CO_2. However, this measure is not included in the WM projection, as there is no detailed information about the impact of the measure on the energy balance. The method to estimate emission impacts of building-related policy measures are described in Annex 2.

Machinery

Emissions from machinery can be reduced by increasing the energy efficiency of machinery, or by switching to alternative fuels or power sources. An act to promote the use of biofuel in heating, machinery, and stationary engines entered into force on 1 April 2019.[57] The act sets an obligation to distribute light fuel oil with bioliquids so that the share of biofuels will increase from 3 per cent in 2021 to 10 per cent in 2028. The new Emissions Trading System for distributors (ETS2) that commenced in the EU in 2025 (see above EU Emissions Trading System) also covers CO_2 emissions from fossil fuels used in machinery. The policies presented next under this section focus on enabling conditions to complement the distribution mandate and CO_2 pricing to ensure sufficient incentives and cost-effectiveness.

The continuation of the low-emission non-road mobile machinery training programme is underway. The content is being updated and will include an English translation of a module aimed at machinery operators. A separate guide on fuel-efficient driving practices for agricultural tractors will also be updated. Communication on the training programme will be tailored towards industry stakeholders and educational institutions.

Continuous effort is also devoted to better assessments and calculations in Finland and the EU for effective and monitorable decarbonisation efforts. Ongoing projects funded by the Ministry of the Environment, the Ministry of

[57] Government Decree 418/2019

Agriculture and Forestry, and Eurostat are enhancing the Finnish Environment Institute's capacity to produce air pollutant and greenhouse gas emission scenarios for non-road machinery, as well as to assess the impacts of different policy measures. Advocacy work also continues to advance EU-level initiatives related to non-road mobile machinery. Efforts have also been made to promote the development of EU-level measures to reduce the greenhouse gas emissions of non-road mobile machinery building on a study commissioned by the Ministry of the Environment.[58]

The first Green Deal agreement for the non-road mobile machinery sector was in force until the end of 2025, and a second agreement is in force for the period from 2026 to 2030. Additional machinery categories have been included in the second agreement period, and targets have generally been increased. Cooperation with the Green Deal agreement on zero-emission construction sites has also been further developed. Market dialogue activities have been carried out, along with the project "Piloting Electric Non-Road Mobile Machinery and Charging Solutions at Construction Sites".

The conversion of tractors to use biogas is supported as an environmental investment through agricultural investment subsidies. Subsidies are available for modifications to enable biogas use and for the equipment involved, but not for purchasing the tractor itself. Modifications of diesel engines and accessory purchases to convert tractors and other agricultural machinery to biogas are eligible for a subsidy. The subsidy covers 35 per cent of eligible costs, including the cost of purchasing and installing new equipment.

Customer energy advice

An extensive energy advisory service, sharing information and best practices, and training services are the means of information guidance to promote energy efficiency, save energy, increase the use of renewable energy, and promote demand response and energy communities. The Government-funded national energy advising network is the core of energy advisory services in Finland. In practice, it is a one-shop-stop service. It is coordinated and led by the state-owned sustainable development company Motiva and the Energy Authority of Finland. The steering group covers ministries in the fields of energy, transport, environment, buildings, construction, agriculture, and finance. Municipalities and energy companies play an active role in the national energy advice network. This network's service offers free guidance to all Finns. Consumers, companies, and housing associations can contact either national energy advising or regional energy advisers.

[58] Söderena, P., Pihlatie M., Nylund N-O. (2024). Pathways for CO_2 regulation in NRMM. VTT Research Report, VTT-CR-0032-24.
Available: https://cris.vtt.fi/en/publications/pathways-for-co2-regulation-in-nrmm/

Advising activities are versatile, including web services, active information and knowledge sharing, webinars, workplace activities, newsletters, online courses, information campaigns, announcements, media cooperation, podcasts, videos, and the use of social media.

Active sharing of best practices and updated information about improving energy efficiency in companies and municipalities is done in a network that covers all parties of energy efficiency agreements. Additional targeted advice, partly financed by certain trade unions, on improving energy efficiency is given to small and medium-sized companies that have signed the energy efficiency agreement.

Special attention in energy advising is also paid to vulnerable consumers and consumers at risk of falling into energy poverty by, e.g., active collaboration between regional energy advisors and social workers and with pensioner organizations. Special counsel by regional energy advice is targeted at municipalities, for example, on information of energy performance contracting, the energy efficiency first principle, and the funding of energy efficiency investments.

National energy advisory service is complemented by online courses that contain learning materials for, for example, energy efficient construction, housing, and procurement, and by online services, that contain the entire recent comprehensive information and different web pages about the national energy advisory service. The most essential are listed below.

- Energy Advice for Consumers – Motiva https://www.motiva.fi/tietopankki/motivan-energianeuvonta/
- Regional energy counselling – Energy Authority https://energiavirasto.fi/en/regional-energy-councelling
- Online courses about energy efficiency and renewable energy – Motiva https://motiva-verkkokurssit.fi/
- Promoting household consumption flexibility by Motiva: https://www.motiva.fi/kodin-sahkonkaytto-sahkosopimukset-ja-kulutuksen-ohjaus/
- Energy service providers – Motiva https://www.motiva.fi/energiaosaajat/.

A main aim of the Action Plan for Energy Services in the Energy Efficiency Agreement scheme and Energy Efficiency Agreement for oil-heated buildings is to enhance their customers' energy efficiency. Energy advice actions have been running since the first agreement period which started in 1997. Customer energy advice is also one of the policy measures notified for Energy Efficiency

Directive[59] Article 7 implementation in Finland. When calculating energy savings for these behavioural measures based on advice services, only a conservative one-year energy savings lifetime has been considered. Annual estimated energy savings have consistently been around one terawatt hour per year, but after the termination of the agreement for oil-heated buildings at the end of 2025, it is estimated that savings will decline to about 0.8 TWh in 2030. The corresponding CO_2 emissions reduction is estimated at about 0.045 million tonnes per year.

Summary of policies and measures

A summary of the policies and measures in the energy sector is presented in CTF Table 5.

3.4.3.2 Transport

Adopted and implemented policies and measures

This chapter focuses on measures related to road transport, though the renewable energy distribution obligation also slightly reduces emissions from recreational boats. Measures related to shipping and air transport are described in Section 3.4.3.3, as they mainly concern international transport and bunker fuel emissions. Nevertheless, in the projections, the maritime and aviation emissions are reported in accordance with the CRT classification of the greenhouse gas inventory.

In the effort sharing sector, transport offers the greatest potential for reducing emissions. The objectives and measures to reduce transport emissions in Finland are included in the Roadmap to Fossil-Free Transport (2021), the Medium-term Climate Plan (2025), and the National Energy and Climate Strategy (2025). The Medium-term Climate Plan and the Roadmap to Fossil-Free Transport set a target of reducing transport emissions by at least half by 2030 compared with 2005 levels. The Roadmap to Fossil-Free Transport is also one of the reforms included in the Finnish Recovery and Resilience Plan, both in the original plan and the revised plan.

The emissions reduction measures fall into three categories:

1. Replacing fossil fuels with alternative transport fuels

The main measure in this category is the renewable energy distribution obligation. The current legally binding target is for renewable fuels to account for 34 per cent of all fuels consumed in road transport in 2030 and beyond. This would help avoid around 3 million tonnes of CO_2 emissions in 2030. Finland has revised the gradually rising distribution obligation several times: upwards

[59] EED, (EU) 2018/2002

for more ambitious climate policy, but also temporarily downwards to ease energy poverty. In 2025, the distribution obligation shares for 2025 to 2027 were reduced, being 16.5 per cent in 2025, 19.5 per cent in 2026, and 22.5 per cent in 2027. Adjustments downwards were also made to the required shares of advanced biofuels and biogas for 2026 and 2027. The distribution obligation shares will then bounce back to the previously approved levels according to the current legislation. As of 2025, renewable electricity delivered at public charging stations can also be used to fulfil the distribution obligation. A new minimum share for renewable fuels of non-biological origin was established for 2028 to 2030 and beyond, requiring a 1.5 percentage-point share in 2028 and 2029, and a 4 percentage-point share in 2030 and beyond. In addition to reducing fossil fuel consumption and emissions in transport, the distribution obligation may also increase fuel prices and thus further reduce transport emissions.

Other measures included in this category are the promotion of the infrastructure for electricity and biogas used in transport. In November 2024, the Ministry of Transport and Communications published the National Programme for Alternative Transport Fuels Infrastructure.[60] The programme contains an updated assessment of the development of distribution infrastructure and market for fuels other than fossil fuels in road, rail, maritime, and air transport. The programme sets objectives and presents measures that will promote the achievement of the objectives. The programme will promote the implementation of the AFIR Regulation[61] and will be the basis for monitoring required by the Regulation. The programme is being partly updated in 2026 based on the European Commission's comments.

Regarding the support mechanisms in place, between 2018 and 2025, there was a state-funded infrastructure support programme for alternative fuels infrastructure (electricity, biomethane, hydrogen). Approximately EUR 35 million was allocated to subsidies for 2022 to 2023. EUR 10 million has been reserved for 2024.

In Finland, the construction of electric car charging points in housing associations was supported between 2018 and 2023. During 2022 and 2023, subsidies were also granted for electric car charging devices installed at workplaces.

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[60] National Programme for Alternative Transport Fuels Distribution Infrastructure; Publications of the Ministry of Transport and Communications 2024:10; https://urn.fi/URN:ISBN:978-952-243-747-1

[61] Regulation (EU) 2023/1804 of the European Parliament and of the Council of 13 September 2023 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU.

2. Renewal of the vehicle fleet

According to the latest WM projection, there will be approximately 926,000 electric cars (BEV[62] + PHEV[63]) and 2,400 electric trucks in Finland in 2030, and their number will continue to increase strongly towards 2040. The main measure in this category is the binding CO_2 threshold values applicable to automotive manufacturers at the EU level. The regulation strengthening the CO_2 standards for cars and vans was adopted in 2023, and the regulation strengthening the CO_2 standards for heavy-duty vehicles (HDVs) in 2024.

According to an estimate by VTT Technical Research Centre of Finland, the regulation on CO_2 emission performance standards for cars and vans will reduce greenhouse gas emissions from transport by approximately 0.21 million tonnes of CO_2 eq. in 2030 and 1.0 million tonnes of CO_2 eq. in 2040 compared with the previous WM projection. The regulation on CO_2 emission performance standards for heavy-duty vehicles will reduce emissions by approximately 0.13 million tonnes of CO_2 eq. in 2030 compared with the previous WM projection.

In December 2025, the European Commission presented the Automotive Package to support the automotive sector's efforts in the transition to clean mobility. Among other proposals, the Package includes proposals for a review of CO_2 emission standards for cars and vans, a targeted amendment for heavy-duty vehicles, and a Regulation on Clean Corporate Vehicles. As the proposals are still partly being considered, their impact has not been included in this report. Initially, the proposal on Clean Corporate Vehicles is expected to have a limited direct impact on CO_2 emissions in Finland, as corporate fleets are already transitioning rapidly towards low- and zero-emission vehicles, driven by market trends and company policies. It is estimated that the proposals for amending the regulation on CO_2 standards would increase the emissions of the new vehicle registrations compared with the current regulations in force.

Between 2018 and 2024, Finland provided both purchase and conversion subsidies for cars, vans and heavy-duty vehicles. The purchase subsidy for electric passenger cars was in use between 2018 and 2022. The conversion subsidy for gas or ethanol powered cars was in use between 2018 and 2022, and in 2024. The purchase subsidies for electric or gas-powered vans and trucks were in use between 2022 and 2024. During the period from 2018 to 2024, EUR 50 million was directed to purchase and conversion subsidies.

Finland has also supported the electrification of transport through taxation. The taxable value of zero-emission and low-emission company cars was temporarily reduced until the end of 2025. In the spring of 2024, the Government decided to extend this reduction for the zero-emission vehicles benefit into 2026 to 2029,

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62 A battery electric vehicle.

63 A plug-in hybrid electric vehicle.

while increasing the daily vehicle tax for battery electric vehicles and plug-in hybrids. The car registration tax on battery electric vehicles was abolished as of 1 January 2022, and this was compensated for by increasing the daily vehicle tax for battery electric vehicles. The total net effect of these tax changes on emissions is probably modest.

In Finland, several separate scrapping bonus campaigns have been carried out. The scrapping premium campaign aims to boost sales of new cars and promote the renewal of the vehicle fleet. The scale of the impact depends on how the campaign is conducted. The current scrapping premium campaign started at the beginning of 2026, and it will end on 31 December 2027 or earlier if the allocated funding runs out. EUR 20 million has been set aside for the campaign for 2026 to 2027. The scrapping premium means that private persons can get support for buying a new car if they bring an old vehicle registered in 2015 or earlier for scrapping. The state offers a scrapping premium of EUR 2,500 for the purchase of a new zero-emission car powered by electricity or hydrogen, and EUR 2,000 for a new car powered by another fuel type, provided its CO_2 emissions do not exceed 140 g/km.

3. Improving the energy efficiency of the transport system

This category includes participation in the coordination of transport and land use in urban regions, as well as participation in transport system planning through agreements on land use, housing and transport (MAL agreements), for example. Other measures to improve the energy efficiency of the transport system include the investment programme for walking and cycling, discretionary government grants for public transport, making use of longer, heavier vehicle combinations (HCT, High Capacity Transport), and comprehensive EU-level emissions trading for road transport (ETS2).

In 2024, the MAL agreements were updated for the period from 2024 to 2035, and the measures for the period from 2024 to 2027. The objective of the MAL agreements is to promote a sustainable urban structure and transport system, as well as related infrastructure investments. The MAL agreements cover Finland's largest urban regions (Helsinki, Tampere, Turku, Lahti, Jyväskylä, Kuopio, and Oulu). The agreements support measures that enhance sustainable mobility, integrate land use and transport, and promote infrastructure and development projects related to public transport, walking, and cycling. Under the MAL agreements, the state commits to more than EUR 570 million in funding for projects that improve accessibility and sustainable mobility in urban regions during the period from 2024 to 2027 (e.g. light rail and tramway projects).

Between 2018 and 2025, EUR 94 million has been directed to 292 projects in 100 municipalities of different sizes from the investment programme for walking and cycling. The funding for the investment programme has been significantly

reduced in recent years. According to an estimate, the MAL agreements and the investment programme for walking and cycling could together reduce emissions by around 0.006 million tonnes in 2030.

Between 2018 and 2025, EUR 528.7 million has been granted as state grants to public transport authorities. The grants were allocated for the procurement of transportation services and include Covid-19 subsidies for 2020 to 2022, as well as discretional state grants for promotion of clean fleets in bus transport organised by the authorities, and projects promoting the growth and better monitoring of the modal share of public transport. The previously implemented climate-based state grant for public transport has been discontinued.

In addition, some changes were implemented in the taxation of fringe benefits from the beginning of 2021. Employer-subsidised commuter tickets are tax-free up to EUR 3,400 of the taxable value per year. Employer-provided bicycles were tax-free up to EUR 1,200 of taxable value per year, but the Government decided to discontinue the employee bicycle benefit as of the beginning of 2026.

The regulation related to the HCT vehicle combinations for road transport[64] was amended and entered into force in 2019, increasing the maximum length of combination to 34.5 metres. This will decrease kilometres driven when the same amount of goods can be transported with fewer vehicle combinations. HCT transport could reduce emissions by 0.06 million tonnes of CO_2 eq. in 2030 and 0.05 million tonnes of CO_2 eq. in 2040.

The update of the National Transport System Plan for 2026 to 2037 (Transport 12 plan) was launched in 2025. The Transport 12 plan is a strategic plan for the development of Finland's transport system for 12 years according to the Act on the Transport System and Roads.[65] The Plan covers passenger, goods, and freight transport across Finland, as well as infrastructure and transport services in all modes of transport. It sets out goals for an efficient and sustainable transport system that takes comprehensive security into account. The Plan includes a tangible action programme that guides the development as a whole, taking the different modes of transport into account. The Plan also includes a government funding framework and a summary of impact assessments. Decisions on funding will be made within the budget and spending limit processes.

In 2025, a new Emissions Trading System for distributors (ETS2) commenced in the EU (see Section 3.4.3.1). It obliges fossil fuel distributors to surrender allowances based on the carbon content of the fuels they sell beginning from 2028. This increases the prices of fossil fuels and is directed towards lower-

64 729/2018

65 503/2005

emission solutions such as electric transport. According to estimates made in Finland, the ETS2 will reduce traffic emissions by approximately 0.04 to 0.4 million tonnes of CO_2 eq. in 2030.

Planned policies and measures

The planned policies and measures include actions planned to be financed through the EU's Social Climate Fund. The key target of the Social Climate Fund is to support vulnerable EU citizens and enterprises when emissions trading is extended to road transport and to the buildings sector. A particular focus will be on providing funding for vulnerable households, micro-enterprises and transport users.

In the road transport sector, Finland has planned to utilise the fund for a purchase subsidy for micro-enterprises for electric trucks and buses, scrapping the incentive for low-income households for purchasing an electric vehicle, promoting regional public transport and demand-responsive transport, and support for walking and cycling infrastructure investments. The plan is being prepared at the time of writing.

Summary of policies and measures

A summary of the policies and measures in the transport sector is presented in CTF Table 5.

3.4.3.3 International bunkers

Adopted and implemented policies and measures

Finland has actively participated in the International Maritime Organization's (IMO) and International Civil Aviation Organization's (ICAO) work to limit emissions from international transport.

Shipping

In relation to maritime transport, the IMO adopted an Initial Strategy on the Reduction of Greenhouse Gas (GHG) Emissions from Ships in 2018 and the 2023 IMO Strategy on Reduction of GHG Emissions from Ships in 2023. The main level of ambition of the 2023 IMO Strategy is that the GHG emissions from international shipping should peak as soon as possible and reach net-zero GHG emissions by or around, that is close to, 2050. In addition, the 2023 strategy includes levels of ambition that address the carbon intensity of international shipping, and the uptake of zero and near-zero GHG technologies by 2030. To achieve these objectives, the IMO is currently negotiating new measures to reduce greenhouse gas emissions.

The EU MRV Regulation on the monitoring, reporting, and verification of carbon dioxide emissions from maritime transport entered into force in 2015 and was amended in 2023. Since 2018, the regulation has applied to ships with a gross tonnage of more than 5,000 tonnes, irrespective of their flag, undertaking to follow voyages in EU and EFTA regions. It requires ships to monitor and report their CO_2 emissions, fuel consumption, transport work, and average energy efficiency. Starting from 2025, the regulation also covers methane and nitrous oxide emissions from shipping, smaller general cargo ships, and offshore ships as a new ship type. In 2016, the IMO approved amendments to Annex VI on Data Collection System (DCS) for the fuel oil consumption of ships of the International Convention for the Prevention of Pollution from Ships (MARPOL). These amendments require that as of 2019, ships of 5,000 gross tonnage and above collect consumption data for each type of fuel oil they use, as well as other additionally specified data, including proxies for transport work. The aggregated data are reported annually to the flag State, which issues a Statement of Compliance to the ship. Flag States are required to subsequently transfer this data to an IMO Ship Fuel Oil Consumption Database. The IMO is required to produce an annual report for the Marine Environment Protection Committee (MEPC), summarising the collected data. These measures were implemented in Finland's national legislation in 2021.

In 2021, the IMO adopted amendments to MARPOL Annex VI that require ships to reduce their GHG emissions. These amendments combine technical and operational approaches to improve the energy efficiency of ships, also providing important building blocks for future GHG reduction measures. The measures require all ships to calculate their Energy Efficiency Existing Ship Index (EEXI) by following technical means to improve their energy efficiency and establish their annual operational carbon intensity indicator (CII) and CII rating. Carbon intensity links GHG emissions to the amount of cargo carried over the travelled distance. Ships are rated for their carbon intensity (A, B, C, D, E – where A is the best). A ship rated D for three consecutive years, or E, is required to submit a corrective action plan to show how the required index (C or above) will be achieved. The EEXI and CII measures were implemented in Finland's national legislation in 2024.

Since 2024, the EU Emissions Trading System has been extended to ships of 5,000 gross tonnage and above calling at European ports, regardless of their flag. The system is being phased in gradually: shipping companies were required to surrender allowances for 40 per cent of their emissions reported for 2024, for 70 per cent for 2025 and will be required to surrender 100 per cent from 2026 onwards.

From 2025 onwards, the FuelEU Maritime regulation[66] sets maximum limits on the annual average GHG intensity of the energy used on board ships of above 5,000 gross tonnage calling at European ports, regardless of their flag. The required level of reduction will increase gradually, reaching up to an 80 per cent reduction by 2050 compared with the reference value of 91.16 grams of CO_2 equivalent per MJ. In addition, starting from 2030, container and passenger ships moored at the quayside in an EU port should use onshore power supply or zero-emission technologies which comply with the requirements provided for in the regulation for all their electrical power demand at berth.

Aviation

The 2010 ICAO Assembly adopted the existing global aspirational goals for the international aviation sector of 2 per cent annual fuel efficiency improvements and carbon-neutral growth from 2020. At the ICAO Assembly in 2016, a global Carbon-Offsetting and Reduction Scheme for International Aviation, CORSIA, was adopted. With this decision, aviation became the first industrial sector to have a global market-based measure scheme in place. Under CORSIA, all operators conducting international flights are required to monitor and verify the CO_2 emissions of these flights, and to report the related information to their State of registration. Aircraft operators offset the growth of emissions in international civil aviation by purchasing CORSIA's approved emission units, mainly originating from emissions reduction projects in other fields, on the carbon market. The compensation obligation is calculated annually by comparing the emissions generated on the routes between CORSIA member states to the baseline, which is 85 per cent of 2019 emissions between 2024 and 2035, and by reducing the potential use of CORSIA-eligible fuels.

The 41st ICAO Assembly in 2022 adopted a long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050 in support of the UNFCCC Paris Agreement's temperature goal. To advance towards carbon neutrality, the ICAO Conference on Aviation and Alternative Fuels (CAAF/3) in 2023 agreed on increasing sustainable aviation fuels, low-carbon aviation fuels, and other cleaner energy sources so that carbon dioxide emissions will decrease by 5 per cent by 2030. This is compared with a situation where these types of fuels are not used. The target is global and non-binding. Member states submit State Action Plans on the reduction of CO_2 emissions from international aviation every three years. Finland's 6th Action Plan to Reduce CO_2 Emissions from Aviation[67] was submitted to the ICAO in 2025.

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[66] Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the use of renewable and low-carbon fuels in maritime transport.

[67] Finland's Action Plan to Reduce CO_2 Emissions from Aviation 2025 https://www.traficom.fi/sites/default/files/media/file/Finlands%20Action%20Plan%202025.pdf..pdf

The EU Emissions Trading System (EU ETS) currently applies to aviation and covers all intra-European Economic Area flights. As a member of the European Union, Finland has participated in the EU ETS from its outset. The EU Emissions Trading System has generally been seen as a cost-effective way to reduce emissions from the activities it covers, as it provides a better incentive to reduce emissions and improve energy efficiency than through air passenger taxes, for example. However, the system enables additional purchases of emissions rights if it is very expensive or impossible to reduce emissions by means of new technology, for example. Despite the growth in aviation emissions, the EU ETS aviation has contributed to a net CO_2 emissions reduction of 240 Mt, mainly through funding of emissions reductions in other sectors over the period from 2013 to 2024.[68]

Aviation has been included in the EU ETS since 2012, and it applies to flights between airports in the European Economic Area. The EU ETS Directive was revised in 2023, with a goal of resulting in an overall emissions reduction of 62 per cent in the sectors concerned by 2030 compared with 2005. Several key provisions of the Directive were strengthened, and the scope of the scheme was extended. During the current emissions trading period's first years from 2021 to 2023, the total number of emission allowances was reduced annually, with a linear reduction factor of 2.2 per cent. Starting from 2024, the linear reduction factor tightened to 4.3 per cent, and from 2028 to 2030, it will be 4.4 per cent. For the aviation sector,[69] free allocation of emission allowances was removed as of 2026. However, between 2024 and 2030, aircraft operators have the possibility to receive emission allowances free of charge (a total of 20 million allowances) if the aircraft operator uses sustainable aviation fuels (SAF). The purpose of the mechanism is to increase the use of sustainable aviation fuels and promote the reduction of emissions by covering at least half the price difference between fossil and sustainable aviation fuel.

Within the EU ETS for aviation, an MRV (monitoring, reporting and verification) system for non-CO_2 aviation effects has applied since 1 January 2025, calculating CO_2 equivalent for aviation activities within the scope of the EU ETS.

The ReFuelEU Aviation Regulation[70] aims to ramp up the production and deployment of renewable and low-carbon fuels. The ReFuelEU Aviation regulation includes a blending obligation for sustainable aviation fuel (SAF) and a sub-mandate for synthetic aviation fuel. The blending obligation started in 2025 with a mandate of 2 per cent SAF and will gradually increase to a 70 per

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68 The 16th EU ETS Compliance Conference in November 2025; European Commission presentation "20 years of the EU ETS: retrospective with facts and figures", p. 18 https://climate.ec.europa.eu/document/download/606f1a8e-9374-4bd1-9b45-ebcffb99a79a_en?filename=1_20%20years%20of%20EU%20ETS.pdf

69 https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-aviation_en

70 Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation).

cent blending obligation in 2050. From 2030, 1.2 per cent of the fuel must be synthetically produced SAF, rising to 35 per cent in 2050. Aircraft operators departing from Union airports in the scope of the regulation must refuel with the aviation fuel necessary to operate the flight. This avoids excessive emissions related to extra weight when carrying excessive fuel and minimises the risks of carbon leakage caused by so-called "tankering" practices. EU airports must facilitate access to the necessary infrastructure to deliver, store, and refuel aircraft with SAF. In Finland, Helsinki-Vantaa and Rovaniemi airports classify as Union airports as of 2025 onwards. The Energy Authority is the competent authority regarding aviation fuel suppliers, and the Finnish Transport and Communications Agency Traficom is the competent authority regarding aircraft operators and Union airport managing bodies.

According to the AFIR Regulation,[71] all airports of the TEN-T[72] core network and TEN-T comprehensive network shall ensure the provision of electricity supply to stationary aircraft by 31 December 2024 at all aircraft contact stands, and by 31 December 2029 at all aircraft remote stands used for commercial air transport operations. By 2030, Member States shall ensure that the electricity supplied originates from the electricity grid or is generated on site without using fossil fuels. Member States may exempt airports of the TEN-T network with fewer than 10,000 commercial flight movements per year, averaged over the last three years, from the obligation to supply electricity to stationary aircraft at all aircraft remote stands.

Planned policies and measures

The EU ETS Directive is expected to be reviewed in 2026, but the content of the proposal is not yet known. The MRV (monitoring, reporting, and verification) system for non-CO_2 aviation effects commenced in 2025. According to the ETS Directive, the Commission shall submit a report by the end of 2027 on the results and if appropriate, will make a legislative proposal to address the non-CO_2 effects of aviation.

In November 2024, the Ministry of Transport and Communications published the National Programme for Alternative Transport Fuels Distribution Infrastructure.[73] The programme contains an updated assessment of the development of distribution infrastructure and market for fuels other than fossil fuels in maritime and air transport. The programme sets objectives and presents measures that will promote the achievement of the objectives. The programme will promote the implementation of the AFIR Regulation and be the basis for monitoring required by the Regulation.

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[71] Regulation (EU) 2023/1804 of the European Parliament and of the Council of 13 September 2023 on the deployment of alternative fuels infrastructure.

[72] The trans-European transport network.

[73] National Programme for Alternative Transport Fuels Distribution Infrastructure; Publications of the Ministry of Transport and Communications (2024):10; http://urn.fi/URN:ISBN:978-952-243-747-1.

Summary of policies and measures

A summary of the policies and measures for the international bunkers is presented in CTF Table 5.

3.4.3.4 Industrial processes and product use

Adopted and implemented policies and measures

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 have until now mainly included changes in industrial production activity. However, one can observe a clear change today in which the manufacturing industry is actively seeking low-carbon technology alternatives and has significantly reduced process emissions. Typically, this is not the result of a single measure but several measures strengthening the overall feasibility of new technology investments.

In the WM projection, the growth of industrial production increases emissions, while technology changes reduce them. Most of the industrial process emissions reported in this sector are part of the EU ETS, which is also the main measure for reducing process emissions. The steep rise in EU ETS prices, with lower electricity tax, new investment grants, and increased climate awareness, are motivating manufacturing industry to reduce process emissions. The measures are the same as those for reducing energy sector emissions, and a description of them can be found in Section 3.4.3.1. No additional measures targeting CO_2 emissions from industrial processes are planned.

The policies and measures described in this chapter therefore only address measures related to F-gases.

F-gases

The share of F-gas emissions (HFCs, PFCs, and SF6) was 2 per cent of total greenhouse gas emissions in 2024. NF3 emissions do not occur in Finland. F-gases are emitted from various applications that use these industrial gases, which are very damaging to the climate. More than 90 per cent of the emissions originate from the use of F-gases as refrigerants in refrigeration and air-conditioning equipment. Most are HFC emissions, and they increased heavily from the early and mid-1990s, when they were introduced as substitutes for ozone-depleting substances in many applications. From the peak year of 2008, emissions have since decreased by more than 50 per cent. PFC emissions are very low, and they have decreased significantly from the peak level in the late 1990s. SF6 emissions are also low (4 per cent of total F-gas emissions in 2024), and the peak level of SF6 emissions occurred in the early and mid-1990s. The level of emissions has since decreased, mostly due to electricity distribution industries' voluntary actions. However, there is a

fluctuation in the total annual emissions level due to the use of SF6 in specific applications in which the consumed amount of SF6 varies year-on-year. F-gases are not produced in Finland.

The existing measures will efficiently reduce HFC emissions and therefore total F-gas emissions. The most important legislation affecting use and emissions is the EU F-gas regulation[74]. In addition, the EU MAC Directive (Mobile Air-Conditioning Directive[75]) prohibits the use of HFCs with a GWP higher than 150 in air-conditioning systems in passenger cars and light commercial vehicles. Technical development has also affected the development of emissions. The main features of the F-gas regulation in cutting F-gas emissions are the phasing down of F-gases that can be placed on the EU market, bans on the use of F-gases in certain applications, and obligations related to leak checking and repairs, F-gas recovery, and technician training. These measures will lead to a replacement of F-gases with natural and other low GWP alternatives in most applications.

A slight increase is expected in SF6 emissions until 2035 due to the increased use of SF6 in electricity distribution equipment. However, the restrictions introduced in the EU F-gas regulation[76] for the use of SF6 in electricity distribution equipment will halt the increase after 2035.

Additional measures related to F-gases

As additional measures to slightly accelerate emissions reductions, there are plans to promote an accelerated transition to natural refrigerants, and the lifecycle management of refrigerants through information and regulatory policies. The measures would include the updating of the criteria for public green procurement, promoting the harmonisation of norms and standards related to building services and building regulations in a direction that enables natural refrigerants. In addition, the measures would also entail the preparation of a report for a national plan for the lifecycle management of refrigerants, and exploring opportunities to promote producer responsibility and the systemic promotion of the circular economy.

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 5.

[74] 573/2024

[75] 2006/40/EC

[76] 573/2024

3.4.3.5 Agriculture

Adopted and implemented policies and measures

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 to have profitable domestic production and make agriculture sustainable and multifunctional. The objectives of sustainable and multifunctional agriculture include a consideration of greenhouse gas emissions, the possible need for adaptation measures, and other environmental and socioeconomic aspects. These objectives can be achieved through the EU's Common Agricultural Policy (CAP), as well as through national measures. According to conclusions of the European Council, agricultural production should continue in all areas of the Community.

The starting point of agriculture emissions projection is that domestic food production will be secured and maintained at the current level, and mitigation policies will be implemented where the most cost-effective reduction potential exists. Some of the effective climate policy measures may conflict with other agricultural policy objectives and measures such as securing the availability of food, animal welfare, and the biodiversity of rural areas. If Finnish consumption patterns remain unchanged, a reduction in domestic agricultural production will probably not reduce global greenhouse gas emissions because domestic production will be replaced by production elsewhere.

Agricultural greenhouse gas emissions come from dispersed biological emission sources, which makes reducing them more complicated than in many other sectors. It is worth noting, however, that agricultural land is not just a source of greenhouse gas emissions but may also sequester atmospheric carbon into soil. Favourable cultivation practices such as plant cover in winter, perennial grassland, and reduced soil tilling can make this possible.

The current measures in the agricultural sector are mainly related to the implementation of the EU's Common Agricultural Policy (CAP). The new CAP period from 2023 to 2027 began in January 2023. The main tasks of Finland's CAP Strategic Plan (CSP) include safeguarding active food production, climate and environmental sustainability in agriculture, and strengthening the vitality of regenerating rural areas. However, in its CAP strategic plan, each EU country is obliged to display a higher ambition on environment and climate action than in the previous programming period. Each country is also required to update the plan when climate and environmental legislation is modified. The aim is that 40 per cent of total EU funding for CAP measures will be allocated to climate measures at the EU level. Member States are obliged to allocate 35 per cent of rural development funds to environmental and climate measures at the

national level. In addition, at least 25 per cent of the budget for direct payments is allocated to eco-schemes, providing stronger incentives for climate- and environment-friendly farming practices and approaches.

Hence, compared with the previous programming period, the Finnish CAP Strategic Plan has increased environmental and climate ambition. According to the environmental impact assessment of Finland's current CSP, greenhouse gas emissions from agriculture will decrease by around 0.8 million tonnes CO_2 eq. per year compared with the previous CAP funding period.

Finland's CAP Strategic Plan includes measures that, in addition to their impacts on waterbodies, contribute to increasing and preserving carbon in soil. The emissions reduction impact will affect both the land use and agricultural sectors. These measures include turning cleared areas permanently into grassland, catch crops, soil improvers, and renovation plants, subsidies for grasslands and fallows (including grasses on peat fields), investments in controlled subsurface drainage and its management, and establishing and managing wetlands (including managed climate wetlands). An investment subsidy is also available for the more efficient storage, treatment, and use of manure and for investments in energy efficiency and sustainable energy, such as biogas plants. The advisory services in the programme offer advice on energy efficiency and issues related to the mitigation of and adaptation to climate change.

As it is neither possible nor appropriate to implement all climate change mitigation or adaptation measures in agriculture through the EU's Common Agriculture Policy, national measures are also required. These measures are identified in the Medium-term Climate Plan and in the Climate Plan for the Land Use Sector. The Medium-term Climate Plan was updated in 2025. The emissions reduction measures in the Medium-term Climate Plan are related to: groundwater level in peatland; grass cultivation on peatland; increasing the area of forest land; improving the real estate composition of fields; precision farming; carbon sequestration on mineral soils; biogas production and use; nutrient recycling; and preventing the conversion of forests to fields and the conversion of agricultural land into climate wetlands.

The Medium-term Climate Plan has also highlighted several measures that are likely to reduce greenhouse gas emissions from agriculture in the future but for which the emission impact cannot currently be calculated. Such measures include changes in the age structure of cattle, increasing the use of gender-selected semen, improving carbon sequestration with various soil improvers, increasing compliance with nutrition recommendations, reducing food waste, developing public procurements, promoting carbon markets, new technologies for methane capture from animal shelters, and deepening cooperation between stakeholders in the food system.

The Climate Plan for the Land Use Sector complements the climate measures targeted at agricultural peatlands. Alternative measures include raising the groundwater level on peaty arable land to prevent peat decomposition, the promotion of perennial grasslands without tilling and converting agricultural land into managed wetlands (when the area would no longer be used for agricultural production). These measures targeted at agricultural soils also reduce CO_2 emissions in the land use, land use change, and forestry (LULUCF) sector. The EU Restoration Regulation and the upcoming national restoration plan will also set new targets and requirements for peatlands in the coming years. The concrete policy measures will be identified in the national restoration plan, which will be finalised by the summer of 2027.

Finland lacks a separate strategy for reducing methane emissions but addresses them as part of the sectoral strategies. Agriculture is the biggest source of methane emissions in Finland: in 2023, approximately 49 per cent of CH_4 emissions in Finland originated from agriculture, including enteric fermentation and manure management. In the agriculture sector, methane emissions mostly depend on the number of domestic animals. The expected reduction in the number of bovine animals also reduces the methane emissions from their digestion. In addition, the reduction in the number of bovine animals and pigs will reduce the emissions from manure processing.

Enteric methane emissions from ruminants can be reduced by changing the feeding practices for dairy cows. Using rapeseed cake in the feeding of dairy cows can reduce methane emissions by approximately 10 per cent per litre of milk if the cows are fed predominantly roughage, that is, grass. However, as more than 40 per cent of dairy cows' feed is concentrated feed, rapeseed cake would mostly replace the currently widely used rapeseed meal, and the actual reduction in methane emissions would probably be between 3 and 5 per cent per cow.

Of the feed additives that reduce enteric methane production, research has advanced furthest regarding 3-NOP (3-nitrooxypropanol), which has been approved in the EU as a feed additive for dairy cows and cows for reproduction. In the best-case scenario, this additive may reduce methane emissions from dairy cows by up to 25 per cent, but at the same time, it entails a permanent cost to farmers.

The Government has strongly highlighted the role of manure management and nutrient recycling as part of the overall sustainability of agricultural production. Various incentive schemes are available for research, experiments, advice, and investments and operating in streamlining manure management and nutrient recycling. The purpose is to create conditions for a well-functioning organic fertiliser market and thereby to ensure efficient recycling and use of nutrients. An experimental nutrient recirculation programme has been running since 2016. The support scheme for biogas investments and new manure processing

techniques was launched in December 2020. Another subsidy scheme (operating aid for nutrient recycling) to produce biogas based on nutrient cycles was launched in April 2024.

Ammonia is to some extent involved in greenhouse gas emissions because part of the ammonium nitrogen landing on the ground is transformed into nitrous oxide. International treaties and EU legislation oblige Finland to reduce its ammonia emissions into the air. Approximately 90 per cent of Finland's ammonia emissions originate from agricultural sources. The most effective measures for reducing ammonia emissions from agriculture involve manure management, its storage and application. Ammonia emissions can also be reduced by measures involving the feeding of domestic animals, but these measures are more difficult to regulate, and their impact is more difficult to assess than measures related to the management of manure.

In addition to the measures referred to above, many other factors may help reduce greenhouse gas emissions from agriculture by 2035. However, the magnitude remains difficult to estimate. For example, gender-selected semen is a relatively new technology. The goal is to reduce the number of male dairy calves and increase the share of faster-growing dairy-beef crossbreed calves among dairy cattle. More research is required on the use and effects of gender-selected semen, but the method is already rapidly gaining popularity.

The Medium-term Climate Plan highlights the reduction of edible food waste and promotion of eating in accordance with national nutrition recommendations as measures related to food consumption. Finland's National Waste Plan sets the target of halving food waste by 2030. The Finnish Waste Act[77] and the Government Decree on Waste[78] lay down further provisions on how food sector actors must keep records of the amount and treatment of food waste generated in their activities.

New Nordic nutrition recommendations were published in 2023. For the first time, the Nordic nutrition recommendations contained scientific recommendations on a healthy and ecological diet. The recommendations emphasise a more plant-based diet, increasing fish consumption and reducing meat consumption. The Finnish nutrition recommendations are based on the Nordic nutrition recommendations and were published in November 2024.

A shift to a more plant-based consumer diet will change agricultural production and land use in a direction with lower emissions, but it is difficult to estimate the tangible climate impact. Despite the national dietary change, the reduction of greenhouse gas emissions may be slow if exports of dairy products increase due to strong global demand and prices. Structural development and

[77] 646/2011

[78] 978/2021

productivity will then progress, and the change in production and land use will remain small. Whether consumers reduce their consumption of meat and dairy products depends on the development of consumers' taste and eating habits. When implemented, a more plant-based diet will significantly reduce emissions from livestock production, and with land use measures, it will also give the opportunity to reduce emissions from cropland, which are currently around 75 per cent of total agricultural emissions.

As part of Prime Minister Petteri Orpo's Government Programme, the Ministry of Agriculture and Forestry published a long-term strategy for Finnish food production in 2025. The strategy aims to build a proactive, sustainable, and profitable food system that safeguards security of supply, reduces negative environmental impacts, strengthens biodiversity, and promotes public health. The strategy is a vision of the kind of food system Finland will have in 2040, which measures are required to achieve the vision, and the kind of agricultural changes for which Finland should be prepared. The strategy also takes perspectives related to climate change into account. The strategy will be carried out through a four-year implementation plan. The Finnish Government is committed to improving the sustainability of the Finnish food system and doubling food exports by 2031. To strengthen the national vision and enhance the appreciation of agricultural producers, the long-term strategy for domestic food production was drawn up in parliamentary cooperation.

Summary of policies and measures

A summary of the policies and measures in the agriculture sector is presented in CTF Table 5.

3.4.3.6 Land use, land use change and forestry

Adopted and implemented policies and measures

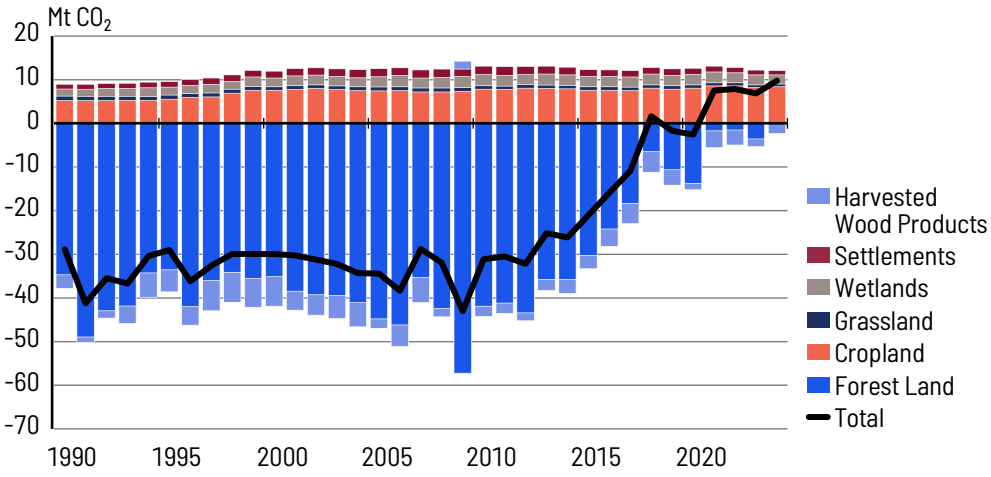
The overall LULUCF sector has historically been a net sink in Finland because its emissions have been smaller than removals. However, this net sink from the LULUCF sector can vary significantly from year to year. The first indicators regarding the LULUCF sector becoming a source of emissions instead of a net sink were seen in Statistics Finland's preliminary data in the spring of 2022. According to current national GHG inventory data, the LULUCF sector has been either a net source of emissions or a small net sink since 2018.

The trend can be explained by the declined volume increment in forests and increased volume of harvested roundwood, as well as the change in weather conditions. The latter has had a particular impact on soil emissions. The net sink of the forest has varied from year to year, especially due to changes in the harvesting of domestic roundwood, which is affected by the market situation

of forest industry products and the demand for energy wood. Ending wood imports from Russia has also increased the demand for domestic raw wood.

Living trees bind still more carbon through growth than is removed in fellings and as a natural loss. The highest emissions come from the soils of drained peatlands in forests, on cropland, and in peat production areas. In addition, smaller emissions are generated by other managed wetlands, including unsuccessfully drained forest areas or drained forests, that have been transformed into wetlands. Forest fires, prescribed and restoration burning, as well as nitrogen fertilisation of forests and settlements, generate minor emissions.

Figure 3.4–4
Historical (1990–2024) greenhouse gas emissions and removals in the LULUCF sector per land use category. Positive figures indicate emissions and negative removals.



The Climate Plan for the Land Use Sector was prepared in 2022, and it specifies how climate emissions from the land use, land use change, and forestry sector can be reduced, and carbon sinks and reservoirs strengthened. The Plan aims to achieve an annual net impact of at least 3 million tonnes of CO_2 eq. by 2035. To ensure that this target is achieved, Natural Resources Institute Finland Luke was commissioned to produce a new estimation with updated inventory numbers at the beginning of 2024, which indicated that the target of 3 million tonnes would be achieved.[79] This will also contribute to Finland's EU LULUCF target for 2030. A monitoring system for the Climate Plan for the Land Use Sector has been prepared, and the annual achieved amount of increased net sink or emissions reduction under the Plan are reported as part of the Government's Annual Climate Report. Until the summer of 2026, the annual effect has been around 1.02 million tonnes of CO_2 eq. The monitoring systems

[79] Silfver et al. (2024) Natural Resources Institute Finland (Luke): http://urn.fi/URN:ISBN:978-952-380-869-0

also attempt to capture those small-scale climate measures that are not visible in the national GHG inventory.

The Climate Plan for the Land Use Sector brings together more than 30 different climate measures such as the updated ownership policies of the State Forests (Metsähallitus), the ash fertilisation of peatland forests, and the act on fixed-term support for afforestation, the latter having ended in December 2023. It also outlines measures in the following categories: resource-efficient land use and land use change; climate-resilient use of peatlands; other measures to promote carbon sequestration and carbon storage; and crosscutting measures. For example, in addition to the measures presented above, the measures focus on actions in peatland fields and forests, the development of carbon markets, swift and timely forest regeneration, increasing the amount of dead wood for climate and biodiversity perspectives, promoting training and expertise, and communication. The most effective measures have been identified in halting deforestation and promoting actions in peatlands. The preliminary climate impacts of the measures listed in the Plan are presented below in Table 3.4-3. However, it should be noted that there is currently no national funding outside CAP measures for paludiculture/rewetting peatlands. Furthermore, the national funding for fixed-term support for afforestation ended in December 2023. However, the Ministry of Agriculture and Forestry is currently preparing a new aid scheme for afforestation. A mid-term assessment of the Climate Plan for the Land Use Sector was carried out in 2025, and the Plan will be updated during the next government term from 2027 onwards.

Table 3.4-3
Preliminary climate impacts in 2030 and 2035 of the measures presented in the Land Use Sector Climate Plan, in million tonnes of CO_2 eq.

Measure	Area	Climate impact in 2030	Climate impact in 2035
New ownership policy decisions concerning Metsähallitus (State Forests)		0.4 Mt CO_2 eq.	0.7–0.9 Mt CO_2 eq.
Preventing the conversion of forests into fields	About 1,700–1,900 ha per year		0.5 Mt CO_2 eq.
Act on fixed-term support for afforestation	3,000 ha per year, of which 40% in peat production areas	0.09 Mt CO_2 eq.	0.11 Mt CO_2 eq.
Afforestation of low-yield arable land	9,000 ha in 2024–2028	0.08 Mt CO_2 eq.	0.09 Mt CO_2 eq.
Raising the groundwater level in peaty agricultural lands (cropland on grass) –30 cm	2030: 20,000 ha 2035: 32,500 ha	0.132 Mt CO_2 eq.	0.215 Mt CO_2 eq
Paludiculture, groundwater level –30 cm	2030: 5,000 ha 2035: 10,000 ha	0.046 Mt CO_2 eq	0.093 Mt CO_2 eq.
Paludiculture, groundwater level –5 – –10 cm	2030: 2,500 ha 2035: 5,000 ha	0.052 Mt CO_2 eq.	0.105 Mt CO_2 eq.
Managed wetlands (no longer in agricultural use)	2030: 4,000 ha 2035: 7,500 ha	0.081 Mt CO_2 eq.	0.151 Mt CO_2 eq.
Perennial cropland on grass without tilling	2030: 40,000 ha 2035: 40,000 ha	0.081 Mt CO_2 eq.	0.081 Mt CO_2 eq.
Rewetting of low-yield, thick peaty arable land into wetlands	2030: 10,000 ha 2035: 10,000 ha	0.202 Mt CO_2 eq.	0.202 Mt CO_2 eq.
Comprehensive planning of peatland forest management (avoidance of remedial ditching)	–	–	–
Comprehensive planning of peatland forest management (continuous cover forestry)	6,000 ha per year	0.21 Mt CO_2 eq.	0.21 MtCO_2 eq.
Ash fertilisation of peatland forests	26,000 ha per year	0.18 Mt CO_2 eq.	0.40 Mt CO_2 eq.
Promotion of forest fertilisation on mineral soils	25,000 ha per year	0.46 Mt CO_2 eq.	0.28 Mt CO_2 eq.
Increasing carbon stocks of decaying wood in commercially utilised forests by leaving trees for biodiversity and climate reasons	–	–	–
Total		**2.01 Mt CO_2 eq.**	**3.14–3.34 Mt CO_2 eq.**

Source: Natural Resources Institute Finland 2022

In line with Prime Minister Petteri Orpo's Government Programme, a package of measures to strengthen forest growth and carbon sinks was prepared during 2024 to 2025 by the Ministry of Agriculture and Forestry. The package's implementation started in mid-2025. The package will contribute to the achievement of the climate targets. The measures have been prepared in close interaction with stakeholders and researchers. Various actors in the forest sector play a key role in the measures' implementation.

The Government decided on the framework for the steering instruments and financing of climate measures related to forests in the mid-term policy review session and the second supplementary budget of 2025. The total financing to be allocated to the package was approximately EUR 27 million for the period between 2025 and 2027. The extensive package of measures to strengthen forest growth and carbon sinks will promote the preparation for forest damage and the impacts of climate change. The measures will also boost remedial fertilisation of forests and the expansion of the forest area, and the growth of stands and carbon sequestration into them through forest management.

The package of measures also includes legislative amendments, financial instruments, and their development, as well as communication and advice to forest owners and actors in the forest sector. The package will support the achievement of the objectives of the Climate Act and the implementation of the National Forest Strategy. The package also covers the preparation and implementation of regulatory measures, economic incentives, and support for informational guidance related to forest growth actions and emissions reduction measures.

In addition, the package includes around EUR 4 million of funding for development projects to strengthen the knowledge base of forest owners concerning the practical application of climate actions and the multiple benefits to be gained. The projects and the more effective implementation of forest management recommendations will promote access to information that takes climate risks and impacts into account, and the capability of forest owners of managing their forests both profitably and sustainably. The project application round was carried out by the National Climate Unit of the Economic Development Centre.

The Ministry of Agriculture and Forestry launched an RDI call for promoting the use of wood in construction in the spring of 2026. In particular, the call aims to produce scalable solutions for practical wood construction and building technology to promote industrial wood construction from the perspective of security of supply, fire safety, adaptability, undamaged demolition, and data model requirements, for example. The total funding for the call is around EUR 2 million, and the projects will begin in Q3 to Q4/2026. The call also implements the target of promoting carbon stocks in long-term wood products as set in

the Climate Plan for the land use sector and in the National Energy and Climate Strategy.

Organic soils are the main source of CO_2 emissions in the LULUCF sector. The CAP Strategic Plan for 2023 to 2027 and the Climate Plan for the Land Use Sector both include measures for the climate-resilient use of peatland fields, such as raising the groundwater level in peatland fields to prevent the decomposition of peat, establishing managed climate wetlands and perennial grassland on peatland. One of the policy measures in the Climate Plan for the Land Use Sector is the preparation of a roadmap[80] for the use of peatland fields. The roadmap was published in December 2024. In addition to these measures, the Ministry of Agriculture and Forestry has piloted market-based competitive tendering for rewetting peatlands and performance-based funding models for carbon sequestration. These new measures are part of Finland's increased ambition to meeting national and EU climate targets.

The size of the managed forests' sink or source depends mainly on the tree growth and harvesting rates, which result from the global demand for housing and packaging, for example. The National Forest Strategy[81] was revised in 2022, and its implementation began at the beginning of 2023. The National Forest Strategy 2035 is a coordinating strategy for the whole sector that brings together people, the environment, and the economy. The strategy considers the principle of comprehensive sustainable development and the important role forests play in climate change mitigation and adaptation. The objectives of forest use have been reconciled in the National Forest Strategy 2035. Active forest management and use will maintain forests' health and ability to grow, which is a basic prerequisite for their capacity to bind carbon. The current National Climate and Energy Strategy also emphasises the importance of enhancing the implementation of the National Forest Strategy, especially of maintaining good forest health and strengthening forests' long-term growth and carbon capture capacity.

A significant source of emissions in the land use sector is the clearance of forests for other land use purposes, mainly as a result of civil engineering, construction, and clearing land for agricultural use. Finland is the most forested country in the EU, and estimates indicate that the potential for reforestation is limited. The Act on fixed-term support for afforestation was in force between 2021 and 2023. The objective of the Act was to increase the forest area and carbon sinks by supporting afforestation and reduce greenhouse gas emissions on sites to be afforested, without weakening biodiversity. As referred to above, a new aid scheme for afforestation is

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[80] Lehtonen et al. (2024) Natural Resources Institute Finland (Luke): Turvepeltojen käytön tiekartta vuoteen 2050 (Roadmap for the use of peatland fields up to 2050) (in Finnish with English abstract). http://urn.fi/URN:ISBN:978-952-380-980-2

[81] The National Forest Strategy (2035). http://urn.fi/URN:ISBN:978-952-366-748-8

currently under preparation and will come into force at the beginning of 2027. The EU Deforestation Regulation entered into force in June 2023. The regulation will probably decrease deforestation caused by agriculture in the coming years, especially as it will hinder the clearing of forest to cropland.

In previous years, public financing for private forest owners has been around EUR 48 to 60 million annually. Financing instruments until the end of 2023 were Act on the Financing of Sustainable Forestry[82] and Act on fixed-term support for afforestation. Since 2024, the Act on a Temporary Forestry Incentive Scheme has been in force. The management fees for afforestation made between 2021 and 2023 will also continue until 2033. The general objectives of forestry financing are to increase the growth of forests, maintain road networks for forestry purposes, secure forest biodiversity, and promote the adaptation of forests to climate change. Nature management in commercial forests is promoted through environmental support and forest nature management projects. Private forest owners themselves invested around EUR 200 million in forest management and improvement work in 2022.

Prime Minister Petteri Orpo's Government carried out an impact assessment of a proposal for a fee for land use change. The impact assessment was published at the beginning of 2024.[83] According to the assessment, a potential fee for land use changes could decrease land clearing by around 2,000 hectares in agriculture and 1,000 hectares in the built environment. The potential emissions reduction by 2030 would be 0.59 million tonnes of CO_2 eq. and 0.74 million tonnes of CO_2 eq. by 2035. However, no political decision has been made on the implementation or continuation of the preparation.

The uncertainties considering the land use sector's GHG inventory have been under public discussion since the sector shifted from a strong net sink into a net source of emissions. Prime Minister Orpo's Government has therefore allocated significant funding to develop both national GHGI and the broader MRV of the LULUCF sector. In 2024, one-off additional funding of EUR 2 million was allocated for the development of the GHG inventory and monitoring to make national climate actions more visible and to improve monitoring in line with the requirements of the EU LULUCF Regulation. Approximately half the funding was directed specifically to methodological development. In addition, funding was targeted to a project to develop accounting for biogenic carbon capture and storage, as well as research on aerosol formation in forests. In addition, in 2025, significant funding of EUR 8.1 million was allocated to the Holistic Infrastructure for Knowledge on Land-use Sector Carbon Sinks and Emission Tracking project (HIKET). For more information about the project, please see Chapter 6.

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[82] 34/2015

[83] Ministry of Agriculture and Forestry of Finland (2024): Impact assessment of a proposal for a fee for land use change http://urn.fi/URN:ISBN:978-952-366-756-3

Summary of policies and measures

A summary of the policies and measures in the land use, land-use change, and forestry sector is presented in CTF Table 5.

3.4.3.7 Waste management and waste tax

Adopted and implemented policies and measures

Emissions from waste management originate from landfill, composting, digestion, the treatment of wastewater, and the incineration of waste. Emissions from waste treatment have decreased steadily since the 1990s. Since 2005, emissions (excluding waste incineration) have decreased by around 48 per cent, most of which is attributed to landfills. The placement of organic waste in landfills is restricted, and in practice, all mixed municipal waste is incinerated. The recovery of landfill gas has also reduced emissions. However, carbon dioxide emissions from waste incineration have been growing because of increased incineration capacity and volumes. National measures to reduce emissions from waste incineration have not been implemented. Instead, it seems likely that the sector will be included in the EU's Emissions Trading System in the coming years. The following presents various policies for reducing emissions in the waste sector.

The Waste Tax Act[84] entered into force at the beginning of 2011. The purpose of the Waste Tax Act is to collect tax from those waste fractions which could be technically and environmentally recovered, but which are disposed of in landfill sites. Industrial landfills are also subject to taxation. The waste tax has been EUR 80 per tonne since 2023.

Waste legislation was mainly reformed in 2021. The reform's key objective is to reduce the amount of waste, and increase reuse and recycling. The separate collection obligations for waste have become stricter, and more waste, especially municipal waste, packaging waste, and construction and demolition waste, will therefore be directed to recycling instead of waste incineration. Waste legislation is currently being amended with the aim of increasing the separate collection and recycling of waste, and reducing the incineration of recyclable waste. The National Waste Plan, updated in 2022, aims to prevent waste generation and, with legislative amendments, to increase the recycling rate. These policy measures will indirectly reduce greenhouse gas emissions in the waste sector in the longer term, but it is difficult to estimate their potential for reducing emissions. An amendment of the Waste Act and the Decree on Waste are planned, with implementation in 2027.

[84] 1126/2010

The restrictions on the landfilling of biodegradable municipal solid and other organic waste have been made stricter. Since 2016, the Decree on Landfills has restricted the amount of biodegradable and other organic waste to less than 10 per cent of total organic carbon or loss on ignition. These restrictions have increased the incineration of waste and decreased landfilling.

The estimated total emissions reduction of waste management measures is roughly 4 million tonnes of eq. per year between 2025 and 2035.

Summary of policies and measures

A summary of the policies and measures in the waste sector is presented in CTF Table 5.

3.4.3.8 Land use planning and spatial structure

The development of the built environment has long-term implications on greenhouse gas emissions from both transport and buildings. The most significant solutions for emissions reductions are linked to sustainable urban development, including the coordination of land use and transport planning; the creation of preconditions to support 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 vibrant and well-functioning city centre, and easy access to recreational and green areas. Well-functioning urban subregions are a prerequisite for economic vitality and Finland's competitiveness. The measures to reduce emissions may vary considerably across different parts of the country, reflecting differences in local conditions and development needs.

The preconditions for increasing wind power production include the coordination of wind power construction with land use in the surrounding areas, giving sufficient consideration for potential negative environmental impacts, and ensuring local acceptability. To promote planning, the Land Use Act contains specific provisions on local master plans that directly apply to wind power construction. Rapid progress has been made in recent years in land use planning for wind power construction.

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

Nearly all Finland's regions and many individual municipalities have prepared their own climate strategies. However, it is difficult to provide quantitative emissions reduction potentials for the policies and measures concerning land use planning and the urban structure. For example, the urban form influences

emissions mainly in the energy sector through its effects on transport and the heating of buildings. Emissions from daily mobility especially may be many times higher in car-oriented zones than in urban centre areas. Emissions from the heating of buildings depend greatly on energy solutions for the dwelling and possible district heating. A dwelling's location is also connected with 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 thus depend not only on the urban structure but on complex processes that include lifestyle changes, as well as economic conditions and development.

The land use planning measures are included in the energy and transport measures in CTF Table 5.

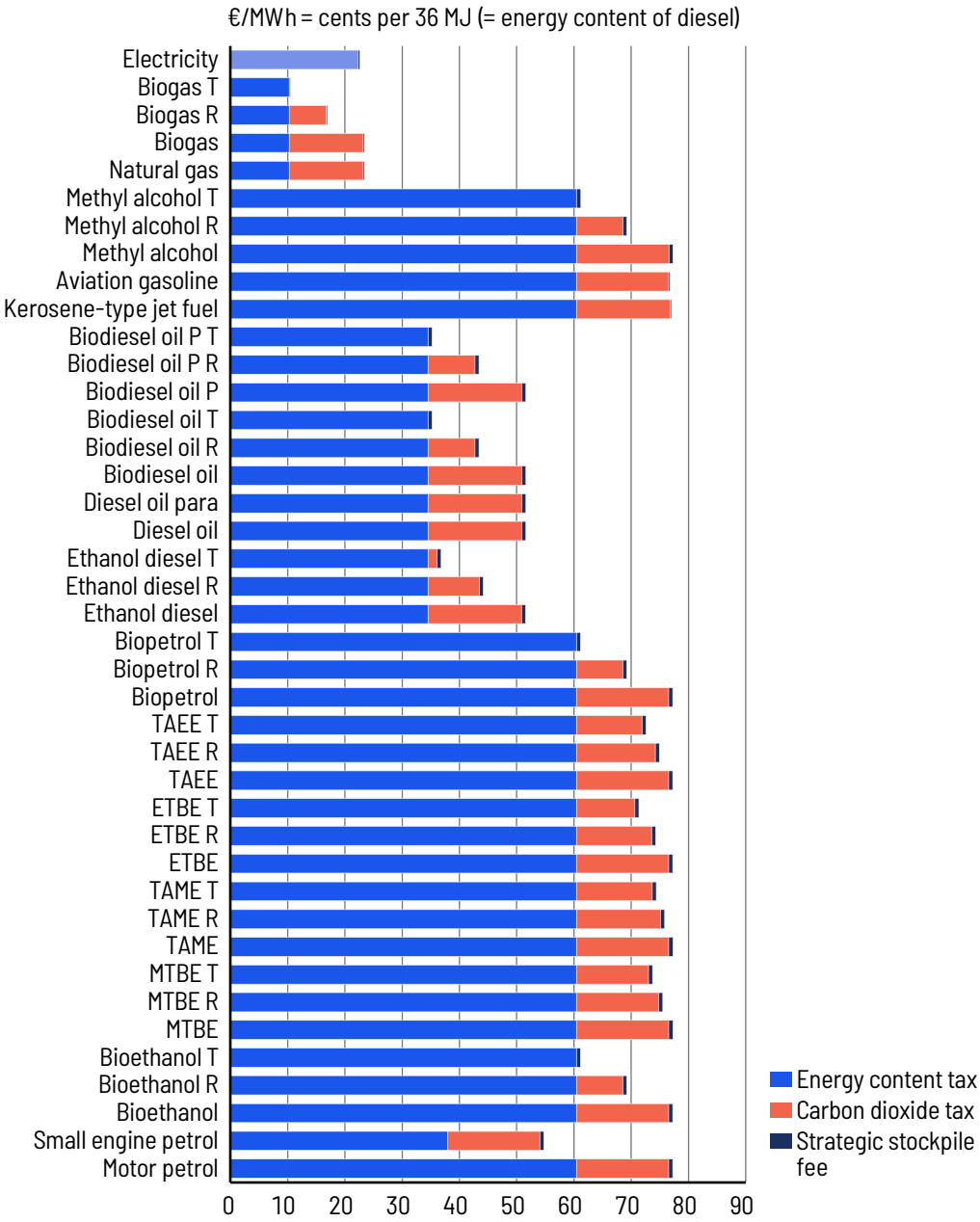
3.4.4 Energy taxation and related measures

Energy taxation

Energy taxation is a key instrument of the Government's climate and energy policy. Energy taxes are levied on electricity, coal, natural gas, peat, tall oil, and liquid fuels. The energy taxation of fuels is based on the energy content, lifecycle carbon dioxide emissions, and local emissions of fuels. The energy content component is levied on both fossil fuels and biofuels, based on their volumetric energy content. The CO_2 component is based on the lifetime CO_2 emissions of the fuel in question, and biofuels are therefore subject to a CO_2 tax rate that is reduced by 50 to 100 per cent if they meet the European Union's sustainability criteria. In connection with the excise duties on electricity, coal, natural gas, and liquid fuels, the Government also collects a strategic stockpile fee, which is transferred to the National Emergency Supply Agency.

Figure 3.4-5 illustrates the energy tax structure for energy used in transport as of 1 January 2027.

Figure 3.4-5
Energy tax structure and rates for energy used in transport as of 1 January 2027



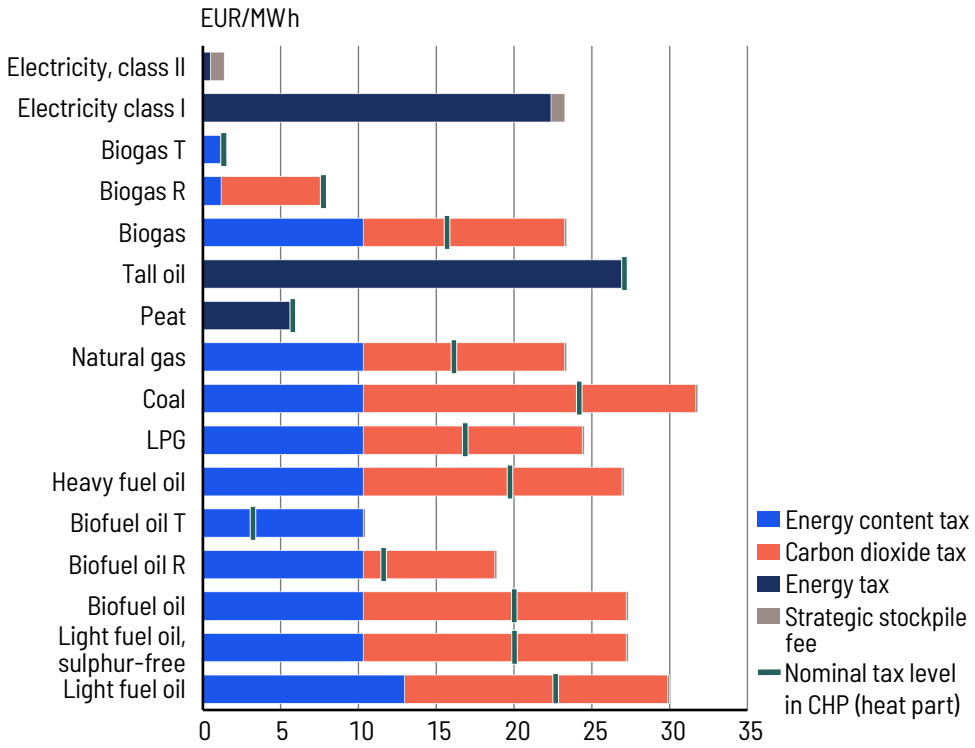
The energy content tax for petrol is approximately EUR 60.5 per MWh (benchmark rate), and the carbon dioxide tax for lifecycle emissions is EUR 51.3 per tonne of CO_2.[85] For diesel, the energy content tax is reduced by EUR 25.95 per MWh compared with the benchmark rate. Tax rates for gaseous fuels used in transport are also lower than the benchmark rates for transport use, as gaseous fuels are taxed with benchmark rates of heating use. The energy tax rate for electricity used in road transport is also lower. For passenger

[85] This corresponds to a tax rate of approximately EUR 62 per tCO_2, applied to emissions of fuel combusted. The carbon dioxide tax was reduced from EUR 77 to EUR 62 per tCO_2 at the beginning of 2024, further to EUR 58 tCO_2 at the beginning of 2026, and it will be reduced to EUR 51.3 per tCO_2 in 2027.

cars, lower taxation of diesel, gaseous fuels, and electricity is compensated for by an annual propelling force tax, which is part of the vehicle tax, so that lower taxation effectively applies mostly to commercial vehicles. The strategic stockpile fee for petrol and diesel is EUR 0.61 per MWh. According to the General Government Fiscal plan, a tax refund of EUR 40 million on diesel consumed by heavy duty vehicles (commercial diesel) will be introduced in 2028 to mitigate the impact of the introduction of the ETS2.

Figure 3.4-6 illustrates the energy tax structure for fuel used for heating and mobile machinery, as well as electricity, as of 1 July 2026.

Figure 3.4-6
Tax rates for fuels used in heating and mobile machinery as of 1 July 2026 (EUR/MWh)



The energy content tax for separate heating and mobile machinery is EUR 10.33 per MWh, and the carbon dioxide tax is EUR 53 per tonne of CO_2. Energy content tax rates for fuels used in combined heat and power production are reduced by EUR 7.63 per MWh (see Figure 3.4-6). The strategic stockpile fee for fuels used in heating and mobile machinery is EUR 0.1 per MWh.

The energy content tax for oil products used in professional agriculture (excluding transport use) is rebated. For 2025 and 2026, the refund is temporarily increased by EUR 4 per MWh. The tax rebate for fuels used by energy intensive businesses in manufacturing, mining, and greenhouse cultivation was phased out at the end of 2024. The energy tax on electricity for manufacturing and certain heat pumps and agriculture is at the minimum

EU level, EUR 0.5 per MWh (class II). For households, services, and so on, the energy tax for electricity is EUR 22.4 per MWh (class I). The electricity tax rate for mining and data centres was increased in 2026 following their reclassification from Class II to Class I. In addition to energy tax, strategic stockpile fee of EUR 0.85 per MWh is levied on both classes. The strategic stockpile fee was increased as of 1 April 2026. Small-scale production of electricity for an entity's own use is exempt.

Government expenditure on energy and climate policy

The Finnish Government supports the transformation to a greener economy with a variety of different subsidies. Total government expenditure on energy and climate policy has been relatively high in recent years, with the sum for 2024 being EUR 2,361 million. This expenditure covers a wide range of sectors, and the largest outlays are in subsidies given to the energy sector and to agriculture.

Government appropriations for the energy and climate policy are discussed, and the relevant decisions are made within the central government spending limits in the General Government Fiscal Plan, coordinated with other expenditure needs in the public economy.

One of the main ways in which the Government supports the transition to greener energy production is a direct subsidy for projects that aim to cut emissions at the firm or municipality level ("Energy Subsidy"). The current total level of this subsidy is EUR 450 million for 2024 (including RRF funding), which is substantially higher than just a few years ago, when it was around EUR 230 million (2022).

There have been separate fixed-term aid schemes for renewable energy and additional budget authorities for different large demonstration projects. As renewable energy has become more profitable, direct subsidies for renewable production have decreased. These energy-related measures include the Recovery and Resilience Facility (RRF) energy projects (around EUR 500 million between 2022 and 2023) and large demonstration projects. Initially, EUR 200 million was earmarked for large demonstration projects in the period from 2019 to 2022. The Ministerial Working Group on Preparedness decided to increase the budget authority for the energy aid item for the period from 2022 to 2023 by EUR 150 million. At the same time, an additional budget authority was decided for hydrogen projects (EUR 150 million) and battery ecosystem projects (EUR 50 million). The development is partly based on the policies of the previous climate and energy strategy on shifting the focus of renewable energy subsidies from production subsidy type aid schemes to supporting new technologies. In addition, the number of projects has increased significantly, and national targets have become stricter.

In addition to these subsidies, the Government also actively provides support for R&D projects and rail projects, and funding for private sector projects such as housing efficiency and charging infrastructure that aim to cut emissions. While this support is divided over several smaller measures, they amount to several hundred million euros annually.

A compilation of funding related to the energy and climate policy from 2018 to 2024 is presented in Table 3.4-4.

Table 3.4-4
Funding under the current General Government Fiscal Plan

Appropriation	2018	2019	2020	2021	2022	2023	2024
	EUR million						
Ministry of Economic Affairs and Employment							
Energy aid	58	47	61	101	231	364	450
Investment and operating subsidies for renewable energy and new energy technologies	354	215	337	294	135	90	309
Subsidies for green R&D and innovation	120	121	130	143	176	203	237
Other measures	189	146	155	180	190	267	252
Ministry of Agriculture and Forestry							
Agri-environment payment measures	218	218	185	236	263	279	279
Other measures	313	313	398	353	413	312	205
Ministry of Transport and Communications							
Investment in rail infrastructure	0	0	8	26	123	135	186
Other measures	150	127	521	267	281	128	106
Ministry of the Environment							
Investment subsidies for lower emission heating systems	65	70	306	261	323	150	0
Other measures	85	86	116	105	105	181	108
Ministry for Foreign Affairs							
Development aid for environmental, water, and energy-related projects	144	159	199	266	283	277	170
Other measures	65	70	236	186	184	104	58
TOTAL appropriations	**1,761**	**1,573**	**2,651**	**2,418**	**2,706**	**2,490**	**2,361**

Other taxation-related measures

In addition, a tax credit for clean transition investments was adopted in 2025 as a temporary form of support. The Government is currently preparing an extension to the credit until the end of 2027. Projects could be eligible if they are related to

- production of biofuels, biogas, and renewable low-carbon synthetic fuels or the long-term storage of electricity and heat;
- decarbonisation of industrial operations; or
- production of clean technology end products and their key components, as well as of critical raw materials.

The minimum investment size is EUR 50 million. In the case of industrial decarbonisation investments, it would be possible to count an investment programme consisting of multiple individual investments towards the minimum investment size. State aid rules mean that the euro limit would not be applied to fuel production or energy storage projects. The amount of the tax credit would be 20 per cent of the eligible investment costs, but no more than EUR 150 million per company or group of companies. For some net-zero technology investments, the EU's state aid rules would cap the credit at 15 per cent.

3.4.5 Effect of policies and measures on longer-term trends

Finland has a long tradition of assessing longer-term energy and climate development. The Government's Foresight Report on Long-term Climate and Energy Policy (published in 2009) highlighted possible paths to a low-carbon Finland. Moreover, the report of the parliamentary committee from 2014, the Energy and Climate Roadmap 2050, analysed the means of constructing a low-carbon society and achieving an 80 to 95 per cent reduction in greenhouse gas emissions from the 1990 level in Finland by 2050. The background material for the 2014 roadmap included four projections of alternative development paths for a low-carbon society until 2050 made by the Low Carbon Finland 2050 platform research project. Finland's target of carbon neutrality by 2035 was officially laid out as part of the Government Programme in 2019. The target is also reflected in the latest Long-term Strategy (LTS), which was submitted to Parliament in 2026 and contains updated possible projections for achieving the target. The latest Climate and Energy Strategy prepared in 2025 is also closely tied to the carbon neutrality target and assesses if the target can be achieved with the current policy measures.

A large proportion of the current Finnish climate and energy policies already contribute to reducing greenhouse gas emissions and increasing carbon

sinks in the longer term, especially when they are based on creating structural changes in the respective systems. For example, the regulations for improving the energy efficiency of new and existing buildings will have long-lasting impacts due to long lifetimes.

Land use planning also yields permanent emissions reductions in buildings and transport by allowing use of low-emission heating modes or improving possibilities for walking, cycling, and using public transport, for example. However, the actual emissions reductions will depend on a large array of factors, including general economic development.

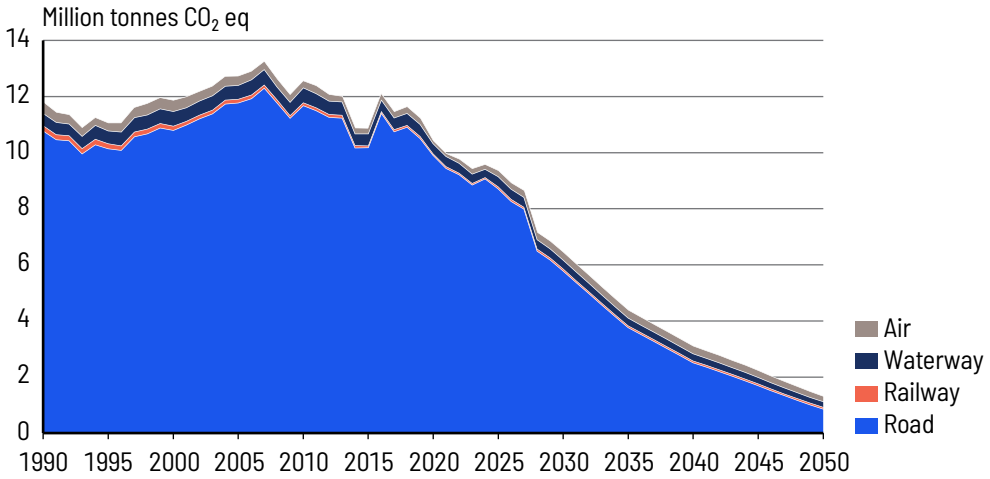
Investments in the energy infrastructure also have long lifetimes. Measures that promote investment in renewable energy and improve competitiveness of renewable energy sources will therefore reduce greenhouse gas emissions in the longer term. Measures that would in principle directly contribute to emissions reductions only if the measure is ongoing, such as feed-in tariffs for renewable energy, also have long-term emissions reduction effects, provided the measure has triggered new investments. This is exactly what has happened in the case of Finland's feed-in tariff for wind power.

Prohibiting the use of certain F-gases and the replacement of F-gases with low GWP alternatives or halting the disposal of biodegradable waste on landfills can be expected to lead to permanent changes in current practices, and therefore to yield permanent emissions reductions.

The impact of policies and measures on the longer-term trend in greenhouse gas emissions from road transport has been calculated using a new standalone model called ELIISA. More information can be found in Annex 2.

According to the projections, transport volumes will continue to grow over the forecast period, whereas GHG emissions start to decline (see Figure 3.4-7). The main reasons for emissions reductions are the replacement of fossil fuels with alternative transport fuels and the improvement of the energy efficiency of vehicles and the transport system.

Figure 3.4-7
Projection of the longer-term trend in greenhouse gas emissions in transport.



3.4.6 Assessment of economic and social impacts of response measures

Economic impacts

Most of the effects of the WM projection on the economy stem from the need to invest in new carbon-free and energy-efficient technologies in the energy, industry, and transport sectors. These large investments will probably dominate economic activity for most of the next two decades and entail account deficits, but once completed, they will facilitate a structural shift towards an energy- and material-efficient low-carbon economy, in which many of the current industries will become newly competitive and create export growth.

Economic growth and changes in the economy's structure also 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 indefinitely. However, in the short and medium terms, factors affecting labour input growth also matter because changes in labour input directly affect the economy's potential output. In Finland, the ageing population is the most significant single factor in terms of its effect on labour input and thus the development of the national economy in the short and medium terms. Another factor that will affect the availability of labour is the level of structural unemployment.

The previously mentioned new investments will result in both increased spending and changes to economic consumption and production structures.

At the microeconomic level, the WM projection assumes that businesses make mostly profitable investments. Nevertheless, less profitable investments (such as carbon capture technologies) may also be necessary to meet the strict emissions reduction targets. Such investments usually require subsidies or investment aid from the Government, which contributes to households being susceptible to a decline in their purchasing power. For example, if the Government implements a costly investment aid scheme to reduce emissions, it is likely that part of the funding will need to come from tax increases or spending reductions, which will also affect households.

An increase in energy prices due to emissions trading, taxation, or renewable fuel mandates reduces households' purchasing power. In absolute terms, the impact is most significant on households that consume the most energy and energy-intensive commodities and services, that is, middle- and high-income households. Yet in relative terms, the impact may be even more significant on lower-income households because they usually spend a larger part of their income on energy.

At the macroeconomic level, the new structures are expected to lead to improved economic efficiency, including labour productivity and new business opportunities, adding value especially to exports. Structural changes in the economy will also have impacts on employment. The total employment rate is expected to grow slightly thanks to new investments by large and medium-sized enterprises, especially in the energy sector. However, as is often the case, some sectors will benefit more than others. It is expected that the industrial and construction sectors, including expert work, product development, installation work, and production of renewable materials, will receive most of the benefits, whereas agriculture and services especially will add fewer jobs.

The Confederation of Finnish Industries maintains information about green and clean transition investments[86] in Finland. The data window puts the overall estimate of cumulative investments by 2035 at EUR 314 billion (June 2026 data). The largest estimated investments would be made in wind power (both offshore and onshore), clean hydrogen production, and battery materials production, to name a few.

Social impacts and just transition

The general principle of planning and preparing new policies and measures is that emissions reductions should be implemented in a way that is socially and regionally as fair as possible and in consultation with many sectors of society, including those most vulnerable and the Indigenous Saami people.

86 https://ek.fi/en/green-investments-in-finland/

Although Finland has top expertise in various sectors, skills gaps relevant to the green transition have already been identified. Demand for specialist work and other occupations requiring a high level of competence will increase. The labour market can adapt to the green transition, but targeted support measures related to jobseeking and employment may be required locally. It is likely that the transition will eventually affect a wide range of professions, as well as citizens' experience of societal development. Responding to these developments will require the strengthening of sustainability skills at all levels of education, and in all forms and programmes. In particular, there is a need to emphasise the role of transformative learning and challenging current practices, skills, and structures as part of building a knowledge base for the green transition. Workplace learning will therefore also play a key role in the green transition.

The EU Just Transition Fund (JTF) is one example of a direct policy instrument implemented in Finland. The JTF aims to halve the energy use of peat by 2030 and to mitigate adverse socioeconomic impacts. There are 14 different regional plans on implementing the JTF. It provides support for diversification of livelihoods, revitalising economic structures, and boosting employment by reskilling and upskilling the workforce, especially young people, in peat extraction and related sectors. Furthermore, peat fields will be restored to halt emissions where possible. Finland's EU funding from the JTF is approximately EUR 466 million. Public national funding, including some EUR 665 million, can be allocated to projects during the programme period from 2021 to 2027.

Since the Social Climate Fund (SCF) regulation came into force in the summer of 2023, Finland has actively sought to strengthen the knowledge base on the definitions of energy and transport poverty, and to identify (through numbers, regional distribution, and type) the households, transport users, and microenterprises affected by the expansion of the EU ETS. This is done via several avenues, both EU-related projects and national efforts. The scope and spread of energy poverty in Finland have been clarified in studies conducted by Gaia Consulting[87] and VATT Institute for Economic Research's data room.[88]

In addition, Finland is preparing the Social Climate Plan (SCP). The SCP forms part of the broader national and European climate policy framework, the key objective of which is to advance the green transition in a socially just manner. The Plan's preparation is linked to the EU Social Climate Fund (SCF), which is intended to support vulnerable EU citizens and businesses as emissions trading is extended to cover road transport and the separate heating of buildings (ETS2). The draft of Finland's national plan, which was published for broad public consultation until the end of August 2026, sets out measures

[87] https://energiavirasto.fi/-/uusi-selvitys-avaa-nakyman-energiakoyhyyden-ehkaisemiseen-suomessa

[88] https://vatt.fi/en/data-room

aimed at mitigating the social impacts of the extension of emissions trading and preventing energy and transport poverty in a context where the cost of using fossil fuels is increasing. The measures are targeted in particular at those groups and regions that are expected to be most strongly affected by these cost impacts. The objective is to improve the ability of households and micro-enterprises to adapt to the transition by reducing energy consumption, improving energy efficiency, or shifting to low-emission solutions, for example. At the same time, the proposed plan seeks to support a structural transformation towards more sustainable energy and mobility solutions. After the consultation process, the SCP will be finalised, and later assessed and approved by the European Commission.

3.5 Summary of greenhouse gas emissions and removals

A summary of greenhouse gas emissions and removals is presented in CTF Table 6 and in Table 1.1-1 of this report. Further information is provided in the CRT tables and in the national inventory document (NID) submitted as a stand-alone national inventory report (NIR) in conjunction with this report.

3.6 Projections of greenhouse gas emissions and removals

3.6.1 Overview of projections

The projections presented in this chapter are integrated energy and climate projections based on comprehensive modelling and assessments conducted by experts from various research fields. The projections were first modelled in an extensive project "Baseline scenarios for energy and climate policy package towards zero emissions" (PEIKKO)[89] financed by the Government's analysis, assessment and research activities, and updated in a similar project "New Measures and Scenarios for National Energy and Climate Policy" (KEITO)[90]. The modelling covers the energy system and all GHG sources and sinks that are included in the GHG inventory. The projections of the PEIKKO project include those policy measures that have been implemented by the previous Government or earlier than that, i.e. before 1 April 2023. In addition, the KEITO project took into account later EU-level policies. For this report, the projections of the KEITO project have been further updated with information and data on a few recently adopted or implemented policy measures. The resulting projection is called the WM projection.

[89] Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO), https://julkaisut.valtioneuvosto.fi/handle/10024/165717

[90] https://hiilineutraalisuomi.syke.fi/projektit/repower-cest/keito-hankeyhteistyo/

Because the government term is coming to an end, there are no major policy measures under planning at the time of writing. Therefore, no WAM projection is available for this report.

A pure "Without Measures Projection" (WOM) is not applicable to Finland's national circumstances and has therefore not been provided either. Some essential mitigation policies and measures (such as measures related to energy efficiency improvements and use of renewable energy) have been implemented since the 1970s. The creation of a WOM projection omitting all measures of previous climate and energy strategies (e.g. 2025, 2022, 2016, 2013, 2008, or 2005) would be very complicated and require significant effort, particularly in predicting the industrial structure. The technology development outlook in the energy sector would also be quite different without the current emissions trading system and binding renewable energy targets set by the EU. In other words, the outcome would be quite an arbitrary WOM projection. In Finland's case, a more reliable and suitable approach is to compare the current projection with previous WM projections, which is done in Section 3.6.4.

The Covid-19 pandemic and its assumed effects on the economy were considered in the modelling of the WM projection. The projection also includes the energy crisis and changed energy scene following Russia's unprovoked and unjustified invasion of Ukraine. This is especially reflected in cutting off all energy imports from Russia throughout the modelling period. For the LULUCF sector, the most recent results on a decline in tree growth from the national forest inventory now form the basis for the projection work. Certain measures considered as additional measures in BTR1 have been implemented and are now part of the WM projection, for example the investment subsidy scheme for biogenic carbon capture.

The starting point of the WM projection is 2024 (the most recent inventory year available in the annual greenhouse gas emission inventory submission to the UNFCCC in 2026). Climate and energy policies and measures that have been implemented or adopted by the end of June 2026 are as far as possible included in the "With Measures" (WM) projection. Section 3.4 discusses the policies and measures included in the WM projection, including estimated impacts on greenhouse gas emissions (as available) in more detail. The original time horizon of current projections is mid-term and targeted to the years 2030–2040.

The population growth in the projections is based on the population forecast drawn up by Statistics Finland in 2021. The population will increase only slightly from 5.56 million (end of 2022) to 5.60 million in 2030. In 2033, the population will start to decrease. The population's age structure will significantly change over the next couple of decades as the proportion of older age groups increases.

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 a macro-economic study for the ministries by Merit Economics. The current economic growth is modest but it is expected to improve toward the end of the decade. In the WM projection, the annual average increase in the national economic output is 1 per cent from 2020 to 2030 and 1.7 per cent from 2030 to 2040.

Regarding the forest industry, the basis for the WM projection is the same as in the BTR1 but the latest market development, including some production capacity closures, has been taken into account. As a result, compared to the BTR1, the total growth is more modest as the production volumes of pulp, cardboard and sawmill increase less and the volumes of other products, especially paper, continue to decline.

The key assumptions are summarized in Table 3.6-1

Table 3.6-1
Assumption of the WM projection

Parameter	Trend 2025 to 2040
GDP growth	1.5 per cent annually
Structure of economy	Increasing share of services
Structure of industry	Less capital and energy intensive
Population growth	Stable from 2020 to 2035 after which slowly decreases
Population structure	Ageing
Technology development	Gradual introduction of improved and more energy efficient technology, increased electrification

Projection of the key indicator, annual total net GHG emissions of the EU and its member states, consistent with the scope of the EU's NDC, is presented in the EU's BTR2 and its CTF Table 10 to determine progress towards EU's NDC. The key indicator in question is the same for the EU and its member states because they are committed together to a legally binding, joint emission reduction target described in their NDC.

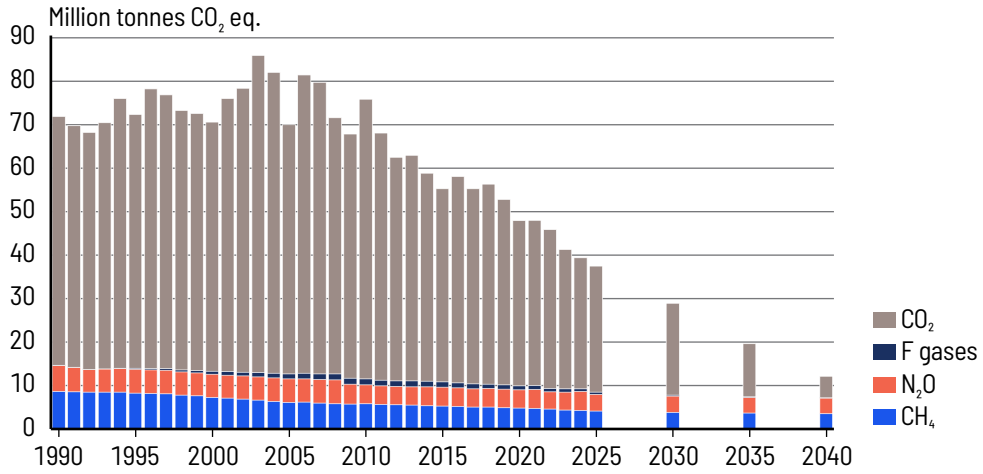
3.6.2 'With Measures' projection

3.6.2.1 Total effects

Total emissions in the WM projection from 1990 to 2040 are shown in Figure 3.6-1 (total emissions without the LULUCF sector) and Table 3.6-2 (without and with the LULUCF sector). Compared with the 1990 base year, the total greenhouse gas emissions without LULUCF are projected to be 59 per cent lower in 2030, and 83 per cent lower in 2040. The corresponding figures for

CO_2 emissions are 63 and 92 per cent. CH_4 emissions are expected to continue to decline steadily, being 49 per cent lower in 2030 and 53 per cent lower in 2040 than in 1990. N20 emissions are projected to decrease the least but still being 42 per cent lower in 2030 and 44 per cent lower in 2040 than in 1990. The amount of emissions from F-gases is small and expected to decrease further in the coming years.

Figure 3.61
Greenhouse gas emissions without LULUCF by gas according to the latest greenhouse gas emission inventory (1990 to 2024) and the WM projection (until 2040), million tonnes CO_2 eq.



The split of greenhouse gas emissions between the EU ETS sector and the non-ETS sector is illustrated in Figure 3.6-2 and Table 3.6-3. The historical ETS emissions correspond to the EU ETS scope of the emissions trading period from 2013 to 2024. The emissions in the EU ETS sector reached their peak in the mid-2000s and have declined since. In 2024, emissions in the EU ETS sector accounted for 34 per cent of the total greenhouse gas emissions without the LULUCF sector, whereas the non-ETS sector accounted for 66 per cent. The ETS emissions are expected to decrease further in the future being 72 per cent lower than the 2005 level in 2030 and around zero in 2040 provided that carbon capture becomes viable. The EU ETS and non-ETS emissions split is projected individually for the industrial branches and emission categories. The EU ETS and non-ETS shares for the projected years are based on GHG inventory data for the years 2022–2024 and presented in Table Annex 3-12.

The emissions from the non-ETS sector have decreased steadily since 2005, and the decrease is expected to continue. In the WM projection, the emissions from the non-ETS sector in 2030 are 45 per cent, and in 2040, 62 below the 2005 level when using the 2013–2020 scope for the EU ETS. Approximately 2.4 million tonnes of CO_2 eq. non-ETS emissions in 2005 originate from sources that have since been moved to the ETS sector. Carbon capture volumes of 0.2 million tonnes of CO_2 in 2030 and 0.6 million tonnes of CO_2 in 2040 contribute slightly to the non-ETS emissions reduction figures.

Table 3.6-2
Greenhouse gas emissions according to the most recent inventory data (1990 to 2024) and the WM projection (2025 to 2040)

	GHG emissions and removals (kilotonnes CO_2 eq.)											
	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
Sector												
1. Energy[1]	41,277	43,860	41,458	40,718	47,405	29,698	23,777	17,028	15,843	10,743	5,071	135
* Transport	12,091	11,312	12,071	12,870	12,668	10,850	10,461	9,632	9,450	6,536	4,458	3,160
2. Industrial processes and product use	5,276	4,994	5,978	6,702	6,232	5,763	5,185	4,556	4,603	4,553	3,192	2,070
3. Agriculture	7,829	6,880	6,675	6,442	6,582	6,497	6,435	6,401	5,940	5,784	5,728	5,798
4. Land use, land-use change and forestry	-28,832	-29,011	-29,944	-34,392	-31,125	-21,015	-2,578	9,768	9,336	7,393	6,742	5,512
5. Waste	5,208	5,125	4,251	3,119	2,837	2,311	1,915	1,624	1,503	1,250	1,067	929
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Indirect CO_2	164	130	106	86	67	55	66	42	41	31	24	18
Total (including LULUCF, with indirect)	43,012	43,289	40,594	35,546	44,667	34,159	45,261	49,052	46,716	36,290	26,281	17,622
Gas												
CO_2 emissions without net CO_2 from LULUCF[2]	57,086	58,254	57,125	57,152	64,158	44,247	37,784	29,945	28,830	21,040	12,070	4,808
CO_2 emissions with net CO_2 from LULUCF[2]	25,155	26,161	24,078	19,770	30,301	20,784	32,831	37,333	35,831	26,081	16,482	7,998
CH_4 emissions without CH_4 from LULUCF	8,728	8,368	7,363	6,182	5,938	5,394	4,896	4,411	4,219	3,933	3,755	3,643
CH_4 emissions with CH_4 from LULUCF	10,304	9,822	8,658	7,291	6,774	6,024	5,409	4,890	4,724	4,468	4,280	4,166
N_2O emissions without N_2O from LULUCF	5,976	5,490	5,328	5,454	4,349	4,316	4,228	4,284	3,808	3,693	3,575	3,565
N_2O emissions with N_2O from LULUCF	7,498	7,118	7,135	7,335	6,246	6,134	6,088	6,186	5,638	5,511	5,380	5,363
HFCs	0	149	693	1,123	1,321	1,193	904	614	490	198	105	63
PFCs	0	2	3	4	3	1	1	1	1	1	1	1
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	54	38	27	23	22	23	26	29	30	32	33	31
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (without LULUCF)	71,680	72,170	70,433	69,851	75,724	55,119	47,773	39,241	37,339	28,865	19,515	12,092
Total (with LULUCF)	42,848	43,159	40,488	35,459	44,600	34,104	45,195	49,010	46,675	36,259	26,257	17,604
Total (without LULUCF, with indirect)	**71,844**	**72,301**	**70,538**	**69,937**	**75,791**	**55,174**	**47,839**	**39,283**	**37,380**	**28,897**	**19,539**	**12,111**
Total (with LULUCF, with indirect)	**43,012**	**43,289**	**40,594**	**35,546**	**44,667**	**34,159**	**45,261**	**49,052**	**46,716**	**36,290**	**26,281**	**17,622**

[1] without transport; [2] with indirect CO_2; NO = not occurring

Figure 3.6-2
The split of greenhouse gas emissions between the EU ETS sector and the non-ETS sector (2005 to 2024) based on the latest greenhouse gas inventory and the WM projection (until 2040). The development of the total emissions without the LULUCF sector is also presented.

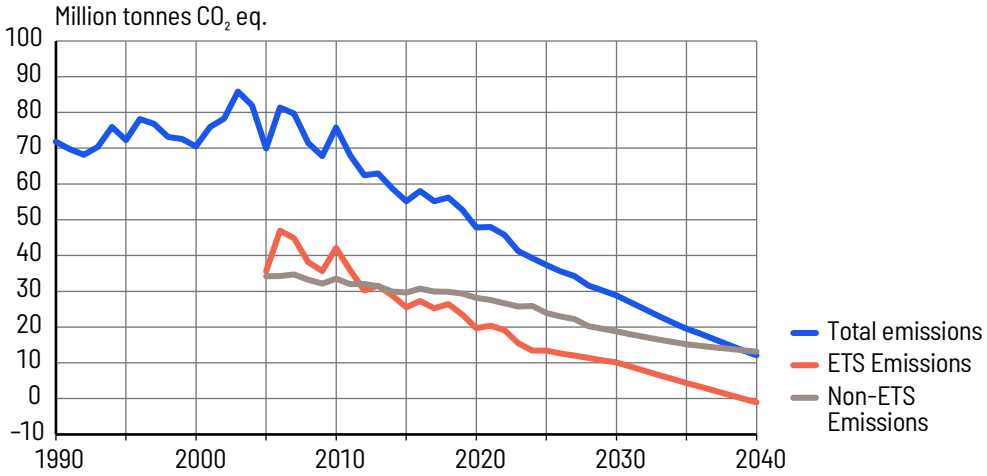


Table 3.6-3
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions in the Non-ETS and ETS sector and civil aviation based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical				**WM Projection**			
	2005	**2010**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
	million tonnes CO_2 eq.				**million tonnes CO_2 eq.**			
Non-ETS	34.338	33.711	28.170	25.872	23.939	18.785	15.189	13.147
ETS	35.297	41.853	19.580	13.265	13.241	9.844	4.082	–1.289
Civil aviation, CO_2	0.302	0.228	0.089	0.147	0.198	0.266	0.266	0.251
Total emissions	**71.844**	**69.937**	**47.839**	**39.283**	**37.378**	**28.895**	**19.538**	**12.109**

The development of total emissions regarding the number of inhabitants, primary energy use, and economic development is presented in Table 3.6-4. All indicators show a steady downward trend that continues in the WM projection. Today, the emissions are decoupled from both the GDP growth and energy use development and continue to decline steadily.

Table 3.6-4
Greenhouse gas emission intensity based on the latest greenhouse gas inventory for 2010-2024 and the WM projection for 2025-2040

	Historical			WM Projection			
	2010	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
Emissions per capita, tonnes CO_2 eq. /capita	14.08	8.64	6.97	6.76	5.22	3.52	2.45
Emissions per GDP, kg CO_2 eq./EUR (2025 prices)	0.30	0.18	0.14	0.13	0.10	0.06	0.04
Emissions per primary energy, tonnes CO_2 eq./MWh	0.19	0.13	0.11	0.11	0.08	0.05	0.04

3.6.6.2 Sectoral emissions

Energy

The energy sector is strongly affected by policy measures to reduce emissions, enhance energy efficiency and increase the share of renewable energy sources. Both the supply and demand sides have faced significant changes in the last decade: part of the changes results from policy measures; part from technological development and the development of the energy and fuel markets. However, the transition is not yet completed, and the emissions will decline further in the energy sector. As many of the changes involve or concern large investments, the effects are robust and enduring.

The supply and demand situation in the Nordic-Baltic regional electricity market to which Finland belongs was a very important factor affecting the Finnish power supply's greenhouse gas emissions in the past when a considerable share of the domestic generation capacity was still based on fossil fuels. However, 96 per cent of the Finnish electricity production is emissions-free today resulting in lower and less varying total greenhouse gas emissions for Finland.

In the WM projection, the most significant recent changes in electricity generation are the rapid increase in wind power in the 2020s and the start-up of a new 1,600 MW nuclear power plant unit in 2022. Going forward, the significant increase in use of renewable energy sources and waste heat both in electricity and heat production is expected to continue. Use of coal for energy is banned from May 2029, and use of peat has rapidly decreased due to high EU ETS prices. All these changes reduce emissions.

Factors affecting the future energy demand are primarily energy efficiency measures, as well as the economic development and structural and technology changes within the industry. According to the WM projection, energy used to heat residential and service sector buildings will decrease,

even though the volume of buildings is expected to increase continuously. The emissions from space heating are decreasing even faster than energy demand due to the increased use of renewable energy and other low-carbon energy sources. In the district heating sector, the share of heat pumps and electric boilers is growing rapidly at the expense of conventional generation, especially combined heat and power production, which has been struggling with feasibility. Highly volatile electricity prices and rising prices of emission allowances and fuel prices in the 2020s have challenged combustion-based heat and power generation causing power plants to shut down as a result of poor profitability.

District heating, power generation, and industrial energy use are strongly affected by the EU ETS price, which makes use of fossil fuel increasingly infeasible and with energy taxation, efficiently cuts emissions in these sectors. This trend will lead to increased electricity demand replacing some fossil fuel consumption, which is also reflected in the low-carbon roadmaps prepared by all major industries and sectors. In power generation, the emphasis has shifted from fossil fuels (especially coal and natural gas) and peat to renewable energy sources and nuclear power. In district heating and industry, fossil fuels are increasingly being replaced with renewables, waste heat recovery and even direct electrification. Electrification is a major trend in the industrial sector and in heating and cooling, resulting in more electric boilers, heat pumps and electricity-based industrial processes.

In specific industrial sectors, electrolysis-based hydrogen production is also expected to take off, although the exact timing is difficult to predict. Carbon capture in its various forms (such as CCS, CCSU, BECCS[91]) could reduce emissions even further, but the timing of large-scale deployment is equally difficult to estimate. Annex 2 presents the exact carbon capture volumes used in the WM projection. Electrification is also taking place in other sectors like transport, due to which (together with Finland's biofuel and other policies) the refining volumes of fossil oil are also decreasing.

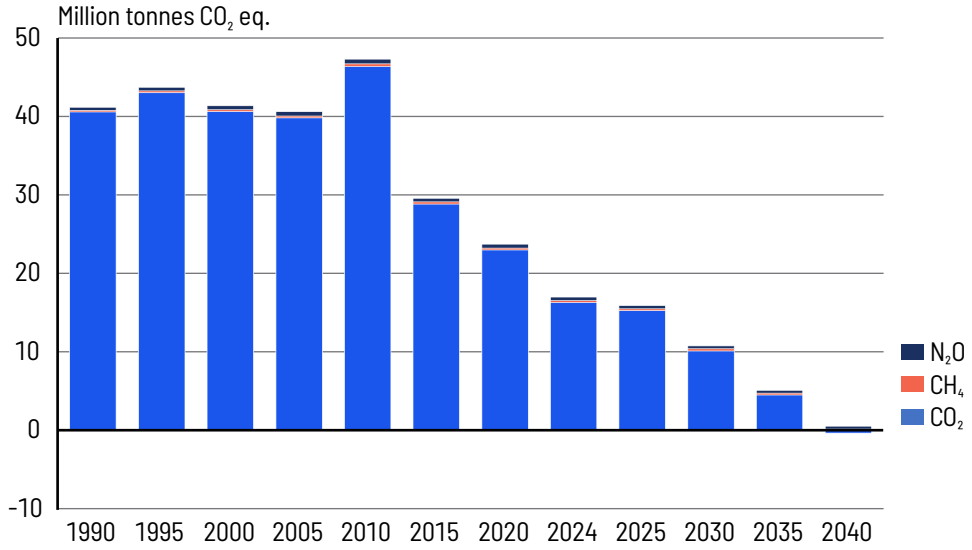
The historical and projected emissions from the energy sector (excluding transport) in the WM projection are presented in Table 3.6-5 and Figure 3.6-3. The emissions in the energy sector are mainly CO_2 emissions from combustion of fossil fuels and peat. Most of the energy production, as well as industrial energy use, is subject to the EU Emissions Trading System.

[91] CCS= carbon capture and storage, CCSU=carbon capture, storage and utilisation, BECCS = bioenergy with carbon capture and storage

Table 3.6-5
Historical (1990–2024) and projected (2025–2040) greenhouse gas emissions from the energy sector (excluding transport, including carbon capture) based on the latest inventory and the WM projection, respectively

	Historical								WM projection			
	1990	1995	2000	2005	2010	2015	2020	2024	2025	2030	2035	2040
	million tonnes CO_2 eq.								million tonnes CO_2 eq.			
Total emissions	41.28	43.86	41.46	40.72	47.40	29.70	23.78	17.03	15.84	10.74	5.07	0.14
CO_2	40.71	43.15	40.74	39.92	46.53	28.97	23.12	16.42	15.28	10.17	4.55	-0.33
CH_4	0.23	0.33	0.31	0.36	0.37	0.32	0.27	0.25	0.24	0.25	0.24	0.22
N_2O	0.34	0.38	0.41	0.44	0.50	0.41	0.38	0.35	0.33	0.32	0.28	0.25

Figure 3.6-3
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the energy sector (excluding transport, including carbon capture) based on the latest greenhouse gas inventory and the WM projection, respectively



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

The impact 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 low.

Non-ETS emissions within the energy sector (excluding transport) are mainly the result of using fossil fuels for machinery and driers, space heating of buildings and industry outside the EU ETS. In the WM projection, the emissions from individual heating of residential and commercial buildings decrease from the recent approximately 1 million tonnes of CO_2 eq. to 0.2 million tonnes of CO_2 eq. in 2030 and close to zero in 2040. The emissions from machinery are expected to decrease from their current level, i.e. 2.4 million tonnes of CO_2 eq. to 2.1 million tonnes by 2030 and 1.5 million tonnes by 2040. The reasons for this favourable development are more efficient equipment (including some electric machinery) and a more efficient use of the equipment. The emissions from non-ETS industrial energy use remain at around the current level of 0.6 million tonnes of CO_2 eq. in the WM projection at first and decrease later, despite an increase in activity. The energy-related emissions from agriculture and forestry are 1.4 million tonnes of CO_2 eq. today, of which 0.6 million tonnes of CO_2 eq. originates from machinery. By 2030 and 2040, the energy-related emissions in agriculture and forestry are expected to decrease to 1.0 and 0.7 million tonnes of CO_2 eq., respectively.

Emissions from facilities that burn municipal waste are mainly included in the effort sharing sector as well, while emissions from co-incineration plants belong to the EU ETS. The waste incineration emissions of the effort sharing sector have increased significantly since 2005. The increase in emissions is due to the increase in the energy utilisation of municipal waste. About 55 per cent of the municipal waste generated in 2024 was used as energy, while in 2008 only about 17 per cent of the municipal waste was incinerated. In 2008, emissions from municipal waste incineration were lower than 0.1 million tonnes of CO_2 eq. and, in 2024, 1.0 million tonnes of CO_2 eq. Emissions from waste incineration are still expected to increase slightly in the next few years, but level off after that.

Transport

Greenhouse gas emissions from domestic transport (without domestic aviation) totalled 9.5 million tonnes of CO_2 eq. in 2024. Transport emissions account for approximately a fourth of Finland's total greenhouse gas emissions (without LULUCF) and approximately 37 per cent of the emissions in the effort sharing sector. Greenhouse gas emissions from domestic transport have mainly been decreasing since 2008. From 2005 to 2024, greenhouse gas emissions from transport (without domestic aviation) dropped by some 3 million tonnes in total, or by 24 per cent.

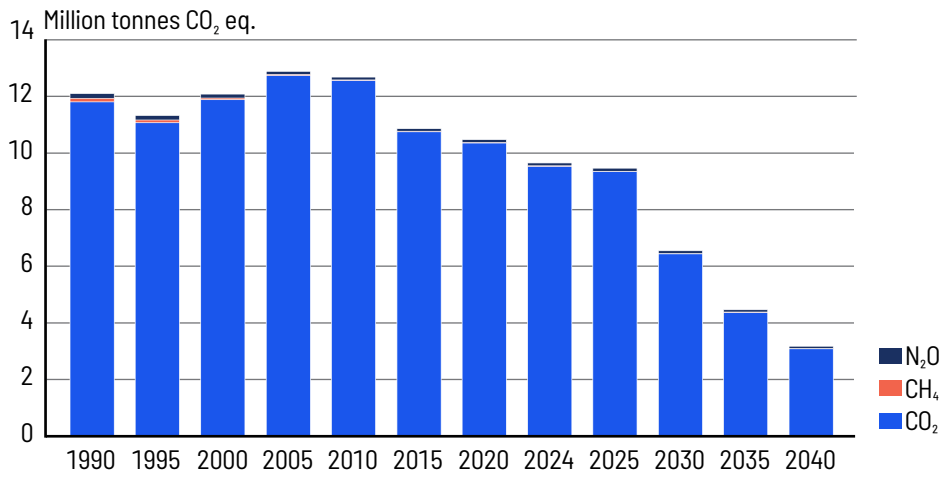
Table 3.6-6 and Figure 3.6-4 present the historical and projected greenhouse gas emissions, including domestic aviation. The WM projection for transport is

based on the traffic performance projected until 2040 by the Finnish Transport and Communications Agency Traficom. In road transport, the transport performance of passenger cars is increasing as a result of the strong increase in the number of electric cars. This is due to the reduction in the marginal cost of driving. By 2030, it is estimated that the vehicle kilometres of passenger cars will grow by 10 per cent from 2024, and that of other vehicles (mainly heavy-duty) remains at the current level. Other key assumptions in the WM projection are the replacement rate of cars and technologies and the average CO_2 emissions of new vehicles, which are projected by VTT Technical Research Centre of Finland Ltd. In the WM projection, the annual replacement rate of cars is estimated at approximately 5 per cent. In 2030, the specific emissions of new cars would be close to the limit that the EU has established for car manufacturers, and in 2035, sales of combustion engine cars would stop completely. The latter is consistent with the European Commision's previous plan, which was included in the projection as well at the time of modelling. The Commission has later proposed to relax the requirement. The third factor having a substantial impact on transport greenhouse gas emissions in the WM projection is the share of biofuels in the total consumption of fuel in road transport. The distribution obligation has been lowered for the years 2024–2027 compared to what was stipulated by the national legislation previously in force. This will result in a slower but temporary decrease of the emissions from transport until 2027. Most of the measures will be focused on road transport where, with existing measures (WM), emissions could be reduced by approximately 52 per cent, or 6.70 million tonnes of CO_2 eq., by 2030 and by approximately 78 per cent, or 10.0 million tonnes of CO_2 eq., by 2040 compared to 2005. In the period 2005–2024, the emissions fell by approximately 3.4 million tonnes. The emissions from domestic aviation have been roughly 0.2 million tonnes of CO_2 eq. except for the years after the Covid-19 pandemic and are expected to increase slightly.

Table 3.6-6
Historical (1990 to 2024) and projected (2025 to 2040) 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	2020	2024	2025	2030	2035	2040
	million tonnes CO_2 eq.								million tonnes CO_2 eq.			
Total emissions	12.09	11.31	12.07	12.87	12.67	10.85	10.46	9.63	9.45	6.54	4.46	3.16
CO_2	11.82	11.08	11.89	12.74	12.57	10.76	10.36	9.54	9.35	6.45	4.38	3.09
CH_4	0.13	0.10	0.07	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01
N_2O	0.14	0.14	0.11	0.09	0.07	0.07	0.08	0.07	0.08	0.08	0.07	0.05

Figure 3.6-4
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from transport based on the latest greenhouse gas inventory and the WM projection, respectively



International bunkers

According to the most recent GHG emission inventory, the total emissions from international bunkers for international marine transport were 0.9 million tonnes of CO_2 eq. in 2024, which is similar to before the pandemic in 2019. In contrast, the pandemic affected international aviation, as according to the most recent GHG emission inventory, the total emissions were 2.0 million tonnes of CO_2 eq. in 2024, which is approximately a fifth less than in 2019.

At present, no sector-specific projection is available for international bunkers. However, the emissions from international aviation are expected to decrease through the European Union's Emissions Trading System (ETS) and sustainable aviation fuel mandate. The EU ETS will likely result in emissions reductions of marine bunkers as well.

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 volumes and technology changes. In the WM projection, the growth of the industrial production volumes increases these emissions. Most of the emissions other than F-gases in this sector are part of the EU ETS, which is also the main measure for reducing process emissions. Other measures driving low-carbon technology investments in the manufacturing industry are increased funds for new technology investments and the reduction of the electricity tax.

In the WM projection, it is assumed that the industrial use of fossil fuels will decrease thanks to the above measures. It is expected that use of peat will be replaced with biomass almost completely in every sector. In carbon steel

production, Finland's largest steel mill has disclosed plans to replace the existing two blast furnaces with electric arc furnaces and the use of carbon-free direct reduced iron (or sponge iron). However, the exact timing of this shift is still a significant uncertainty, as well as the availability of carbon-free direct reduced iron. The assumption in the WM projection for the commissioning of the first blast furnace is by 2035 and for the second one by 2040. In the chemical industry, the share of fossil fuels will probably decrease due to the largest plastic producer's plans to replace the existing chemical cracking furnace with an electric cracking process. In the WM projection, the replacement will be implemented by 2045. In hydrogen production, use of natural gas as raw material will be partially replaced with electrolysis. The low-carbon roadmaps prepared by different industries also include additional but more high-level measures that are difficult to include in the projection but are expected to decrease industrial emissions further in the future.

In 2024, F-gas emissions totalled 0.6 million tonnes of CO_2 eq., which currently equals approximately 2.4 per cent of the emissions in the effort sharing sector and 1.6 per cent of the national total greenhouse gas emissions. The emissions peaked in 2008 at approximately 1.4 million tonnes of CO_2 eq. Since then, emissions have decreased by more than 50 per cent. More than 90 per cent of the emissions originate from the use of F-gases as refrigerants in refrigeration and air-conditioning equipment. The WM projection for F-gases includes the impacts of the EU F-gas Regulation[92] and the so-called EU MAC Directive (Mobile Air-Conditioning Directive) that prohibits the use of HFCs with a GWP higher than 150 in air-conditioning systems in passenger cars and light commercial vehicles. The main features of the F-gas regulation in cutting F-gas emissions are a phase-out of HFCs that can be placed on the EU market by 2050, bans on the use of F-gases in certain applications and obligations related to leak checking and repairs, F-gas recovery and technician training. As a result, F-gases will be replaced with natural and other low GWP alternatives in most applications. The existing measures are estimated to reduce F-gas emissions to 0.2 million tonnes of CO_2 eq. by 2030 and further to 0.1 million tonnes of CO_2 eq. by 2040.

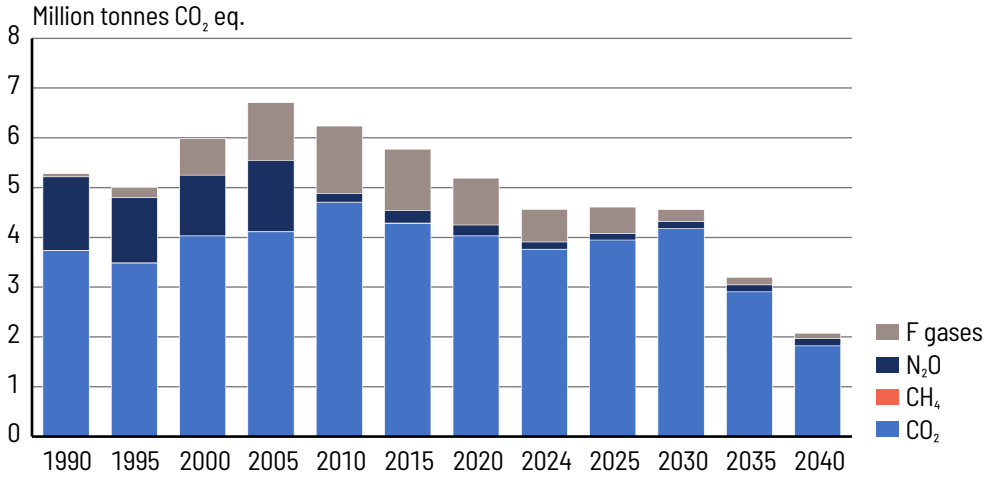
Emissions from solvent and other product use are expected to remain at their present level in the WM projection. Historical and projected greenhouse gas emissions from industrial processes and other product use are presented by gas in Table 3.6-7 and Figure 3.6-5.

[92] 573/2024

Table 3.6-7
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the industrial processes and other product use sector based on the latest greenhouse gas inventory and the WM projection respectively

	Historical								WM Projection			
	1990	1995	2000	2005	2010	2015	2020	2024	2025	2030	2035	2040
	million tonnes CO_2 eq.								million tonnes CO_2 eq.			
Total emissions	5.28	4.99	5.98	6.70	6.23	5.76	5.18	4.56	4.60	4.55	3.19	2.07
CO_2	3.74	3.49	4.04	4.12	4.71	4.29	4.04	3.77	3.95	4.19	2.91	1.83
CH_4	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N_2O	1.47	1.31	1.22	1.43	0.17	0.25	0.22	0.14	0.13	0.13	0.14	0.15
F-gases	0.05	0.19	0.72	1.15	1.35	1.22	0.93	0.64	0.52	0.23	0.14	0.10

Figure 3.65
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the industrial processes and other product use sector based on the latest greenhouse gas inventory and the WM projection, respectively



Agriculture

In recent years, changes in the emissions from agriculture have been small. The emissions in the agricultural sector in 2024 totalled about 6.4 million tonnes of CO_2 eq. Agricultural sector is the second most significant source of greenhouse gas emissions in Finland, accounting for approximately 16 per cent of Finland's total emissions and approximately 25 per cent of emissions from the effort sharing sector. Over the past two decades, emissions from the agricultural sector have remained relatively stable, fluctuating within a narrow range of approximately 6.2–6.6 Mt CO_2 eq. (Table 3.6-8). Agriculture WM projection was updated in autumn 2026 (Table 3.6-8, Table 3.6-9 and Figure 3.6-6). In the WM projection, the total emissions from the agricultural sector are expected to decrease by around 0.6 million tonnes of CO_2 eq. by

2030 compared to the 2024 level. After this, the emissions from agriculture are expected to remain between 5.8 and 5.7 million tonnes of CO_2 eq./year until 2040. This is because the number of animals will remain more or less at the 2025 level or decrease very slowly, while emission reduction measures in peatlands are assumed to remain at their current level throughout the projection period. The minor decrease in livestock numbers, together with the increasing treatment of manure in biogas plants, is projected to reduce emissions from manure management and manure application by around 0.26 million tonnes of CO_2 eq. by 2040. The N_2O emissions from agricultural soils are expected to decrease by around 0.1 million tonnes of CO_2 eq. by 2040. Energy-related emissions related to agriculture are reported in the energy sector and not included in Tables 3.6-8 and 3.6-9.

Table 3.6–8
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the agriculture sector based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical								WM projection			
	1990	1995	2000	2005	2010	2015	2020	2024	2025	2030	2035	2040
	million tonnes CO_2 eq.								million tonnes CO_2 eq.			
Total emissions	7.83	6.88	6.67	6.44	6.58	6.50	6.44	6.40	5.94	5.78	5.73	5.80
CO_2	0.65	0.41	0.35	0.29	0.28	0.17	0.20	0.17	0.20	0.20	0.20	0.20
CH_4	3.24	2.90	2.83	2.77	2.82	2.85	2.79	2.61	2.56	2.52	2.53	2.57
N_2O	3.94	3.57	3.49	3.38	3.48	3.48	3.44	3.62	3.18	3.07	2.99	3.02

Figure 3.6–6
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from agriculture based on the latest greenhouse gas inventory and the WM projection, respectively

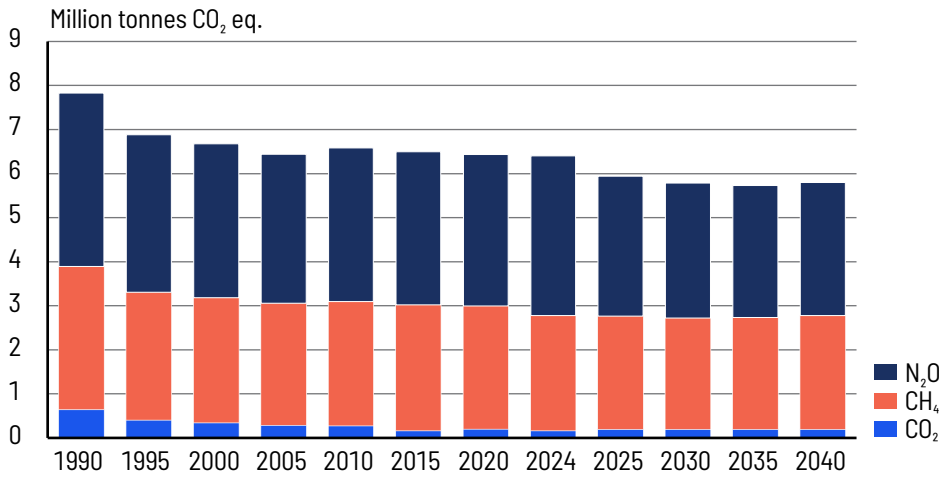


Table 3.6–9
Projected greenhouse gas emissions for 2025 to 2040 by categories and the emissions in 2024

	Historical	WM Projection			
	2024	2025	2030	2035	2040
		million tonnes CO_2 eq.			
WM – total	**6.40**	**5.94**	**5.78**	**5.73**	**5.80**
Enteric fermentation, CH_4	2.08	2.04	2.03	2.07	2.11
Manure management, CH_4	0.53	0.53	0.49	0.46	0.46
Manure management, N_2O	0.27	0.27	0.26	0.24	0.24
Agricultural soils, N_2O	3.35	2.91	2.81	2.75	2.79
Liming and urea application, CO_2	0.17	0.20	0.20	0.20	0.20

LULUCF

The LULUCF sector was a net sink from 1990 to 2017, after which the sector has either been a net source of emissions or a small net sink. In 2024, the LULUCF sector as a whole acted as a source of 9.8 million tonnes of CO_2 eq. as total removals in the sector were smaller than the total emissions. Forest land and harvested wood products were the main net sink, whereas cropland, organic forest soils and wetlands were the main source of emissions. The development of emissions and removals in the LULUCF sector is described in Section 3.1.1. The latest historical and projected emissions and removals by land-use category and for harvested wood products are presented in tables 3.6-10 and 3.6-11 and Figure 3.6-7.

The LULUCF WM scenario was originally prepared as a part of the "Baseline scenarios for energy and climate package towards zero emissions"[93] in June 2024. Since then, projection has been updated twice due to methodological changes. In the most recent update, prepared in autumn 2026, the LULUCF sector is projected to remain a net source of emissions throughout the period from 2025 to 2040.

[93] Baseline scenarios for energy and climate policy package towards zero emissions. Publications of the Government's analysis, assessment and research activities 2024:26. Prime Minister's Office. https://urn.fi/URN:ISBN:978-952-383-219-0

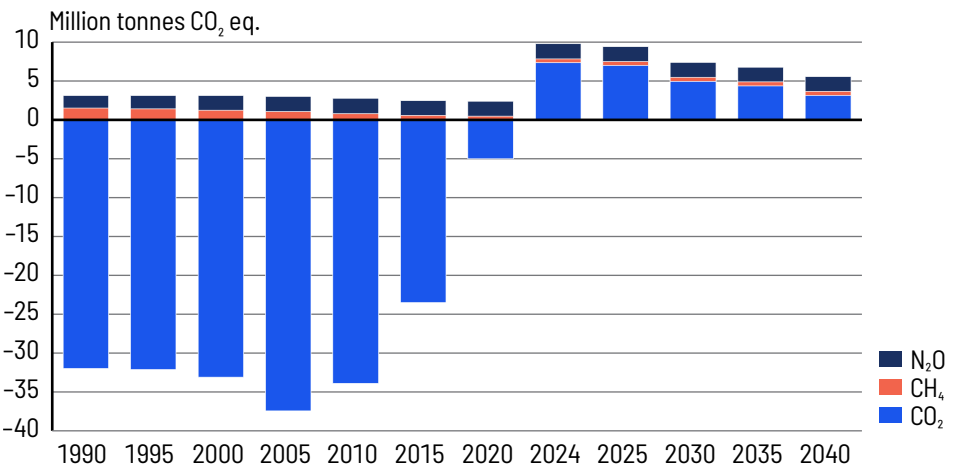
Table 3.6-10
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the LULUCF sector based on the latest greenhouse gas inventory and the WM projection, respectively

	Historical								WM projection			
	1990	1995	2000	2005	2010	2015	2020	2024	2025	2030	2035	2040
	million tonnes CO_2 eq.								million tonnes CO_2 eq.			
Total emissions	-28.83	-29.01	-29.94	-34.39	-31.12	-21.02	-2.58	9.77	9.34	7.40	6.70	5.50
CO_2	-31.93	-32.09	-33.05	-37.38	-33.86	-23.46	-4.95	7.39	7.04	5.00	4.40	3.20
CH_4	1.58	1.45	1.29	1.11	0.84	0.63	0.51	0.48	0.51	0.54	0.53	0.52
N_2O	1.52	1.63	1.81	1.88	1.90	1.82	1.86	1.90	1.83	1.82	1.80	1.80

Table 3.6-11
Projected greenhouse gas emissions for 2025 to 2040 by categories and the emissions in 2024

	Historical	WM Projection			
	2024	2025	2030	2035	2040
		million tonnes CO_2 eq.			
WM - total	**9.77**	**9.34**	**7.39**	**6.74**	**5.51**
Forest land	-0.13	0.83	0.11	-0.64	-2.21
Cropland	8.44	7.61	6.66	6.97	7.33
Grasslands	0.65	0.77	0.77	0.77	0.76
Wetlands	2.09	2.07	1.62	1.34	1.25
Settlements	0.87	1.22	1.20	0.97	0.78
Harvested wood products	-2.14	-3.16	-2.96	-2.66	-2.41

Figure 3.6-7
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions and removals from the LULUCF sector based on the latest greenhouse gas inventory and the WM projection, respectively



Forest land is projected to be a small net source of emissions from 2025 to 2030 in the updated WM projection. By 2035, forest land is projected to become a small net sink, which is expected to strengthen throughout the rest of the projection period. In the WM projection, the area of forest land will decrease by only approximately 5,000 ha by 2055. Between 2024 and 2055, both the area of deforestation and the area of afforestation are projected to be approximately 300,000 hectares. Deforestation is mainly caused by construction. Most new forest land is expected to originate from grassland (approximately 102,000 hectares), but also from other land use categories, such as peat production areas (47,000 hectares) and cropland (25,000 hectares). Approximately 31,000 hectares of forest land are projected to become converted to cropland between 2024 and 2055.

In the WM projection, annual roundwood removals are estimated to average 74.3 million cubic metres in 2021–2030 and 73.4 million cubic metres in 2031–2040.

In the WM projection, the emissions are projected to decrease to 6.97 million tonnes of CO_2 eq. for cropland and increase to 0.77 million tonnes of CO_2 eq. for grasslands by 2035. The area of arable land is projected to decrease by approximately 80,000 hectares by 2055.

The Harvested Wood Products (HWP) pool has been a net sink throughout the period from 1990 to 2024, except in 2009. The annual fluctuations in the HWP net removals are mainly caused by changes in production volumes, which are affected by the economic situation and the demand for wood products. In the WM projection, the HWP sink is projected to decrease over time during 2025–2040. This is because production is projected to remain at its current level, while carbon continues to be released from products already in the HWP pool. Because paper and paperboard have considerably shorter lifetime than solid wood products, their contribution to the HWP balance responds more rapidly to changes in production and produces net emissions in some years.

In the WM projection, the emissions from wetlands are expected to decrease to 1.25 million tonnes of CO_2 eq. by 2040. Peat extraction areas are the most significant source of emissions. The projected decrease in emissions is mainly due to the declining use of peat for energy, which reduces the area needed for peat extraction.

Waste / Waste management

Greenhouse gas emissions from waste management (excluding incineration) totalled 1.6 million tonnes of CO_2 eq. in 2024, or four per cent of Finland's total emissions. The most significant greenhouse gas produced in waste management is methane emitted from landfills. Waste management emissions

in the effort sharing sector also include the greenhouse gases produced in the biological treatment of waste and in the disposal and treatment of wastewater: CO_2, methane and nitrous oxide. These emission sources are of limited importance and their emission volumes are stable. Greenhouse gas emissions from waste management have reduced by approximately 48 per cent from 2005 to 2024. The greatest reductions have been achieved in methane emissions from landfills following a decrease in the landfilling of organic waste. The increased use of digestion in the biological treatment of waste has slightly reduced CO_2 emissions from biological treatment. However, CO_2 is still being emitted from the digestion residue that will be composted and the remaining compost windrows. According to the WM projection, emissions from the waste management sector will decrease by around 60 per cent by 2030 compared to the 2005 levels.

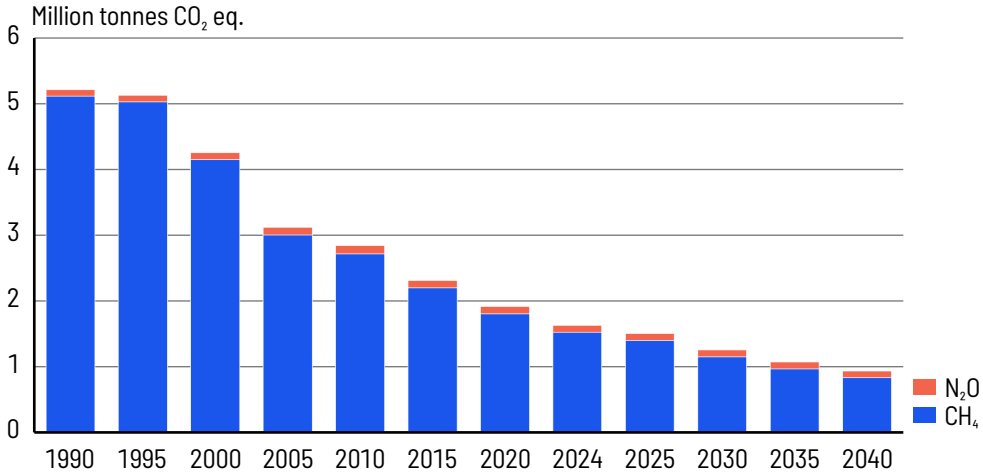
Emissions from facilities that burn municipal waste are discussed above in connection with the energy sector.

Historical and projected greenhouse gas emissions from the waste sector (excluding waste incineration) are presented by gas in Table 3.6-12 and Figure 3.6-8.

Table 3.6–12
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the waste sector based on the latest greenhouse gas inventory and the WM projection, respectively (waste incineration not included)

	Historical								**WM projection**			
	1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
	million tonnes CO_2 eq.								**million tonnes CO_2 eq.**			
Total emissions	**5.21**	**5.12**	**4.25**	**3.12**	**2.84**	**2.31**	**1.92**	**1.62**	**1.50**	**1.25**	**1.07**	**0.93**
CH_4	5.12	5.04	4.16	3.01	2.72	2.20	1.81	1.53	1.41	1.15	0.97	0.84
N_2O	0.08	0.09	0.09	0.11	0.12	0.11	0.11	0.09	0.10	0.09	0.09	0.09

Figure 3.6–8
Historical (1990 to 2024) and projected (2025 to 2040) greenhouse gas emissions from the waste sector based on the latest greenhouse gas inventory and the WM projection, respectively (waste incineration not included)



3.6.3 'With Additional Measures' projection

Because the government term is coming to an end, there are no major policy measures under planning at the time of writing. Therefore, no WAM projection is available for this report.

3.6.4 Assessment of aggregate effect of policies and measures

In total 119 policy measures are reported in CTF Table 5. Six of the measures have expired but still reduce emissions whereas the status of eleven measures is "planned". The aggregated estimates for the greenhouse gas reduction impacts of the individual implemented policies and measures presented in Section 3.4 are 44 and 36 million tonnes CO_2 eq. for 2030 and 2040, respectively. The smaller emissions reduction in 2040 than in 2030 is partly explained by the fact that 2040 impact estimates are not available for every measure for which a 2030 impact is reported. The emissions reduction in 2030 for the set of measures for which the 2040 impact estimates are available is in total 38 million tonnes CO_2 eq.

Implemented and adopted measures cause 90 per cent of the reported emissions reductions. Expired measures contribute to almost 4 million tonnes CO_2 eq. emissions reduction during the whole reporting period. Expired building regulations bring about most of the reduction in the expired measures category. Regarding planned measures, only a few have had their emissions

reduction impact assessed and reported. The reported effect of planned measures is in total less than 0.1 million tonnes CO_2 eq. Table 3.6-13 presents the total effect of the current, planned and expired policies and measures which has been calculated with a bottom-up approach.

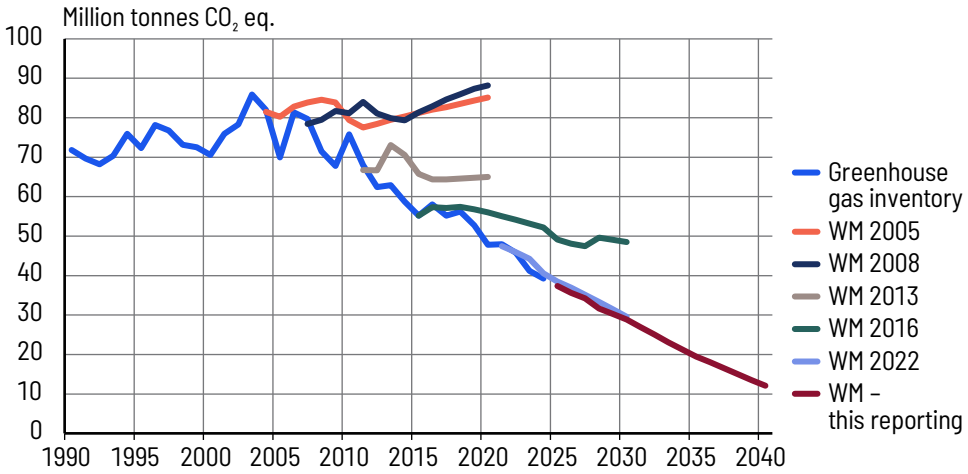
Table 3.6-13
The total effect of the policies and measures (PaMs) calculated based on estimated impact of PaMs for the years 2025, 2030, 2035 and 2040 (million tonnes CO_2 eq)

	Total effects of PaMs			
	2025	2030	2035	2040
	million tonnes CO_2 eq.			
Total	**40.64**	**44.23**	**42.85**	**35.70**
of which				
implemented or adopted	36.68	40.20	38.86	31.71
expired	3.96	3.96	3.97	3.97
planned	0.00	0.07	0.02	0.02

The estimated total effect of policies and measures contains noticeable uncertainties. First of all, mitigation impact estimates are not available for all policies and measures. There are various reasons for this, see Annex 3. Furthermore, the impact estimates of individual policies and measures are not always fully additive. The overlapping effect of measures has, however, been paid due attention to whenever possible – for example in the case of the simultaneous increase of biofuel content and energy efficiency in machinery, the transport sector, and heating. Altogether, the total emissions reduction is probably larger than the reported total effect.

A top-down assessment of the overall effect of mitigation policies and measures is possible by comparing the greenhouse gas emissions of this reporting with WM projections from earlier reporting rounds. Figure 3.6-9 shows Finland's greenhouse gas emissions in the WM projections of five national climate and energy strategies, i.e. strategies from 2005, 2008, 2013, 2016 and 2022, in addition to this reporting. The WM projections in the national energy and climate strategies 2005–2016 projected significantly higher emissions for 2020 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 total emissions.

Figure 3.6–9
Greenhouse gas emissions according to the most recent inventory for 1990 to 2024 and in the WM projections of the climate and energy strategies published in 2005, 2008, 2013, 2016 and 2022, and the WM projection of this reporting



The main difference between the projections shown in Figure 3.6–9 is that most measures from the previous WAM projections have been implemented since the previous reporting and are therefore included in the following WM projections. Promoting renewable energy in different forms, energy efficiency agreements, building regulations and F-gas measures are the measures with the greatest impact. Another significant difference since the WM projections of 2013 and earlier years is the result of domestic conventional condensing power capacity being shut down almost entirely. Furthermore, combined heat and power plants are struggling with feasibility and have been shut down ahead of time due to market circumstances and the prohibition of coal energy use. Electrification of society and the introduction of new emissions-free technology in all sectors are advancing earlier and faster than previously expected. This positive development is partly thanks to policy measures speeding up the deployment of low-carbon technologies but presumably also a result of increased climate change awareness.

The total effect of implementing additional measures can be seen in the emission development trend after 2015, which levelled off in the 2013 and 2016 projections, but was notably upwards in the projections from 2005 and 2008. In turn, the WM projection of this reporting and the one published in 2022 are clearly in decline.

For comparison purposes, the WM projections from 2005 and 2008 can be considered reasonable WOM (Without Measures) projection substitutes, even though they already include some mitigation measures. The gap between the projections for 2005 to 2008 and the projection of this reporting would presumably be around 60 million tonnes of CO_2 eq. in 2030 if the old projections would have extended that far into the future. This is relatively well in line with the bottom-up estimation of the total effect of policies which gives 44 million

tonnes of CO_2 eq. emissions reduction in 2030 noting that the bottom-up estimate does not cover all measures.

3.6.5 Sensitivity analysis of the projections

Energy use and hence greenhouse gas emissions are sensitive to the assumptions made for economic growth. Two sensitivity analyses have therefore been carried out for the WM projection, varying the economic growth of industry and service branches. No sensitivity analysis of the transport sector was made, but lower economic growth could generally have both a reducing and an increasing impact on energy use and greenhouse gas emissions for transport. On the one hand, the need for transport is likely to be lower; on the other, the renewal of the transport fleet will be slower. The situation is similar for buildings in which lower economic growth results in slower growth of the building volume, but also in less investment in energy efficiency and change of heating source. In the sensitivity analyses, energy uses in the transport sector and buildings remain unchanged.

The manufacturing industry uses slightly less than 45 per cent of both the Finland's final energy and 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 significantly influences the projections. The energy balance projections for these branches are based on product-group-specific volume estimates. Both branches develop generally positively in the WM projection meaning increasing industrial activity, even though some product groups already decrease (e.g. paper manufacturing) in the base case WM. In the sensitivity analyses, the annual growth of the product volumes in the forest and metal industries is varied by 1 percentage point in both directions from 2025 compared to the WM projection.

In addition to the branches and sectors mentioned above, the annual growth rate of the other industry and service branches was varied by plus and minus 1 percentage point from the WM assumptions. No dynamic effects were considered.

The results of the sensitivity analyses are presented in Table 3.6-14 below. The overall effect of a lower economic growth (WM–) results in a steeply decreasing final energy consumption in contrast to a higher economic growth (WM+), which leads to a steady final energy consumption at a higher level than the 2024 consumption. In turn, in the base case WM projection, the final energy consumption decreases modestly from 2030 to 2040.

In 2030, the final energy consumption would be only 277 TWh in the low growth case, but 290 TWh in the high growth case compared to 283 TWh in the base

case WM. The corresponding figures for primary energy consumption are 366 TWh (WM–), 379 TWh (WM+), and 372 TWh (base case WM). The relative impact of economic growth is therefore slightly stronger on final energy consumption than on primary energy. The greenhouse gas emissions in 2030 differ in both cases in total by about 0.5 million tonnes of CO_2 eq. from the emissions in the base case WM projection. Most of the emissions increase and reduction would take place in the ETS sector, with only a 0.1 million tonnes of CO_2 eq. reduction in the non-ETS sector.

Table 3.6-14
Main results for the sensitivity analysis on how the economic growth rate affects the overall energy balance and GHG emissions

			2030			2035			2040		
	Unit	**2024**	**WM**	**WM +**	**WM –**	**WM**	**WM +**	**WM –**	**WM**	**WM +**	**WM –**
GHG emissions											
Total excluding LULUCF	Mt CO_2 eq.	39.28	28.90	29.41	28.41	19.54	20.15	18.98	12.11	12.55	11.73
Total ETS	Mt CO_2 eq.	13.27	9.84	10.28	9.43	4.08	4.58	3.63	-1.29	-0.98	-1.55
Total non-ETS	Mt CO_2 eq.	25.87	18.78	18.86	18.72	15.19	15.30	15.09	13.15	13.28	13.03
Primary energy consumption	TWh	360	372	379	366	373	386	361	365	384	349
Gross final energy consumption	TWh	280	283	290	277	276	288	265	271	289	256

WM +, projection with higher economic growth than the WM projection
WM–, projection with lower economic growth than the WM projection

Source for historical data: Energy Statistics

3.7 Other information

According to paragraph 103 of the annex to decision 18/CMA.1, "each Party may provide any other information relevant to tracking progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement". All relevant information can be found in sections 3.1 to 3.6, above. Hence, no additional information is provided here.

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Photo: iStock

4

Climate change impacts and adaptation

This chapter describes how the Finnish climate is expected to change in this century and how the change is expected to affect nature, different sectors of the economy, and society. The chapter includes a description of how these risks are assessed. National adaptation policies and strategies as well as adaptation planning at sectoral and regional levels are discussed, together with progress of adaptation action and monitoring and evaluation systems. Finally, lessons learned and good practice on adaptation are described along with Finland's participation in international cooperation.

4 Climate change impacts and adaptation

4.1 National circumstances, institutional arrangements, and legal frameworks

Finland's biogeophysical characteristics, demographic situation, economic situation, and current climate are described in the National Circumstances section of the Progress chapter (see Section 3.1). Additional information about national circumstances can also be found in the Climate Change Impacts and Adaptation chapter in Finland's BTR1. Finland's infrastructural situation is also described in Finland's BTR1.

Finland has an indigenous Saami population of approximately 10,000, of whom more than 60 per cent now live outside the Saami homeland. The Saami culture faces unique challenges from the adaptation perspective due in particular to the strong dependency on the environment of traditional Saami livelihoods such as reindeer herding and fishing.

4.1.1 Institutional arrangements and governance

Finland's institutional arrangements and governance and legal arrangements contribute to Finland's relatively strong adaptive capacity by global comparison. Achievements in adaptive capacity are described in Section 4.6.2.

Vulnerabilities have been assessed in the preparation of national and sector-specific adaptation plans, as well as in regional and local adaptation planning. The institutional setup for assessing climate vulnerability and risks is based on work by research institutes and universities that conduct research on climate change impacts and adaptation. In addition, the Strategic Research Council and the Research Council of Finland have funded several projects exploring adaptation to climate change.

The monitoring of climate change risks and impacts is integrated into the monitoring activities of research institutes. For example, reductions in resources allocated for the monitoring of natural resources and biodiversity have created challenges. The Finnish Meteorological Institute (FMI) has a weather and climate impact database which contains eight different impact data sources such as air traffic, maritime and land area rescue missions,

and traffic accidents. The Finnish Environment Institute (Syke) collects flood damage information annually from the largest insurance companies. This information was previously given at a detailed level, allowing identification of damage caused by specific flood situations, but all damage is currently reported as total annual damage, without information about location, date, or flood type. Natural Resources Institute Finland (Luke) is responsible for a large repertoire of monitoring and inventories, including those targeted directly at species, as well as their habitats and changes. The Finnish Institute for Health and Welfare (THL) is responsible for monitoring the multiple health effects linked to climate change, including infectious diseases and waterborne outbreaks, as well as for promoting adaptation to the health effects of heatwaves. The monitoring of risks and hazards is described in more detail in Section 4.2.

The Finnish Climate Change Panel has been established based on the Climate Act[1]. It is an expert panel that brings together high-level researchers on climate change, and it has some resources for conducting synthesis work. It also provides recommendations to support climate policy planning and implementation. In addition, the Saami Climate Council was established by the Climate Act. The Council's task is to issue statements on climate policy plans and strengthen the knowledge base in support of climate policy preparation from the perspective of promoting the Saami culture (see Box 6.1 in Chapter 6).

A National Implementation Group and an Expert Secretariat have been appointed for the current National Adaptation Plan 2030 (NAP2030). The group and secretariat share responsibility for monitoring the progress and outcomes of the NAP. In total, approximately 20 key stakeholders are represented, meeting four times a year. A monitoring system for the NAP was established in 2025, and it is described in more detail in Section 4.6.

The Ministry of Agriculture and Forestry is responsible for the coordination of climate change adaptation at the Government level. However, adaptation is relevant to all ministries and administrative branches due to the diversity and broad scale of the consequences of climate change. All administrative branches are responsible for implementing and monitoring adaptation. This is described further in Section 4.4.2.

[1] 423/2022

4.1.2 Legal and policy frameworks and regulations

National adaptation planning is stipulated in Finland's Climate Act.[2] Finland's National Climate Change Adaptation Plan is part of the climate policy planning system under the Climate Act. Under the Climate Act, the Government adopts a National Climate Change Adaptation Plan at least every second parliamentary term. In addition, during the parliamentary terms, when there is no obligation to prepare a plan, the up-to-dateness of the plan in force and the need for new measures must be assessed.

The current national adaptation policy framework is described in the Government Report on Finland's National Climate Change Adaptation Plan until 2030 (NAP2030).

In publishing its first National Strategy for Adaptation to Climate Change in 2005, Finland was among the first countries in the world to produce such a strategy. The first National Climate Change Adaptation Plan was published in 2014. Adaptation has also been recognised in the National Energy and Climate Strategies (2005, 2008, 2013, 2016, 2022, 2025).

Legislation related to climate change adaptation is also described in the sections below describing the implementation (4.5.3-4), planning, and updating of plans (4.5.1-2), measures, and regulations (4.4.1-5).

4.2 Impacts, risks, and vulnerabilities

Under the Finnish Climate Act, the objectives and measures concerning climate change adaptation must be based on scientific evidence to consider the progress of climate change, its probable impacts and their associated hazards, risks, and opportunities, and the capacity to prevent disasters, mitigate the most adverse effects, or harness benefits.

The most recent weather and climate change risk and vulnerability assessment report and a separate regional status and vulnerability assessment report were published in 2023. A climate risk assessment to support the preparation of the next NAP will be published in 2027.

National-level sectorial weather and climate change risk and vulnerability assessments have a long history in Finland (see BTR1, Section 4.2).

[2] 423/2022

4.2.1 Methodologies and tools, and associated uncertainties and challenges

Climate monitoring, modelling, and projections are described in more detail in Sections 6.1.1, 6.2.2, 6.2.3, 6.2.5, and 6.3 in Chapter 6.

Less attention has been paid to uncertainties in modelling the impacts of climate change than in modelling the changes in the climate. These uncertainties arise from multiple sources, including differences in climate projections, impact model structure and parameters, socioeconomic assumptions such as those concerning demography, economy, technology, and management that may also affect potential impacts, as well as the representation of adaptation. There are alternative approaches for combining these sources of uncertainty. These are described, along with information about scenario development work and examples of projects, in Appendix 1 in Section 4.9.

4.2.2 Projected climate trends and hazards

Finland's current climate is described in the Progress chapter under the Climate profile in Section 3.1.1.

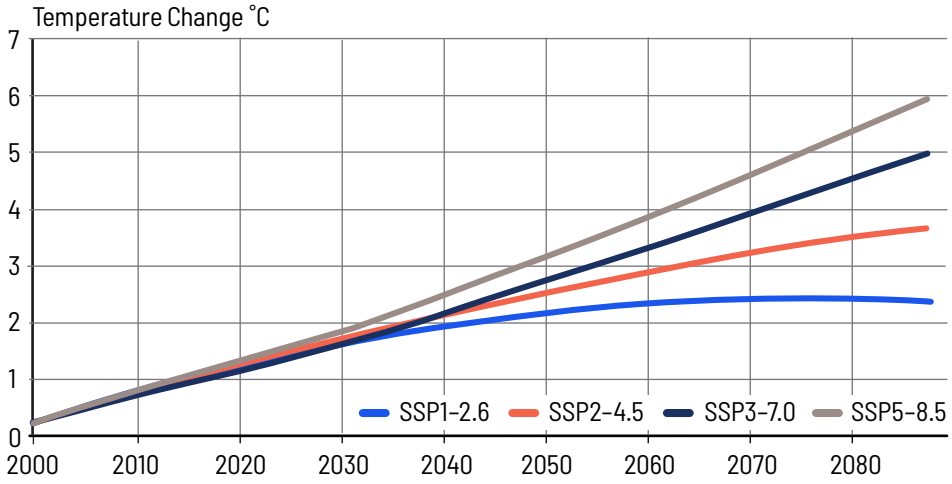
The impacts of climate change are studied using climate scenarios based on climate models produced by the Intergovernmental Panel on Climate Change (IPCC), with several different underlying emissions scenarios. In 2021, the IPCC published a new framework for emissions scenarios, seeking to provide narratives for climate futures and socioeconomic futures, these being to some extent interlinked. There are four of these global Shared Socioeconomic Pathways (SSP). SSP1–2.6 represents the lowest, SSP2–4.5 intermediate, SSP3–7.0 high, and SSP5–8.5 very high greenhouse gas (GHG) emissions.

Finland's climate scenarios regarding temperature and precipitation were updated in 2021 based on the latest IPCC scenarios. Regarding temperature, the results of the latest climate scenarios are similar to those based on earlier scenarios. Figure 4.2-1 shows that Finland's mean annual temperature is projected to rise by around two to six degrees Celsius by the end of the century, depending on the SSP scenario used. The most substantial change in the results of the new scenarios is that the warming of Finnish summers is projected to exceed the projections based on earlier scenarios. However, warming will still be stronger in the winter than in the summer (Figure 4.2-2) in the future. On a timescale of one hundred years, Finland's mean annual temperature will rise at a rate around 1.6 times the global average.

Total precipitation is projected to increase as the climate changes (Figure 4.2-2). The increase will be higher in the winter than in the summer, although

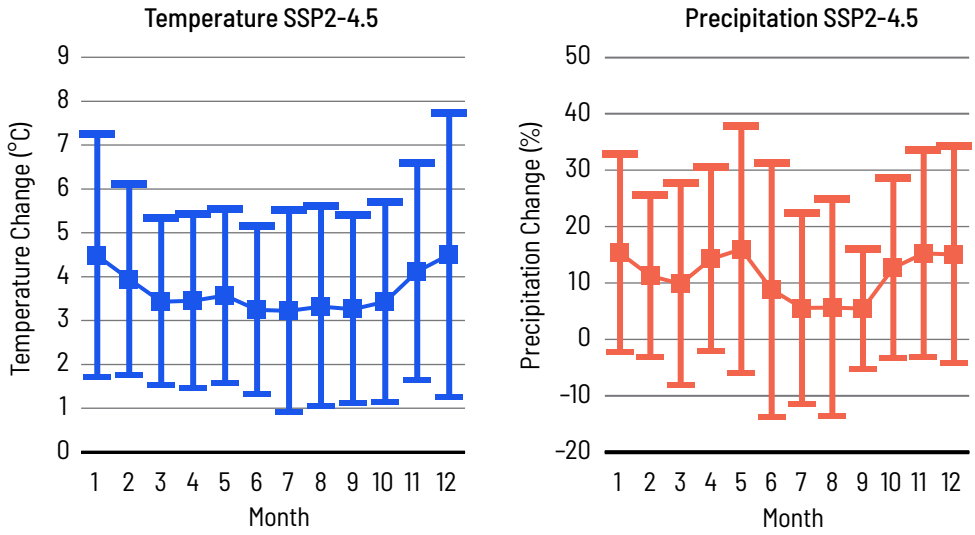
in southern Finland the change may prove to be very minor. Heavy rains in the summer are expected to intensify. In addition, the amount of incoming solar radiation may decrease due to increased cloudiness.

Figure 4.2-1
Temporal evolution of annual mean temperature in Finland in 2000–2085 compared with 1981–2010. Responses to the four different climate scenarios are based on the outputs of 28 global climate models.



Source: Government Report on Finland's National Climate Change Adaptation Plan until 2030 (2024)

Figure 4.2-2
Changes in Finland's (a) monthly mean temperatures (°C) and (b) precipitation (%) from 1981–2010 to 2070–2099. The curves represent the averages of the changes projected by the climate models, and the vertical line segments denote the 90 per cent confidence interval in accordance with the IPCC's SSP2–4.5 scenario.



Source: Government Report on Finland's National Climate Change Adaptation Plan until 2030 (2024)

The number of hot days (with temperatures exceeding 25 °C) in the summer is projected to increase, and heatwaves are expected to become longer and more intense. Regardless of increases in precipitation, the scenarios also project the increased prevalence of periods of drought due to the increased occurrence of severe weather events and the increased evapotranspiration caused by rising temperatures.

The warming of the climate will also prolong the thermal growing season, and the effective temperature sum of the season will increase. However, the winter frost sum and temperature fluctuations will decrease, as the temperature change is proportionally greater with respect to the lowest subzero temperatures. The depth of soil frost will decrease, and the soil frost period will shorten. This is expected to increase windfalls of trees and decrease soil bearing capacity during the winter.

Snowfall will decrease, and the snow-covered period will shorten in Finland during this century. The changes will be more pronounced in southern than in northern Finland.[3]

With the winters becoming milder, a greater share of winter precipitation will fall as rain. This will affect the flowrates of rivers and streams, and the occurrence of fluvial floods, mainly in the form of spring floods becoming reduced but winter floods becoming more common. The direction of change in fluvial floods varies from increase to decrease, depending on location, the period examined, and the characteristics of the river basin.

The flood risk is projected to increase particularly in the large waterbodies of southern and central Finland as precipitation increases. The increased risk of pluvial flooding due to the projected increase in heavy precipitation events needs to be considered in the management of water resources, especially in the design of drainage systems. By contrast, the changes seen in the near future in more northern parts of the country may be quite small, and the direction of change is uncertain, depending on whether the increasing precipitation will be snow, and whether the snow will melt all at once or gradually over the winter. The seasonal variation and increased intensity of floods will challenge the performance of current risk management methods.

The rise in sea level varies on the Finnish coast depending on the location. In the eastern Gulf of Finland, the interim scenario shows an upturn in sea level, resulting in a 20 to 30 centimetre rise by the end of the century. If the highest scenario materialises, the sea level may rise by 70 to 80 centimetres from the current level in the eastern Gulf of Finland by 2100. By contrast, in the Bothnian Bay, the rate of land uplift is sufficiently high to counteract the rise in sea level, at least until the 2040s or even until 2100, depending on the scenario used.

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[3] Räisänen et al. (2025)

In general, Finland's flood risk is projected to decrease slightly over the short term but to double or triple by 2100 if the current flood risk management measures are not continued and implemented as planned. The increased risk is mainly due to assumed steady economic growth increasing the value of damaged property. Over the short term, the risk is reduced in particular by climate change, as the flood risk may decrease in many river basins, and the rise in sea level will not yet significantly increase the coastal flood risk over the short term. Over the long term, the mean sea level rise will significantly increase the probability of coastal floods too, particularly on Finland's southern coast.

The period of Baltic Sea ice cover will become shorter, but ice conditions may also be challenging in the decades ahead. Cold and mild periods shifting back and forth create ice conditions that hinder shipping. The role played by changing sea ice conditions is greater in the northern part of the Baltic Sea, especially concerning shipping.

Windstorms have caused significant impacts, including electrical power outages, in recent years. No major changes are projected based on climate scenarios in windstorms, however. Changes in mean wind speeds are also anticipated to be minor. However, several uncertainties are involved in the assessment of future changes in storm occurrence. The total number and intensity of strong windstorms are projected to decline in the North Atlantic Ocean.

In the light of current knowledge, phenomena related to thunderstorms such as lightning, downbursts, and tornadoes are not anticipated to change in the next few decades. However, major uncertainties are involved in long-term scenarios in particular. A major variation between years and randomness are still emphasised in the occurrence of phenomena, particularly as regards the strongest phenomena. It should be noted, however, that if global warming takes place according to the most pessimistic IPCC emissions scenario, there will be a considerable increase in thunderstorms specifically in northern Europe.

4.2.3 Current and projected trends affecting exposure and vulnerability to changing climate

The risks associated with climate hazards also depend on non-climatic risk drivers as much as on the climate hazards themselves. In addition to the changing climate, risks in Finland are affected by current and future societal and economic developments. The risks vary greatly from one part of the country to another and depend on specific regional characteristics. Regional livelihoods, nature, and other elements of society have adapted to the current climate, but climate change will result in risks growing around Finland, including in the Arctic and Baltic Sea Regions.

The population is ageing throughout Finland, as described in the section on the demographic profile in Finland (Section 3.1.1), with women's life expectancy higher than men's. The decline in the working age population is a major challenge for dependency ratios and employment in many regions. The population is concentrating in the major cities, and even outside the major cities, there is a trend of migration from rural to urban areas. In rural areas, the challenge is compounded by the migration of young people to urban areas, which is expected to continue. Some health challenges related to climate change will particularly affect the elderly, and the ageing of the population will increase the prevalence of these problems.

Climate change affects the entire built environment. The age of the building stock and changing weather conditions throughout Finland are increasing the need for large-scale renovation. In sparsely populated areas, the building stock is underused, making maintenance and repair investments difficult. New construction is concentrated in growing urban areas. Challenges there are related to the resilience of buildings, and ensuring healthy living and working conditions during heatwaves, for example, when the heat island effect affects those living in densely built urban areas more. The importance of stormwater management will also increase significantly with urban densification.

Functioning logistics, the condition of the transport network, and water and energy supply infrastructure play an important role in society's basic functions. For example, risks are increasing as a result of less frost and more frequent periods of rainfall and drought. From a water supply perspective, areas that rely heavily on surface water abstraction are the most vulnerable to the impacts of climate change. All over Finland, especially in small water utilities, human resources are scarce, which creates challenges for operations.

The economic structure of the regions will influence the impacts of climate change. In regions where industry is economically important, the risks are likely to be indirect and will materialise as a result of weather events elsewhere in the world. Livelihoods reliant on natural resources will experience direct impacts as seasons and typical weather conditions change. Such livelihoods include agriculture, forestry, reindeer husbandry, and tourism.

4.2.4 Observed and potential impacts of climate change

By international comparison, the impacts of climate change seen in Finland are expected to be quite small, particularly during the decade ahead. Finland is better prepared for the additional challenges brought about by climate change than most countries. Finland's stable society, well-maintained infrastructure, well-functioning government and administration, high level of education, gender equality, and societal service system improve the country's

opportunities to prepare for and adapt to a rapidly changing climate. Risks to different sectors in Finland were also described in Finland's Eighth National Communication.

The European Climate Risk Assessment published in 2024 identified that northern Europe had already experienced an increase in average temperatures, total precipitation, and heavy rainfall events. These trends are expected to continue in future, along with an increase in heatwave days. The European climate risk assessment expected droughts to decrease in northern Europe in future.[4] The Finnish climate risk and vulnerability assessment conducted in 2023 expects droughts to continue to become more frequent in certain areas (see also Section 4.2.2).

It is anticipated that climate change will accelerate biodiversity loss, and biodiversity loss in turn can intensify climate change. The impacts on biodiversity differ, depending on local conditions, species, and habitats. Rising mean temperatures, shorter periods with considerable subzero conditions, and the temporal shift of the seasons have already caused large-scale changes in Finnish natural ecosystems and biodiversity. Climate change is driving shifts in species distributions and altering ecosystem functioning. In northern boreal ecosystems, vegetation changes such as the expansion of shrubs and declines in lichens have been observed, although these are influenced by multiple factors, including grazing and land use.

The temporal and spatial distribution of species has already changed. As the climate changes, conditions suitable for species shift in space, and many species follow this shift, often resulting in a northwards or north-eastwards shift in species distribution. The situation is particularly challenging for species adapted to Lapland's Arctic conditions, as they are unable to move any further north. Equally, species changing into a white winter coat face excess predation pressure caused by the camouflage mismatch (white fur against black, snow-free ground), while ice-dependent species such as seals suffer from the lack of snow and ice and thus the lack of nesting spots.[5] Changes in species' distribution range have also occurred in protected areas, and climate change may result in species moving outside protected areas too.

The impacts of alien species on native biodiversity are currently most pronounced in southern Finland. However, these effects are expected to become more widespread by the end of the century. As the climate changes, and especially as winters become milder, many alien species that have thus far shown low reproductive and dispersal rates may increase in abundance and become invasive alien species. Alien species may already be displacing

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4 European Environment Agency (2023)

5 Kunnasranta et al. (2021)

indigenous species in various habitats, and the impact is expected to increase in the future.

Climate change adds to the challenges faced in agricultural production, as production risks increase because of increasing weather variability. This may cause fluctuations in crop yields and declines in crop quality. Arable farming will probably face challenges caused by increasing plant pest and disease pressure, increasing heavy rains and excessively wet fields, southern Finland's shorter or absent ground frost periods, and especially coinciding high temperatures and drought and therefore increasing evapotranspiration during the growing season. However, prolonged growing seasons have already allowed the use of more varied crop rotations and new cultivars in both agriculture and horticulture, which may support adaptation and risk mitigation. Several agricultural and horticultural pests that were not considered potential future threats in 2011 are now emergent pests in Finland, highlighting rapid changes in the emergence of pests and the challenges of predicting them. The negative impacts of climate change on the operating conditions, profitability and competitiveness of agriculture may increase in the future. Especially over the long term climate change may affect Finland's food supply, as well as food and nutrition security, both via national and transboundary climate change effects.

Increasing drought and heatwave periods increase the risk of abiotic and biotic disturbances in forests. Biotic disturbances are exacerbated by intense drought periods that weaken the host trees, making them more susceptible to attacks by fungal pathogens and pest insects such as bark beetles. Drought has been identified as the major driver of recent bark beetle outbreaks in Europe,[6] and Finland has also seen drought-induced biotic disturbances in the 2020s.[7] In addition, extensive drought periods increase the risk of forest fires. While forest fires are a natural part of forests' life cycle, they cause financial losses to forest owners and potential hazards to humans, thus requiring significant resources from rescue services. Thus far, extensive forest fires have been successfully controlled by efficient fire protection and detection systems, a dense forest road network, and silvicultural measures. The structure of Finland's forests is effective in reducing the risk of forest fires, as forest compartments are small, especially in southern Finland.

Reindeer husbandry is a livelihood that is sensitive to the negative impacts of climate change. Climate change and changing weather conditions have direct effects on the food access, health, and welfare of reindeer and on practical reindeer husbandry work. In addition, climate change has indirect impacts though changes in the grazing environment. Reindeer husbandry is an inseparable part of the Indigenous Saami culture, which means climate change also has major sociocultural impacts.

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6 Das et al. (2025)

7 Terhonen et al. (2025)

The most important health harms caused by climate change in Finland are related to increased heat, slip accidents, waterborne epidemics, and zoonotic and vector-borne infections. In addition, new species with allergenic potential are spreading to new areas in Finland, strong winds are bringing allergenic species to new areas, and the growing season is becoming longer, increasing the prevalence and incidence of allergenic symptoms. Darker winters can lead to an increase in the prevalence of mental health symptoms. In the worst cases large-scale stormwater floods may cause significant incidents and have adverse effects on the performance of duties such as prehospital emergency medical services.

Heatwaves are currently the biggest health hazard related to climate change in Finland. Prolonged heatwaves lasting three to four weeks have been estimated to have led to between 200 and 400 additional premature deaths per year in the 21st century. The adverse effects of heatwave periods are also greater in urban environments than in the surrounding areas due to the heat island phenomenon, and partly due to the building stock. The mobility of people using assistive devices may be further restricted during extreme weather events.

Climate change poses a threat to cultural heritage and cultural environments through factors such as extreme weather events, increasing floods, and rising sea levels. Climate change has already had significant impacts on the environment, livelihoods, culture, and cultural heritage of the Saami, for example.

Extreme weather events, rising temperatures, increasing floods, and rising sea levels challenge the transport sector and infrastructure. Compound hazards such as wind blowing snow and other debris onto the rails and roads, as well as freeze-thaw cycles that increase road surface erosion, can affect traffic and transport systems. Heavy winds have caused trees to fall on railway tracks. Rigid ice conditions can increase the need for icebreakers for marine transport. Winter conditions especially cause challenges for the management and operations of airports in Finland, which is reflected in the fluency and safety of air traffic. For example, icy conditions on runways, flooding, and fluctuating temperatures create extra work.

Extreme weather events and climate change affect the durability and condition of transport systems, transport development outlooks, railway and road structures, maintenance, and, consequently, adaptation needs. The impacts of weather and climate on the transport system may cause serious harm or accidents, damage and delay risks resulting in costs, value losses and health effects. Climate change may cause increasing disturbances related to critical elements of the transport infrastructure, increase operating costs, reduce the infrastructure service level, exacerbate the infrastructure funding gap, and cause major spillover effects on society and the economy. The weather and climate risks facing transport chains have been identified and reduced

through several different related measures. However, the vulnerabilities of the transport infrastructure are not yet sufficiently known. Identifying adaptation-related information requirements and compiling information have thus been identified as essential in the planning and targeting of adaptation measures.

4.3 Adaptation priorities and barriers

4.3.1 Domestic adaptation priorities

The objective of the Finnish Climate Act and the climate policy planning system based on it is to ensure that national measures are taken to adapt to climate change by promoting climate change resilience and the management of climate risks.

The vision of the Finnish national adaptation activities is formulated in the National Adaptation Plan for 2030 (NAP2030), adopted in 2022: wellbeing, safety, and security in a changing climate. Three overarching goals have been derived from the vision adopted for NAP2030. The goals specify in more detail the adaptation objectives included in the Climate Act regarding strengthening climate change resilience and the management of climate risks.

The goals are:

1. Societal actors have a strong will to adapt to climate change.
2. Societal actors have access to efficient means to assess, prevent and manage the climate change-related risks to nature and society.
3. Societal actors have the capacity to prevent, prepare for and manage the climate change-related risks to nature and society.

To meet these goals, actions are prescribed in ten main priority themes:

Theme 1 National-level strategic planning and foresight
Theme 2 Comprehensive security and general security of supply
Theme 3 Food and nutrition security
Theme 4 Infrastructure and the built environment
Theme 5 Use and management of renewable natural resources, biodiversity, nature-based solutions, and drought risk management
Theme 6 Health protection and promotion
Theme 7 Cultural heritage and the cultural environment
Theme 8 Climate risk management at the regional and municipal levels
Theme 9 International cooperation
Theme 10 Knowledge base, communication, and monitoring

The themes were selected by the preparatory group that led the formulation of NAP2030. The preparatory group was chaired by the Ministry of Agriculture

and Forestry, and consisted of representatives from nine ministries. In the selection of themes and subsequent targets and actions, cross-sectoral themes that engage multiple sectors, as well as selected sectoral priorities for adaptation action, were prioritised. NAP2030 is complemented by sectoral adaptation plans and action programmes, which define further targets and adaptation actions in various sectors.

Furthermore, NAP2030 includes actions for the coordination, monitoring, and evaluation of its implementation. The plan describes the actors responsible for the actions and their implementation, along with timeframes, resources when they are known, or if additional resources are needed.

4.3.2 Progress towards adaptation priorities

The first monitoring cycle of NAP2030 was conducted in 2025. The purpose of the monitoring system is to assess the adequacy of implementation in achieving the targets set out in the NAP. The results of the monitoring cycle are laid out in Section 4.5.3

The mid-term evaluation of NAP2030 is taking place in 2026 (see Section 4.6.1).

The assessment of the progress of the previous NAP and the comprehensive assessment of Finnish adaptation policy was used to inform the formulation of the current NAP.

The evaluation of the implementation of Finnish adaptation policy published in 2022 found:

- The general awareness of the impacts and risks of climate change and the need to adapt has strengthened and is at a comparatively good level in Finland. Climate change has been widely recognised as an issue in legislation and other guidance.
- Regional plans, strategies, and goals of adaptation across sectors have become more common due to the activities of Regional Councils and Centres for Economic Development, Transport and Environment (ELY Centres) (Economic Development Centres (EVK) from the beginning of January 2026). Regional analyses can support the implementation of adaptation measures also in those municipalities that lack sufficient resources of their own to plan adaptation activities.
- The need to plan adaptation measures was identified, especially in cities with more than 50,000 inhabitants. Cities also use their networks to share good practices and develop ideas.
- The adaptive capacity has strengthened in many administrative sectors, with actions that generally improve preparedness for risks and various

extreme conditions, although they are not always recognised as adaptation to climate change.

- R&D activities have supported the development of adaptation activities, increased understanding of the challenges ahead, and enabled the provision of climate services. For example, the Climateguide.fi portal and operation of the flood centre (waterinfo.fi) offer versatile information for adaptation and preparedness. In addition, guidelines and guides have been prepared to assess the climate impacts of projects and legislation, for example.

4.3.3 Adaptation challenges and gaps, and barriers to adaptation

Due to its northern location, Finland is experiencing above-average rates of warming. However, climate and weather extremes have not thus far been catastrophic, and some sectors have even benefited. As a result, climate-change-related risks and the need for adaptation have yet to be fully recognised across all sectors.

Based on the 2022 evaluation of the implementation of adaptation policy, some of the main challenges, gaps, and barriers related to adaptation are:

- Coordinated and comprehensive preparation of and decision making on adaptation action based on continuous monitoring and impact assessment are still taking shape.
- Statutory obligations and tangible adaptation targets are lacking in many sectors, meaning that the authorities can only encourage stakeholders to undertake adaptation measures.
- The labour shortage in the healthcare and social welfare sector and rescue services, as well as the maintenance backlog of infrastructure, such as the road network and water services.
- The shortage of human and budgetary resources allocated to implementation makes it difficult in many sectors to develop and implement new adaptation measures.
- The development of actual adaptation action has been largely based on individual projects and low resources. The lack of permanent staff knowledgeable about climate change adaptation is reflected in short-termism in activities.
- Many sectors have targets and measures that are not recognised as adaptation. This causes difficulties in monitoring adaptation activity and measuring performance. The fragmentation of adaptation action hampers learning, resulting in inefficiency.

- Responsibilities and chains of action related to adaptation are in part complex, which is something municipalities and regional authorities especially have regarded as a challenge.
- General climate change data are abundantly available, but local, sector-specific, and solution-oriented applied knowledge or expertise is not available in all respects.
- The lack of systematic monitoring data on adaptation activities makes it difficult to assess the impacts and effectiveness of adaptation measures.

The challenges, gaps, and barriers identified have been considered when developing the priorities, goals, and actions described in the following sections (4.4, 4.5).

The mid-term evaluation of the current NAP is ongoing in 2026. The evaluation will be completed in 2026, and further updated information and gaps and barriers will be available.

4.4 Adaptation strategies, policies, plans, goals, and actions to integrate adaptation into national policies and strategies

4.4.1 National Climate Change Adaptation Plan

Finland's National Climate Change Adaptation Plan is part of the climate policy planning system under the Climate Act. Under the new Climate Act, the Government adopts a National Climate Change Adaptation Plan at least every second parliamentary term. The revised Act specifies that the following must be presented in the adaptation plan: 1) an up-to-date assessment of risks and vulnerabilities; 2) an assessment of the adaptation in individual administrative branches, across the boundaries of administrative branches, and on a regional basis as considered necessary; 3) measures to achieve the adaptation targets and an estimate of their effectiveness.

The ten themes of the National Adaptation Plan 2030 are presented in Section 4.3.1. Under these themes, 24 targets are prioritised and presented in the NAP:

Theme 1 National-level strategic planning and foresight

Target 1 Adaptation is integrated into the Government's and ministries' strategic planning and foresight by 2030

Target 2 Sectoral adaptation is done in a structured manner and means for implementation are secured by 2030

Theme 2 Comprehensive security and general security of supply

Target 3 The consequences of climate change and the adaptation needs are identified as part of comprehensive security and integrated into the comprehensive security model and the objectives of security of supply by 2026

Theme 3 Food and nutrition security

Target 4 The operating conditions of agriculture to adapt to climate change are enhanced by 2030

Target 5 Climate-resilient food production and consumption maintain food and nutrition security throughout the NAP2030 period

Theme 4 Infrastructure and the built environment

Target 6 The preparedness of water services for climate change impacts is improved by 2026

Target 7 The vulnerabilities of the transport and communications infrastructure are identified by 2026 and climate resilience is improved by 2030

Target 8 The built environment sector has the capacity to manage climate change-related risks and to adapt to foreseen changes in climate by 2030

Target 9 In the energy and industrial sectors and business activities, awareness of climate change impacts, risk management and the innovation environment will have been strengthened by 2030

Theme 5 Use and management of renewable natural resources, biodiversity, nature-based solutions and drought risk management

Target 10 Climate change adaptation is promoted in the use of renewable resources by 2030

Target 11 Adaptation to climate change and halting biodiversity loss are tackled together by 2030

Target 12 Nature-based solutions are established and have increased society's preparedness for climate risks, improved water protection and increased biodiversity by 2030

Target 13 Drought risk management has developed by 2030

Theme 6 Health protection and promotion

Target 14 Negative health impacts of heat are recognised and adaptation and monitoring have progressed on various levels by 2030

Theme 7 Cultural heritage and the cultural environment

Target 15 The protection of cultural heritage and the cultural environment against the impacts of climate change has improved, these are better taken into account in climate change adaptation policy and the utilisation of knowledge carried by cultural heritage and the cultural environments in climate change adaptation has progressed by 2030

Theme 8 Climate risk management at the regional and municipal levels

Target 16 Regional and municipal actors have access to guidelines for managing climate risks as well as the competence to make use of them in planning on various sectors by 2030

Target 17 The guidance of adaptation for regional and municipal level is consistent and appropriate by 2030

Target 18 Funding opportunities encourage regional and municipal actors to strengthen adaptation, and monitoring of the allocation of funding is made possible by 2030

Theme 9 International cooperation

Target 19 Adaptation, particularly the capacities of the most vulnerable countries to adapt, is increasingly promoted in international cooperation

Target 20 The capacities and capabilities of developing countries to plan and implement adaptation measures and to develop in a climate-resilient way are promoted as part of international cooperation

Target 21 Promoting climate change adaptation appropriately as part of international cooperation, strengthening Finland's adaptive capacity and the broadening of the knowledge base

Theme 10 Knowledge base, communication and monitoring

Target 22 The knowledge base related to weather and climate change risks and adaptation is strengthened in a practical manner, and the availability of research data to end users is ensured by 2027

Target 23 Awareness among society's actors of risks and adaptation measures related to climate change is strengthened through communication

Target 24 Adaptation monitoring is systematic and supports the development of activities

4.4.2 Other national-level adaptation plans and actions

The premise of Finland's adaptation policy is that adaptation is integrated into the normal planning and activities of administrative branches and sectors. In addition to the national adaptation plan, adaptation is therefore strengthened and implemented under several administrative branch-specific plans and sector-specific regulation. Adaptation plans and actions are also undertaken at the regional and municipal levels.

The sectoral adaptation (action) plans that detail more specific actions in different sectors include:

- Action Plan for the Adaptation to Climate Change of the Environmental Administration 2022 (revision adopted in 2016). The action plan is to be updated in 2024–2026.
- Action plan for climate change adaptation of the Ministry of Agriculture and Forestry (revision adopted in 2024)

- Climate change adaptation plan of the Ministry of Social Affairs and Health (2021–2031) (adopted in 2021)
- Climate Change Adaptation Plan of the Finnish Defence Administration (adopted in 2023)

In the first part of the Government Report on the Future, published in September 2025, climate change is featured as a crosscutting factor in various future scenarios and in preparations for them. The operating environment analysis concerning environmental factors in the Future Report was updated in early 2026.

In other administrative sectors, the implementation of adaptation or similar plans continues:

- Adaptation has been integrated into broader frameworks within the Ministry of Transport and Communications' administrative sector, such as the joint strategy and the national 12-year transport system plan. The 12-year transport system plan was updated in December 2025. The plan's objectives related to transport functionality, safety, and sustainability also include adaptation to climate change.
- The Ministry of Finance promotes adaptation as part of the implementation of the climate and nature strategy, and adaptation is also considered in the performance guidance of government agencies under the Ministry of Finance. Adaptation is further promoted in connection with green budgeting and its development, as well as in the management of climate risks at government-owned properties.
- The Ministry of Economic Affairs and Employment promotes adaptation in the energy sector as part of the implementation of the energy and climate strategy. Preparedness for the impacts of climate change is also being developed in cooperation with the business sector as part of broader work on security of supply.

Altogether, the plans describe more than 700 adaptation measures and actions. Many actors also undertake autonomous adaptation actions that are not described in formal plans. Due to the large number of measures, examples have been selected below to show the types of measures being implemented. The examples have been categorised into the seven thematic targets identified in the UAE Framework for Global Climate Resilience that highlight global priorities for adaptation. The national targets of NAP2030 cover the majority of the thematical targets in the UAE Framework for Global Climate Resilience that highlight global priorities for adaptation (see also Section 4.4 in Finland's BTR1). NAP2030 includes only health impacts from heat, as they were prioritised as the most important. Other health hazards are included in the climate change adaptation plan of the Ministry of Social Affairs and Health, for example.

Table 3.4-1
Examples of identified climate risks and adaptation measures in national-level plans.

Sector	Examples of climate risks and adaptation measures		Plan/study the measures/risks feature in
Water	**Risk**	Drought can cause problems with water sufficiency, and decreased groundwater levels can cause problems with water quality.	Risks and Vulnerabilities Related to Climate Change in Finland[8]
	Measure	Instructing utilities supplying household water to take account of climate change as part of their risk assessment concerning household water production and the quality and quantity of raw water	National Adaptation Plan 2030 (NAP2030)
		Creating a national drought risk management process that also includes regional aspects of risk management	NAP2030
Food and agriculture	**Risk**	Increased challenges of agricultural production, as production risks increase with the increasing variability of weather conditions	Risks and Vulnerabilities Related to Climate Change in Finland
		Possible decrease in global food availability, as well as an increase in prices and, in the long term, a price crisis, which could affect Finland's food supply and food and nutrition security, impacting Finnish food security	Risks and Vulnerabilities Related to Climate Change in Finland
	Measure	Continuing the emergency stockpiling of certain production inputs that are important for food security	NAP2030
Health	**Risk**	Climate change can impact health through the impacts caused by rising temperatures, increasing extreme weather events, and the mental health impacts caused by the changing climate and decreasing snow cover.	Risks and Vulnerabilities Related to Climate Change in Finland
		Climate change creates new possibilities for vector-borne diseases.	Possible arrival of new vector-borne diseases in Finland as a result of climate change and human mobility[9]
	Measure	Establishing a monitoring mechanism for heat-related mortality to monitor heat-related deaths on a weekly basis during the summer	NAP2030
		Increasing operational capabilities of treating trauma-related psychological crises and stress disorders caused by possible extreme weather events, intensifying treatment to prevent the disease burden increased by hot summers, and increasing the use of timed light to prevent the harm caused by the darkening of winter days.	Climate change in the healthcare and social welfare sector – Ministry of Social Affairs and Health's Climate Change Adaptation Plan (2021–2031)[10]

[8] Pilli-Sihvola et al. (2023) Risks and Vulnerabilities Related to Climate Change in Finland (in Finnish, abstract in English)

[9] Hulden, L. (2021) (in Finnish, abstract in English)

[10] Meriläinen et al. (2021)

Table 4.4-1 continued

Sector	Examples of climate risks and adaptation measures		Plan/study the measures/risks feature in
Ecosystems and biodiversity	**Risk**	Climate change can impact the functioning of the ecological connection network, i.e. the interaction relationships of species.	Risks and Vulnerabilities Related to Climate Change in Finland
		The effects of climate change on natural habitats are primarily qualitative. Habitat types can also disappear as a result of climate change.	Risks and Vulnerabilities Related to Climate Change in Finland
	Measure	Developing the protected area network and its management based on research data	NAP2030
		Restoring and managing degraded habitats to improve nature's adaptive capacity	NAP2030
Poverty and livelihoods	**Risk**	Companies will experience financial losses, but the change in investments is more difficult to anticipate, as damage increases the need to rebuild production capacity.	Risks and Vulnerabilities Related to Climate Change in Finland
	Measure	Assessing the existing funding opportunities for developing and introducing adaptation innovations for businesses	NAP2030
Infrastructure	**Risk**	The effects related to extreme weather phenomena and climate change impact the maintenance and service level of highways, external services for transport networks, traffic control organisation, and the management of an operational road network.	Risks and Vulnerabilities Related to Climate Change in Finland
		Changes in the thaw-freeze cycle and the amount of slanting rain increase the risk of frost corrosion in buildings.	Risks and Vulnerabilities Related to Climate Change in Finland
		Spring floods are expected to decrease, and winter floods to become more common	Risks and Vulnerabilities Related to Climate Change in Finland
	Measure	Assessing the state of private roads and bridges and consequently encouraging road maintenance associations to carry out necessary improvements and maintenance work of the private road network.	NAP2030
		Encouraging the voluntary preparedness measures of real estate and construction actors and raising actors' awareness of adaptation	Finland's environmental administration adaptation programme
		Flood risk mapping and assessment	Flood Risk Management Act

Table 4.4-1 continued

Sector	Examples of climate risks and adaptation measures		Plan/study the measures/risks feature in
Cultural heritage	**Risk**	Increased rainfall and humidity, as well as an increase in the freeze-thaw cycle, affect the preservation of the built cultural environment, cultural landscapes, and ancient remains	Risks and Vulnerabilities Related to Climate Change in Finland
		The rapid warming of the climate in the Arctic region threatens the cultural heritage of the region's Indigenous peoples.	Risks and Vulnerabilities Related to Climate Change in Finland
	Measure	Developing the availability, quality, usability, and interoperability of cultural heritage and cultural environment data	NAP2030

4.4.3 Integration of adaptation into sector-specific planning and development priorities and implementation of adaptation actions

Water resources

In the water resources sector, climate change has been integrated into the implementation of the EU's water framework and flood directives, national dam safety legislation, water supply site risk assessment, and the review process for watercourse regulation permits. The selection and prioritisation of measures proposed in the 2nd flood risk management plans (2022–2027) and 3rd river basin management plans (2022–2027) include an estimation of the climate resilience of different strategies and measures. The frameworks and approaches in these plans are described in more detail in Finland's BTR1 submission (Section 4.4.2).

The Finnish Environment Institute has produced general stormwater flood maps for municipalities' stormwater risk assessments and, with the regional ELY Centres (Economic Development Centres from 2026 onwards), prepared fluvial and coastal flood hazard maps to enhance preparedness and take them into account in land-use planning. Coastal flood maps have been prepared for different climate change scenarios.

National guidelines for drought risk management were published in 2024. The implementation of these guidelines is underway. The drought monitoring service has been in use during growing seasons, and the development of drought monitoring and warning systems has continued. The Flood Centre has developed an operational plan for severe drought conditions. The VN Tutkiva project KuRiTuS, which supports government decision making, is initiating a

study on the impacts of drought and preparedness across different sectors. Planning for drought risk management has been further developed in a pilot study. Finland has actively participated in the activities of an EU working group to develop drought risk preparedness and to take Nordic perspectives into account.

A Roadmap for Watershed Planning until 2030 was published in 2024.[11] Operational models have been developed and implemented through initiatives such as the Ministry of Agriculture and Forestry's "Catch the Carbon" programme and the Ministry of the Environment's watershed pilot funding projects. Several operational models can be adapted based on regional needs. Implementation is an ongoing process.

The stormwater guide is currently being updated to reflect changes in legislation such as in the Building Act and the growing challenges of stormwater management, which include extreme weather events, technical solutions, and changes in the urban environment.

The Adapting to Climate Change in Water Services report, published by the Finnish Environment Institute in 2025,[12] compiles the impacts of climate change on water services, as well as ways to prepare for, anticipate, and manage the risks associated with these changes. The VILSO tool (Tool for Adapting Water Services to Climate Change), developed by the Finnish Environment Institute, helps water utilities identify their adaptation needs in various areas of water services. The tool generates a summary report, and the measures outlined in it are intended to be incorporated into statutory water supply and sewerage plans such as contingency plans or Water Safety Plan (WSP) risk assessments.

Agriculture

Adaptation measures for agriculture are included in the Ministry of Agriculture and Forestry's sectoral adaptation plan for 2022 to 2027. A set of indicators to monitor adaptation in natural resource management sectors, including agriculture and forestry, is being developed as part of the mid-term evaluation of the Ministry of Agriculture and Forestry's adaptation action programme.

Guidelines for water management in agriculture and forestry in a changing environment set out objectives and measures for sustainable water management in agriculture and forestry, including in the light of changing climate conditions. A work programme has been published to support the guidelines' implementation.

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11 Rytkönen et al. (2024) (in Finnish, abstract in English)

12 Rintala et al. (2025) (in Finnish, abstract in English)

The National Food Strategy was published in December 2025. The Food Strategy identifies climate change as one of the major factors shaping the food system. The strategy includes objectives and goals that support adaptation to climate change, emphasises security of supply and the carrying capacity of nature as components of climate risk management, and requires the reduction of environmental impacts and the strengthening of biodiversity. It is built on capabilities designed to support adaptation to change.

The EU's Common Agricultural Policy (CAP) provides many tools for adaptation needs. Measures related to adaptation are included to the Finnish national CAP plan for the new CAP period from 2023 to 2027. In 2025, assessments were published on the progress and effectiveness of Finland's CAP Plan for 2023 to 2027, as well as on the risk management tools included in the CAP Plan. The assessments highlight the need to strengthen resilience in the face of growing environmental and weather-related risks and to develop risk management to respond to crises caused by weather risks. The CAP risk management report examines crop losses, market and production risks, and changes in the external operating environment.

The National Emergency Supply Agency carries out statutory strategic stockpiling of food supplies, primarily bread grains. The consequences of climate change may increase the importance of strategic stockpiling.

Adaptation measures include developing risk profiles and emergency plans for various existing and emerging pests and diseases. Although the risk assessment's main drivers have been the pest and disease risks caused by increasing international trade, the impacts of climate change are also included where relevant.

Further development of cultivation methods and systems is required to reduce risks and increase the resilience and competitiveness of agricultural production in a changing climate. The existing networks in place for farmers, farmers' associations, and advisory services help improve the exchange of knowledge about the means for adapting to climate change and variability.

Forestry

The National Forest Strategy extending to 2035 was completed at the end of 2022. In 2023, the Government adopted a resolution on the National Forest Strategy 2035. Climate-resilient forestry is an integral part of the National Forest Strategy 2035. The main goal is to maintain and improve forests' resilience by integrating climate change considerations into forest management. More detailed information about the Strategy was reported in Finland's BTR1 (Section 4.4.2).

Significant additional resources have been allocated to adaptation efforts through funding from a package of measures included in the Programme of Prime Minister Petteri Orpo's Government that aims to promote forest growth and strengthen carbon sinks. The package strongly emphasises the prevention of forest damage and adaptation to climate change.[13] Implementation, access to information, and expertise are supported through development projects, the development of forest management recommendations and the Metsaan.fi service, information for forest owners, legislative development, and performance management.

In November 2025, the "Roots in knowledge" call for projects was opened. The project call seeks innovative and proven knowledge-based approaches for the forest sector, as well as diverse partnerships that can help mainstream climate-resilient forest management practices. Additionally, the initiative will strengthen the knowledge base of forest owners and forestry sector stakeholders regarding the benefits and practical implementation of climate actions that promote forest growth. The set of national and regional projects will be implemented between 2026 and 2027.

In 2025, the Ministry of Agriculture and Forestry published a new contingency plan for forest damage, which is supplemented by the forestry sector organisations' own contingency plans, as well as specific preparedness plans addressing the most severe causes of damage. The preparedness plan for the European spruce bark beetle is scheduled to be finalised during 2026. A preparedness plan for forest fires is being prepared in cooperation with the Ministry of the Interior.

In the winter of 2026, the Climate Unit of the Economic Development Centres published checklists on adaptation measures for agriculture and forestry intended for use by farmers, forest owners, and advisers.

The most recent changes to the Forest Damage Act entered into force in April 2023, when the validity period of the aid scheme included in the Act was extended until the end of 2027. The aid scheme enables the provision of compensation to landowners for the costs and damages caused by measures to prevent forest damage.[14] Human activity in forests is a significant factor for the emergence of the forest fire risk. It should also be noted that the reduction in forest fires starting from the 1960s has resulted in a decline in species and habitats that are dependent on forest fires, and the need for controlled prescribed burning should not be confused with the need to decrease the risks of large-scale forest fires.

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[13] https://mmm.fi/en/forests/strategies-and-programmes/package-of-measures-to-strengthen-forest-growth-and-carbon-sinks

[14] Sjöström et al. (2019)

Health

Critical issues in adaptation in the healthcare sector are functioning environmental health governance and the supporting health protection infrastructure (energy and water supply and sanitation), as well as high housing standards coupled with functioning disease surveillance. More specific adaptation measures regarding health and wellbeing are included in the Climate Change Adaptation Plan of the Ministry of Social Affairs and Health (2021–2031). Well-functioning healthcare and supporting state-of-the art laboratories allow the surveillance of infectious diseases possibly related to climate change.

A draft national heatwave preparedness action plan, prepared under the leadership of the Ministry of Social Affairs and Health and the Finnish Institute for Health and Welfare, was opened to public comment in the spring of 2026. The plan will be published in the autumn of 2026. The plan aims to prevent health hazards caused by heat as heatwaves become more common by identifying population groups vulnerable to heat-related harm, outlining necessary preparedness measures, and clarifying responsibilities, for example.

In addition, several projects are underway, such as Adaptation to Climate Change and Its Mitigation in Care Work ("Isohoito"), Systemic Transformation towards Local and Regional Climate Resilience ("SMARTER"), and Safe Water for All ("Waterfall"). Indicators for monitoring adaptation in the health sector are also being developed.

Transport

Adaptation is part of standard sectoral policies, plans, and programmes in the transport sector. The Ministry of Transport and Communications will incorporate climate change adaptation into its strategic guidance documents such as the national 12-year transport system plan. The current National Transport System Plan is for 2026 to 2037 and is updated every government term. The plan's objectives related to transport functionality, safety, and sustainability also include adaptation to climate change.

The Finnish Transport Infrastructure Agency, which operates under the Ministry of Transport and Communications, is responsible for road, railway, and waterway construction and maintenance. One of the Agency's infrastructure management challenges is to plan relevant adaptation measures for the transport network. In 2025, the Transport Infrastructure Agency published reports titled "Assessment of the Transport Network's Vulnerability to the Effects of Climate Change" and "Review of the Climate Change Adaptation of the Transport Infrastructure on Network Level". Additionally, geospatial analyses have been conducted on flood risks, heatwave risks, and crosswind

risks for railways. A pre-survey of Climate Proofing of TEN-T[15] network infrastructure projects was started in 2026.

The Finnish Transport and Communications Agency (Traficom) has examined the vulnerabilities in transport and communications infrastructure, and published three reports between 2024 and 2026 on monitoring the impacts of climate change and weather phenomena: a preliminary study on monitoring the impacts of climate change in the transport sector (2024); a report on the impacts of climate change on information and communication networks (2025); and a report on disruptions to the transport system caused by weather conditions (2026) based on the preliminary study.

In 2025, the Ministry of Transport and Communications launched the "Safety and New Economic Growth from Information Networks" (TUUTTI) project, which also strengthens the security and operational reliability of communication networks.

Impact assessment capabilities are being systematically developed within the Ministry of Transport and Communications' administrative branch, and a report on the subject was published in early 2025.

The airport company Finavia has assessed the impacts of changing climatic conditions on runway and pavement winter maintenance, and will update their internal guidance accordingly. The company has also investigated risks of flooding at airports and will take adaptation measures when upgrading airport infrastructure.

Built environment

The new Construction Act,[16] which will improve the effectiveness of regulation, particularly in mitigating and adapting to climate change, entered into force in 2025. The Government's proposal for the Land Use Act was submitted to Parliament during the spring 2026 session.

Another important method for steering land use regarding adaptation has been the national land-use guidelines (Government Decision 2008), one of the main focus areas of which is adaptation. According to the Land Use and Building Act, the national land-use guidelines must be considered in regional-level planning, municipal land-use planning, and in the operations of the authorities. In 2014, the Land Use and Building Act was amended with provisions on stormwater management. Increasing rain levels have been taken into consideration through the issuing of a decree on the preparation of moisture control plans

15 Trans European Transport Network

16 751/2023

in construction in 2014. Urban flood management is also covered by the Flood Risk Management Act.[17]

The flood map service was revamped and integrated into the waterinfo.fi map service in early 2025. New sea flood maps for the entire Finnish coastline were published based on sea flood recurrence estimates prepared by the Finnish Meteorological Institute. In addition, new sea flood maps were prepared for coastal areas according to various emission scenarios. In 2025, the climate unit of the ELY Centres and the Finnish Meteorological Institute published a report on observed and projected changes in heavy rainfall by region.

A performance target for the Ministry of Education and Culture's agencies states that a cultural change towards a sustainability transition is supported through culture, expertise, and social reform. The Cultural Heritage and Climate Change project is underway. The project develops methods for monitoring the impacts of climate change on cultural heritage sites and investigates the effects of climate change on the built cultural environment. A cultural heritage partnership is currently being prepared, with the aim of combining research on cultural heritage and climate change (CORDIS).[18]

Disaster risk management

There is no single national disaster risk reduction strategy in Finland, but legislation, government resolutions, and various strategies and programmes together form the necessary preparedness of society for different kinds of disruptions. Legislation and programmes include the Emergency Powers Act, the Rescue Act, the Act on Security of Supply, and other relevant documents: the Security Strategy for Society; the National Risk Assessment; the Internal Security Strategy; and the national targets for the rescue services for 2025.

The Sendai framework goals are advanced in collaboration between actors. At the national level, agreements have been reached regarding Sendai reporting, and the entities responsible for producing and collecting the reporting data have been designated. The Ministry of the Interior is responsible for coordinating the Sendai network.

In 2023, climate change impacts and risks were included in the National Risk Assessment, made in accordance with the EU Civil protection mechanism. The 2026 update of the national risk assessment will also include an update to the information base regarding climate risks.

The National Security Strategy was updated in early 2025, which included an update to address the observation and monitoring of environmental changes, biodiversity loss, and climate change, as well as the prevention of threats

[17] 620/2010

[18] Co-funded European partnership for Resilient Cultural Heritage

arising from them and preparedness for such changes. The status of the implementation of the strategic task is monitored annually, and the findings are incorporated into the National Security Report.

A project by the Ministry of the Interior and the Ministry of Finance to develop regional preparedness cooperation and situational awareness activities is being finalised. The project examines the current state of regional cooperation, coordination, and situational awareness in preparedness, assesses various options for organising cooperation structures, and drafts a proposal for an operating model and a new organisational model utilising existing information management. In addition, the project is developing a model for regional coordination and division of responsibilities in crisis situations, as well as improving government guidance.

The Climate Change and Finland's Security of Supply (ILHU) project, commissioned by the National Emergency Supply Agency and implemented by the Finnish Institute of International Affairs, examines the impacts of climate change and its mitigation on Finland's security of supply, as well as ways to prepare for them. The project is scheduled for completion in 2026.

The final report of the PUUVILJA project, commissioned by Natural Resources Institute Finland on behalf of the National Emergency Supply Agency, examined and analysed the knock-on effects and risks to the security of supply caused by climate change and increasingly frequent extreme weather events in Finland's agriculture and forestry sectors over the next 20 years. The project was completed in February 2026.

Energy and climate

The National Energy and Climate Strategy was updated in 2025. The strategy strengthens climate adaptation by assessing climate and weather-related risks to the energy and industrial sectors, particularly as the clean energy transition increases dependence on weather-sensitive electricity production. It also promotes public–private cooperation on climate risk management, supports energy system resilience and security of supply, and encourages businesses to identify adaptation-related opportunities and improve preparedness for climate impacts.

The Clean Energy System Transition (REPower-CEST) project (2024–2026), which was part of Finland's chapter of the REPowerEU plan, has analysed the risks facing the energy industry and assessed companies' awareness of the impacts of climate change.

The PIISA project, funded by the EU's Horizon programme (2023–2026), is developing packages of climate-resilient insurance products and risk-sharing models aimed at helping households, businesses, and public actors prepare for increasing climate risks.

Reindeer herding

Reindeer herding is vulnerable to the adverse impacts of climate change, including changes in snow conditions that can hinder reindeer from accessing forage beneath the snow. One of the actions identified for further development in the National Adaptation Plan 2030 is the preparation of a Saami climate change adaptation programme, which would also cover traditional livelihoods such as reindeer herding.

4.4.4 Subnational and community-level plans and actions

The subnational governance levels in Finland vary according to different administrative branches. The 308 self-governing municipalities form the country's fundamental subdivisions. Finland is divided into 19 regions, which are governed by regional councils. These councils are joint municipal authorities and serve as a forum for regional cooperation among municipalities.

The 21 self-governing wellbeing services counties, which are responsible for organising healthcare, social welfare, and rescue services in Finland, largely follow regional boundaries. The main exceptions are the Uusimaa region, which is divided into multiple wellbeing services counties, and Helsinki, which operates outside the county structure.

The central government's regional administration was restructured in January 2026. The primary regional state administrative authorities are ten Economic Development Centres, each covering the territory of one to three regions, and a nationwide Finnish Supervisory Agency.

The institutional and legal setup for climate change adaptation at subnational level is based on multiple legislation: the Local Government Act/Municipal Act,[19] the Regional Development Act,[20] the Flood Risk Management Act,[21] the Water Services Act,[22] the Environmental Protection Act,[23] the Health Protection Act,[24] and the Emergency Powers Act.[25] The new Construction Act of the 1st of March 2023 includes adaptation, considering the location of construction and technical requirements set for building construction, and the preparations for the reform of the Land Use and Building Act continue.

[19] 410/2015

[20] 756/2021

[21] 620/2010

[22] 119/2001

[23] 527/2014

[24] 63/1994

[25] 1552/2011

Municipalities play a central role in climate change adaptation, as a large part of tangible adaptation measures are implemented at the local level. According to a survey conducted by the Finnish Environment Institute in 2025, adaptation is more commonly carried out in large and urban municipalities than in small and rural ones. Nearly two thirds of municipalities that responded to the survey have implemented adaptation measures, and about four out of five plan to implement such measures in the future. Measures have most frequently been identified to manage the impacts of increased precipitation, rising temperatures, and changing flows in lakes and waterbodies.[26]

Initial steps in municipal-level adaptation planning were facilitated through the Covenant of Mayors for Climate & Energy initiative, which mandates its signatories to conduct vulnerability mapping and develop adaptation actions. Eighteen Finnish municipalities have joined the Covenant of Mayors. Additionally, eight regions, including Åland, and four cities have signed the EU Mission Adaptation Charter and are actively developing their adaptation plans in collaboration with the Mission community.

According to the Regional Development Act,[27] climate change mitigation and promotion of adaptation are part of regional development and the duties of regional councils. Most regional councils have adopted, or are currently preparing, a regional adaptation plan. These plans usually consist of an analysis of the region's specific climate risks and vulnerabilities, as well as a description of the adaptation measures that the regional council and municipalities should implement in the near future. Regional adaptation plans have mostly been developed with funding from either the European Regional Development Fund, or with technical assistance or grants provided by the EU Mission Adaptation.

Climate adaptation in Finland's wellbeing services counties is primarily advanced through preparedness, risk assessment, and continuity management, with a strong focus on protecting health and vulnerable populations. While dedicated adaptation strategies are still emerging, integration into core service planning and cross-sectoral cooperation is gradually strengthening.

The central government's regional administration reform divided the work of the previous ELY Centres[28] between two new authorities at the start of 2026. Most of the ELY Centres' duties were transferred to ten Economic Development Centres. These included flood risk management, the use and management of water resources, and operating as a grant authority for various funding instruments, including funding for climate-resilient practices and

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[26] Munck af Rosenschöld et al. (2025)

[27] 756/2021

[28] Centres for Economic Development, Transport and the Environment

the development of adaptation measures. Two of the Economic Development Centres also have specific nationwide tasks regarding the regional coordination, promotion, and monitoring of the climate plans as set out in the Finnish Climate Act.

Responsibilities related to licensing, permits, and supervision were transferred to a multisectoral new government agency: the Finnish Supervisory Agency. The Agency supervises the work of rescue services, which are the responsibility of the wellbeing service counties.

Finland's regional risk assessments are multi-hazard analyses to identify, evaluate, and prioritise risks that could affect society at the regional level. The weather and climate risk perspectives have been integrated in the assessments. Prepared at regular intervals as required by the EU civil protection mechanism, the assessments support regional preparedness and emergency planning. The current regional risk assessments were adopted in 2023, and they will be updated in 2027.

Regional risk assessments in Finland are coordinated at the national level by the Ministry of the Interior, which provides overall steering and methodological guidance. At the regional level, the preparation of risk assessments is carried out in a multisectoral process primarily led by rescue services within the wellbeing services counties. The Finnish Supervisory Agency supports regional preparedness, promotes cooperation among relevant actors, and contributes to the coordination and evaluation of the process.

Adaptation planning and implementation has largely been the responsibility of the public sector, particularly the national, regional, and municipal authorities. Community-level adaptation has received little attention, and few solutions have been proposed for how citizens can take action on climate risk management and building resilience. However, some projects have reached out to communities. For example, the TALVI project (2024–2027) targets housing companies, which are limited liability companies that own residential buildings; the residents are typically the shareholders. These companies are responsible for maintaining the buildings and covering common costs. The TALVI project has produced a web course and tools for housing companies to help them integrate climate risk management into their risk assessments, budgets, and communication. Furthermore, the regions and cities involved in the EU Mission Adaptation have received resources to organise public events where local residents can discuss the impacts of climate change and ways to enhance resilience.

4.4.5 Private-sector plans and actions

The private sector plays a key role in advancing climate preparedness and adaptation solutions in Finland. In particular, identifying opportunities related to new technologies requires close collaboration with private-sector actors. In addition, new operating models are needed to strengthen adaptation efforts across different sectors.

According to NAP2030, dialogue with the private sector will be strengthened, and effective models for public–private cooperation will be explored. The integration of climate change adaptation will also be reinforced within established cooperation frameworks. In addition, sector-specific low-carbon roadmaps have been developed. As these roadmaps are updated, or new ones are prepared, assessments will consider not only climate mitigation but also the needs and opportunities for businesses in managing climate risks and impacts, as well as in leveraging emerging opportunities linked to climate change.

NAP2030 also aims to explore opportunities to enhance funding for innovative adaptation solutions by reviewing existing financing mechanisms for the development and deployment of adaptation innovations in the business sector.

To date, small and medium-sized private enterprises (SMEs) in particular are still in the process of gaining an understanding of current and future climate risks and vulnerabilities. Region-specific training on adaptation for SMEs has been organised in collaboration with the regional administration and councils. The University of Helsinki has published a guide to assessing the climate-induced physical and transition risks, including transboundary risks, in a company's value chain.

The private sector is also engaged in a range of sectoral strategies and initiatives addressing climate resilience and adaptation. For example, the preparation of the National Forest Strategy 2035 has involved broad stakeholder participation, including private-sector actors. The strategic process aimed to align regional interests and the needs of different stakeholders so that the objectives deliver extensive benefits to the forestry sector, such as strengthening knowledge-based management and expertise. In addition, several private-sector forestry actors have received funding through projects under various national programmes and funding calls (e.g. the Catch the Carbon Programme).

4.4.6 Scientific, Indigenous, and local knowledge and justice and fairness in adaptation planning

Research on climate change impacts and adaptation has become well established in the field of climate research. Adaptation research is carried out in national projects, where significant funders include the Research Council of Finland and the Strategic Research Council (SRC). National research institutes, universities, and universities of applied sciences also actively participate in international research and development work, especially through funding received from the European Union.

Key research themes include:

- climate change impacts in different sectors and parts of Finland, for example, agriculture and forestry, health, construction and other infrastructure, ecosystems, and the Arctic region;
- specification of global and European scenarios for Finland, for example, Representative Concentration Pathways (RCP) and Shared Socioeconomic Pathways (SSP);
- an assessment of climate risks, examining not only the risk factors but also exposure and vulnerability at the national, regional, or local level, as well as the assessment of the costs of climate change inaction;
- adaptation and improving resilience using, for example, nature-based solutions for managing floods and waterways in urban areas;
- cross-border impacts and policy actions for their management.

More information on different research themes can be found in the Research chapter (6.2.5).

Project funding strongly directs R&D activities dealing with adaptation issues in Finland. Previous governments' analysis, assessment, and research activities funded projects (this funding instrument has since been replaced by a new, similar funding instrument), and the ministries' R&D funding has produced targeted information for the needs of policy development. The projects are usually relatively short term. In the projects, information can be compiled to support drafting of legislation or strategies, for example. The research funding of the Research Council of Finland, the Strategic Research Council, and the EU is more long term, enabling a focus on new topics such as cross-border impacts and the utilisation of scenarios. More R&D activity that produced practical applications based on the results of long-term theory-oriented research would, however, be useful.

One of the objectives of the Climate Act and a development priority of the climate policy planning system under the Act is to ensure justice and fairness in the context of climate measures. The justice-related objective can be regarded as including procedural and substantive aspects under the Climate Act. The procedural aspect would mean that the process to prepare a plan is just and transparent. The substantive aspect is based on the fundamental and human rights obligations that are binding on Finland. The European Climate Law also underlines that the transition to a more sustainable society should be just.

The Finnish Climate Change Panel has pointed out that climate policy cannot mend all existing inequalities. Many of the factors increasing the vulnerability of groups to climate change, such as socioeconomic status, cannot be solved by adaptation policy or, consequently, by NAP2030. However, when planning measures and allocating resources for climate change adaptation, the aim is to prevent current inequalities from worsening or new ones being created without adequate compensation. NAP2030 includes a measure which aims to develop the assessment of fairness and justness of adaptation measures. Issues related to the fairness and justness of adaptation measures were examined during the process to prepare NAP2030, with methodological challenges discovered in relation to them. Development needs, including methods development and assessment development, and opportunities to solve them will be assessed more specifically based on the results of ongoing projects.

The MountResilience project (Accelerating Transformative Climate Adaptation for Higher Resilience in European Mountain Regions, 2023–2028) aims to enhance climate resilience in European mountain regions. It focuses on developing and scaling up climate change adaptation solutions. Lapland is one of the four replicating regions where nature-based solutions and technological innovations will be tested and implemented. Natural Resources Institute Finland (Luke) is a partner in this project.

The Luke-coordinated project ArcticKnows (Just Knowledge for a Regenerative and Wellbeing-oriented economy in the Arctic, 2025–2028) foregrounds Indigenous and local knowledges, supporting community-led, decolonial, regenerative, just, and climate-wise livelihoods.

For example, Arctic PASSION (Pan-Arctic Observing System of Systems: Implementing Observations for Societal Needs, 2021–2025) has provided background knowledge for the collection and analysis of climate change observations and traditional knowledge, upon which it is planned to build the Saami adaptation plan. The Finnish Meteorological Institute (FMI) was a partner of Arctic PASSION.

Vulnerable groups, including the elderly, persons with disabilities, children and young people, populations with health vulnerabilities, climate-sensitive livelihoods such as agriculture and natural resource sectors, and the Saami as

an Indigenous people, have been identified, and their perspectives taken into account in the preparation of the National Climate Change Adaptation Plan. However, neither the preparation process nor the 127 statements received during the consultation identified gender equality as a specific or prominent issue. Yet although the effect of gender on the impacts of climate change is that women have a higher life expectancy than men, the health impacts of climate change on older people are expected to affect women disproportionately.

4.4.7 Nature-based solutions to climate change adaptation

Finland is well placed to increase the utilisation of nature-based solutions in contexts such as land-use planning, stormwater management, the development of urban regions, and water management in agriculture and forestry. For example, extreme water conditions increasing due to climate change pose a challenge to soil functionality and therefore water management in agriculture and forestry, but existing or correctly implemented wetlands and sites that are in their natural state can help regulate the water cycle. Correspondingly, in densely built urban environments, nature-based solutions can promote stormwater management and provide other benefits as well.

Target 12 of NAP2030 is that "Nature-based solutions are established and have increased society's preparedness for climate risks, improved water protection and increased biodiversity by 2030". This means that

- The number and surface area of floodable parks and forests that retain water and nutrients are increased in flood risk areas from the 2022 level, aiding water protection and management, and improving biodiversity;
- Urban nature-based solutions are commonly used in stormwater, flood risk, and heatwave preparedness and water protection;
- Nature-based solutions have increased biodiversity in and around the implementation areas;
- Research data on multifunctional impacts and benefits of nature-based solutions have increased;
- Research on the benefits and impacts of nature-based solutions has been supported;
- Nature-based solutions are examined as primary options for measures, and their societal appreciation is increased.

This target has been advanced through several projects that develop and strengthen nature-based solutions. For example, the Programme for Enhancing Water Protection (2019–2023) examined, among other things, the quality of stormwater and measures for managing it, including nature-based solutions.

A partial update of the Stormwater Guide is currently underway. The update is expected to be published in sections in 2026 and 2027, and will provide information to municipalities, consultants, and the public about ways to manage stormwater. The original guide from 2012 and its update both include recommendations for nature-based solutions.

The Ministry of the Environment participated in the Nordic Council of Ministers' Nature-based Solutions (NbS) programme from 2021 to 2024. The programme was used to develop and promote nature-based solutions in the Nordic countries. From 2025 to 2027, the Ministry of the Environment is participating in the Nature-based Solutions component of the Nordic Council of Ministers' Nordic Nature programme, which aims to promote the wider adoption of nature-based solutions in the Nordic countries.

4.4.8 Co-benefits of adaptation actions

The revised Climate Act strengthens the general framework of adaptation management, with the obligation to promote climate resilience and sustainable development. In addition, according to the Act, the assessment of climate risks should include both sector- and administrative sector-specific and crosscutting evaluations because the harmful impacts of climate change cross sectoral boundaries. The extension of the Climate Act's planning system to include the land-use sector also emphasises that any impacts on biodiversity must be taken into account when preparing climate policy plans. Protecting biodiversity is a key action in terms of adaptation, and it creates opportunities for strengthening beneficial synergies.

According to the interim evaluation[29] of the National Adaptation Plan to 2022, there have been no major conflicts between adaptation planning and other planning. Instead, practical challenges are typically related to the coordination of mitigation and adaptation, both in terms of practical work and resources. For example, this can be seen in regional low-carbon roadmaps and in the emphasis of regions' and municipalities' climate action. Identified tensions between adaptation, mitigation, and safeguarding biodiversity are related to the development of urban form and the built environment, for example.

In addition to these challenges, important synergies arise from promoting biodiversity through both mitigation and adaptation measures. Both mitigation and adaptation require resources, which can be partly shared, although there may be differences in the activities' emphasis. Legislation and the authority of various institutions direct the implementation of adaptation and emissions reduction strategies, projects, and tasks.

[29] Mäkinen et al. (2019)

The integration of adaptation and mitigation has progressed in the various administrative sectors, including the Ministry of the Environment and the Ministry of Agriculture and Forestry. The Adaptation Programme of the Ministry of the Environment promotes integration between different areas of responsibility. The actions included in the Climate Action Package of the Land Use Sector (MAF 2020) are cross-sectoral and have many synergies with respect to adaptation. Adaptation is also one of the goals.

In addition, guidelines have been developed to assess climate impacts in the application of the Act on Environmental Impact Assessment Procedure (EIA) and the Act on the Assessment of the Effects of Certain Plans and Programmes on the Environment (SEA). The purpose is to promote the examination of adaptation to climate change across sector boundaries and better identify conflicts and synergies between adaptation and mitigation in the assessments.

4.5 Progress on implementation of adaptation

4.5.1 Steps taken update the national adaptation plan

Finland's Climate Act 2022 specifies that the Government must adopt a National Climate Change Adaptation Plan at least every second parliamentary term.

Four significant sets of background material were produced during the preparation of NAP2030:

1. A sectoral and cross-sectoral risk and vulnerability assessment and a regional vulnerability assessment. The assessment results have been utilised in the definition of targets and actions.
2. The results of the KOKOSOPU project, which was funded by the Government's analysis, assessment, and research activities, and which conducted an overall evaluation of the national adaptation policy, were utilised in the definition of targets and actions.
3. Scientific consultation conducted in collaboration with the Finnish Academy of Science and Letters that focused on an improved understanding of cost-effectiveness, and the concepts of vulnerability and justice in the context of adaptation. The synthesis was utilised in the preparation of NAP2030.
4. A report by the Finnish Meteorological Institute and the Finnish Environment Institute on climate and socioeconomic scenarios in climate change adaptation planning, which was utilised in the risk and vulnerability assessment in particular.

In addition, NAP2030 uses results from several projects funded by the Government's analysis, assessment, and research activities, the Finnish Climate Change Panel Finnish Climate Change Panel and its project report on Climate Change Adaptation: Regional Aspects and Policy Instruments and the mid-term evaluation of the implementation of Finland's National Climate Change Adaptation Plan published in 2014.

Under the Climate Act, the next adaptation plan must be prepared during the next government term (2027–2031). The mid-term evaluation of the current NAP will be completed in 2026 and will inform the setting of targets and measures for the next plan. In addition, preparations for a national climate risk and vulnerability assessment have begun, and the assessment will be carried out during 2027.

4.5.2 Changes in regulations, policies, and planning and implementation of sector specific planning

The implementation of sector specific actions and planning is also described in Section 4.4.2. Legislation and plans guiding climate change adaptation have also been described in Finland's BTR1 (Section 4.5.2). Only laws, policies, and plans that have been updated or reviewed since then are described in this section.

The Ministry of the Environment is currently updating its administrative branch-specific adaptation action programme. The updated programme will be published in 2026.

The implementation of the National Water Supply reform will continue actively until 2030. Supervision of water utilities in accordance with the revised Water Services Act[30] and the promotion of the Act's objectives will continue actively, starting in 2026 at the supervising regional Economic Development Centres, which will also participate in water utilities' raw water risk management efforts. The Economic Development Centres train and encourage water utilities in this work to take climate change risks into account more strongly than before in their risk management planning.

The reform of the Water Services Act was enacted in December 2025. The reform imposes a stronger obligation on water utilities to plan for contingency and asset management, which further guides utilities in structural change towards larger organisational units and closer cooperation between utilities. The implementation plan for the national water supply reform programme also

[30] 1087/2025

includes several other measures to improve asset management and promote structural change.

The new Construction Act, which will improve the effectiveness of regulation, particularly to mitigate and adapt to climate change, entered into force in 2025. The Government's proposal for the Land Use Act was submitted to Parliament during the 2026 spring session. The proposal also includes provisions on adaptation. Preparations are underway for new Community Construction and Community Development Acts concerning municipal public areas and stormwater, and the draft provisions take climate change adaptation into account. A consultation round will be held in 2026, and the Government's proposal is scheduled to be submitted in fall 2026.

In the ongoing legislation reform of the Rescue Act,[31] the aim is to make the law more reflective of its operating environment, where climate change has been identified as a central megatrend. The impacts of climate change on comprehensive security have also been taken into account in the Government's decision on the Objectives of the Security of Supply which was updated in 2024. The new Government Decision on the Objectives of Security of Supply is based on Finland's changed security environment, but security of supply issues are also relevant when adapting to climate change.

The Government Resolution on the Cultural Heritage Strategy 2030 was adopted in 2023. The Resolution states that actors in the cultural heritage sector will focus their activities on strengthening sustainable development and take solutions related to climate change mitigation and adaptation, as well as the circular economy, into account in their operations. The Cultural Heritage Strategy website,[32] open to everyone, was launched in the autumn of 2025; cultural heritage actors can add initiatives to the platform, and the site will be used as a tool for communication and reporting.

4.5.3 Implementation of national-level plans and actions

In Finland's Eighth National Communication, progress under the previous Adaptation Plan (2014–2022) was reported. More up-to-date information on the implementation of the current NAP2030 will become available following the evaluation of the plan, which is expected to be completed by the end of 2026. The implementation of sector-specific actions is described in Section 4.4.2.

The first round of monitoring of NAP2030 was conducted in 2025. The monitoring system, including its objectives and methods, is described in

[31] 379/2011

[32] https://kulttuuriperintostrategia.fi/

Section 4.6.1. The assessment in the table below is based on the indicators in Section 4.6.1 and Table 3. The results indicate that, while progress has been made towards all NAP targets, further efforts are required to achieve them by 2030. For each target, the system tracks the implementation of relevant actions. For targets aimed at reducing climate-change-related risks, it also monitors the development of those risks to assess whether the measures taken have been sufficient. Adaptation needs were considered in the preparation of NAP2030.

The results of the first round of monitoring of NAP2030 is illustrated below (Table 4.5-1). The targets and measures in the Adaptation Communication submitted in 2025 are aligned with NAP2030. The implementation described here therefore also applies to the implementation of the Adaptation Communication. The colour green in the table indicates that the implementation has progressed according to plan, or that the impacts of risks have reduced compared with the baseline. Yellow indicates that progress has been made, but it has been slower than anticipated, or that there is no significant change in the indicators measuring the impacts of risks. Red indicates that that implementation has progressed more slowly than planned, or that the consequences of risks have increased. Please also see Section 4.4.2, where examples of measures in different plans are outlined.

The evaluation of the previous national adaptation plan aimed to assess financial resources for adaptation and climate resilience. From the evaluation results, it is evident that it is challenging to track funds targeted at adaptation. Funds are not necessarily earmarked at the budget level, and the approach of mainstreaming adaptation into regular activities in different sectors makes it difficult to track budgetary resources allocated for increasing climate resilience. Financial resources are both permanent (state budget framework) and temporary (projects, separate funding mechanisms). In some ministries, budget funds are directed to advisory work. Funding is also directed to salary costs, training, and communication. For example, two ministries jointly contribute to the funding of the Climateguide.fi portal.

The Ministry of Agriculture and Forestry is responsible for coordinating the preparation of NAP2030. Ministries are responsible for coordinating adaptation in their administrative branches. Relevant ministries are represented in the NAP2030 implementation group that coordinates cross-sectoral adaptation.

The Ministry of Transport and Communications coordinates adaptation work at a national level in the Ministry's administrative sector. The Ministry of Economic Affairs and Employment chairs the network of climate change officials and is in charge of the overall coordination and compilation of the strategy work. The Ministry of the Environment coordinates an adaptation group consisting of the environmental administration concerning the built environment, environmental protection, biodiversity, and water protection.

Table 4.5-1
Progress made on NAP2030 targets

Target	Progress on implementation	Development of risks	Description of assessment
1–3 National-level planning, including administrative sectors, as well as overall security and security of supply			Adaptation has been incorporated into the Government Programme and the Government's Future Report. The consideration of climate risks has increased across government sectors, but the scope and consistency of risk assessments vary.
4–5 Food and nutrition security			Implementation has progressed, but agriculture's adaptive capacity has deteriorated in some areas, and plans have progressed slowly. There is no significant change in the impacts of risks.
6 Water services			Implementation has progressed, but the uptake of information is still developing. There is no significant change in the impacts of risks.
7 Transport and communications infrastructure			Adaptation has been recognised in the sector's programmes, and tangible measures are being implemented in maintenance, planning, and projects. Vulnerabilities have been identified.
8 Built environment			Measures have progressed as planned, and additional information has been produced to support adaptation. In particular, the impacts of flood risks have increased.
9 Energy infrastructure, industry, and businesses			Awareness of risks is good, but awareness of slow-onset or international spillover risks is more limited. The monitoring of climate risks requires more development.
10 Renewable natural resources			Implementation is proceeding largely as planned. Wildfires decreased from 2023. Significant damage caused by snow and wind is mainly increasing.
11 Biodiversity			Progress on sector-specific plans is slower than anticipated. Changes in biodiversity occur gradually, so the impacts of risks are materialised with a delay.
12 Nature-based solutions			The implementation of plans is moving forward, and solutions are being developed in the projects, but implementation requires further effort. In particular, the impacts of flood risks have increased.

Table 4.5-1 t

Target	Progress on implementation	Development of risks	Description of assessment
13 Drought risk management			Progress has been made in the process of managing drought risks. There is no major change in the impacts of risks compared with previous years.
14 Health protection from heatwaves			Plans to prepare for heatwaves are being implemented, and solutions are being developed through various projects; implementation efforts should be strengthened. There is no major change in the impacts of risks compared with previous years.
15 Cultural heritage and cultural environment			Adaptation measures have not been comprehensively integrated into operations. Indicators for monitoring implementation are still underdeveloped.
16 Knowledge base and expertise of regional and municipal actors			Guides and information are available, but using them requires initiative on the part of regions and municipalities.
17 Regional and municipal guidance			The lack of available policy instruments hinders the achievement of objectives.
18 Funding opportunities at the regional and municipal levels			Projects are underway, but they focus on the same actors.
19–21 International cooperation			Monitoring of the target is still under development, so monitoring data are not yet available.
22 Knowledge base and utilisation of information			Implementation is progressing. Progress cannot be compared with the previous situation.
23 Communication and interaction			Implementation has progressed as planned.
24 Monitoring and evaluation			Monitoring has been developed, but implementation requires further development.

Please see the text above for explanations for colours. No assessment has been made for cells marked with grey. White is used for “not applicable”.

4.5.4 Implementation of regional and local adaptation actions and plans

More than half the regional councils have adopted, or are currently preparing, a regional adaptation plan. The largest cities and some smaller municipalities have also published an adaptation action plan, either as a standalone document or as part of a comprehensive climate or sustainability strategy. However, it is unclear how effectively regions and municipalities are generally able to implement these plans. A 2025 study by the Finnish Environment Institute showed that of the municipalities that responded to the survey, nearly two thirds had implemented adaptation measures, and around 80 per cent planned to do so in future.

It is widely acknowledged that the most efficient way to implement adaptation measures is to integrate them into other policies, processes, and functions. For example, including the obligation to ensure enough permeable land cover to manage increasing rainfall in a detailed plan would be more effective than having a separate action point to increase vegetation in the built environment.

Some regions and municipalities use an open online monitoring tool called Ilmastovahti (Climate Watch) to track and publish their progress in implementing climate mitigation and adaptation measures. For example, according to the Climate Watches of the City of Espoo and the Regional Council of Häme, most of their adaptation measures are currently being implemented or have already been completed. The application also allows measures to be noted as continuous, which is appropriate for many actions at a local level.

However, to date, there has been no systematic assessment of the stage at which regional and local adaptation actions and plans are being implemented. The mid-term evaluation of NAP2030, due to be completed by the end of the year, will provide some insight. Monitoring progress on adaptation is recognised as an important part of implementation and the learning cycle for building climate resilience.

4.6 Monitoring and evaluation of adaptation actions and processes

Establishment and use of domestic systems to monitor and evaluate the implementation of adaptation actions

Monitoring of adaptation is an important part of the current National Climate Change Adaptation Plan (NAP2030). Finland piloted a new national-level monitoring system in 2025, building on a proposal developed by the Finnish Environment Institute.[33] The results from the first cycle of monitoring are presented in Section 4.5.3.

[33] Virtanen & Munck af Rosenschöld (2026)

The Ministry of Agriculture and Forestry, which is responsible for the national coordination of adaptation, is also responsible for developing the monitoring and evaluation of adaptation. The goal of the new monitoring system is to track both progress made in reaching the targets set out in the National Adaptation Plan and the development climate risks relevant for the aforementioned targets. This represents a step forward compared with earlier monitoring efforts, which focused primarily on tracking progress in the implementation of policy measures.

The monitoring system differentiates between targets that develop adaptive capacity and targets that focus on managing risks. For targets that focus on developing adaptive capacity, the system monitors the implementation of the targets. For targets that aim to manage climate-change-related risks, the system monitors both the implementation and development of risks. By focusing on both targets and risks, the system can identify more comprehensively the degree to which successfully implemented actions actually reduce relevant climate risks. The system can thus identify instances where planned adaptation actions are implemented according to plan, but fail to reduce risks, calling for a closer inspection of selected adaptation and their appropriateness.

A lesson learned from this process was that while the system does not currently assign attribution or contribution of actions to changes in risks as such, which would require more detailed assessments, it nevertheless signals when planned and implemented actions may fail to generate reductions in climate risks. This in turn would raise questions of adequacy of implemented actions.

Indicators are one practical monitoring tool that can be used to monitor actions or the desired change, and are seen as good practice in monitoring climate change adaptation. For each target in the National Adaptation Plan 2030, a set of indicators was identified and assessed according to the indicator assessment tool[34] developed by the Finnish Environment Institute. For some indicators, data sources already exist, and the data are being monitored. However, the system also identified gaps in knowledge and proposed indicators that are currently not monitored but that would generate knowledge relevant to adaptation. More than 200 qualitative indicators and quantitative means of monitoring were implemented in the system. Some of these indicators are presented below as illustrative examples in the table below.[35] The indicators will be updated periodically to ensure relevance and usability. The results from the first round of monitoring made using the selected indicators are presented in Section 4.5.3 and Table 4.6-1.

[34] Munck af Rosenschöld et al. (2024)

[35] A complete list of indicators, their data sources, and actors responsible for monitoring is available in Virtanen & Munck af Rosenschöld (2026).

Table 4.6-1
Examples of indicators used to monitor NAP2030 targets

NAP2030 target	Indicators used for monitoring target	
Target 1: Adaptation is integrated into the Government's and ministries' strategic planning and foresight by 2030	**Implementation indicators**	Coverage of entries related to adaptation and climate risk management in government programmes (qualitative description)
Target 3: The consequences of climate change and the adaptation needs are identified as part of comprehensive security and integrated into the comprehensive security model and the objectives of security of supply by 2026	**Implementation indicators**	Implementation of the Government Decision on the Objectives of Security of Supply implementation plan
Target 4: The operating conditions of agriculture to adapt to climate change are enhanced by 2030	**Implementation indicators**	Improvement of resilience in agriculture (status)
	Risk indicators	Quality of cereal harvest
Target 6: The preparedness of water services for climate change impacts is improved by 2026	**Implementation indicators**	Number of water utility preparedness plans reported by utilities
	Risk indicators	Number of waterborne epidemics
Target 8: The built environment sector has the capacity to manage climate change-related risks and to adapt to foreseen changes in climate by 2030	**Implementation indicators**	Implementation of flood risk management measures
	Risk indicators	Flood damage estimates based on flood maps
Target 11: Adaptation to climate change and halting biodiversity loss are tackled together by 2030	**Implementation indicators**	Connectivity of the network of protected areas by habitat
	Risk indicators	Number of habitat types whose endangerment is caused and accelerated by climate change
Target 13: Drought risk management has developed by 2030	**Implementation indicators**	Number of regional drought risk management plans
	Risk indicators	Occurrence of wildfires
Target 16: Regional and municipal actors have access to guidelines for managing climate risks as well as the competence to make use of them in planning on various sectors by 2030	**Implementation indicators**	Number of regional adaptation plans
Target 22: The knowledge base related to weather and climate change risks and adaptation is strengthened in a practical manner, and the availability of research data to end users is ensured by 2027	**Implementation indicators**	Number of adaptation-related publications produced by Finnish research organisations during the monitoring period
Target 24: Adaptation monitoring is systematic and supports the development of activities	**Implementation indicators**	Are monitoring methods or systems defined for administrative branch plans, programmes or other entities? (proportion of plans with monitoring system)

Some of the indicators adopted in the national system align with those included in the Belém adaptation indicators, particularly those included in the Red List Index. Finland's Sustainable Development Goals (SDG) indicators also provide data relevant to the Belém indicators. In addition, the indicators developed to monitor the NAP partly track progress across all sectors identified in the UAE Framework for Global Climate Resilience.

The national-level monitoring system also assigns responsibilities and roles for monitoring for ministries, research institutes, and other agencies, establishing a process by which monitoring data are collected and assessed annually. This helps produce up-to-date monitoring data for the Annual Climate Reports to be submitted to Parliament and support reporting activities. National adaptation reporting is done through the Annual Climate Report, which is part of the Finnish climate policy planning system under the Climate Act. The Act requires that the report include "to the extent necessary, an estimate of the adequacy and effectiveness of the adaptation measures contained in the adaptation plan [referred to in section 10 of the Act] and, if necessary, a report on the implementation of the planned adaptation measures in individual administrative branches and regionally". The Ministry of the Environment leads the process of compiling the Annual Climate Report.

At a sectoral level, flood risk management is the most advanced in terms of monitoring the outcomes and effectiveness of adaptation plans and measures. A central guiding document is the EU Floods Directive, as part of which Finland reports on indicators and other related information biennially. The regional measures proposed in the management plans have an estimated implementation schedule, and their implementation is monitored annually through the Flood Information System. The indicator assesses the proportion of completed measures of the total number of proposed measures that can be completed.

Under the Climate Act, NAP2030 must be assessed during the 2023 to 2027 parliamentary term to determine whether it remains up to date, and if additional measures are needed. A mid-term evaluation is currently underway and will be completed in 2026. No separate final evaluation of the plan will be prepared, meaning that the mid-term evaluation is intended to provide input both for improving the implementation of the current plan and for preparing a new plan during the next parliamentary term.

The transparency of planning and implementation of monitoring and evaluation is ensured by using published studies as a basis of the monitoring system, as well as by making the results of monitoring available online on climateguide.fi. The report outlining the monitoring system and its indicators is available publicly. The mid-term evaluations of national adaptation plans and administrative-branch adaptation programme evaluations are also public documents.

4.6.2 Achievements, impacts, resilience, review, effectiveness, and results

General awareness of the impacts and risks of climate change and adaptation to climate change has strengthened. This is evident in numerous documents and public discourse referring to adaptation, as well as through the adaptation activities reported across several sectors (see e.g. Section 4.4.2).

Flood risk evaluations every six years based on the EU's Floods Directive[36] show that implemented actions have reduced flood risk in certain areas. Based on a risk assessment in 2024, ELY Centres made a proposal for significant flood risk areas, which would remove significant flood risk status from four areas, resulting in 18 significant areas. Three of these areas would be excluded from the list of significant flood risk areas due to a successful implementation of flood risk management actions. The Ministry of Agriculture and Forestry named the final list of significant flood risk areas at the end of 2024.

The revised Climate Act strengthens the general framework of adaptation management with the obligation to promote climate resilience and sustainable development. In addition, according to the Act, the assessment of climate risks should include both sector and administrative sector-specific and cross-cutting evaluations because harmful impacts of climate change appear across sectoral boundaries.

Moreover, a new content requirement for the development of National Adaptation Plans is that a regional risk assessment is to be carried out when necessary. The assessment should cover especially vulnerable sectors, ecosystems, groups, and communities. Efforts have been made to strengthen the strategic crosscutting nature of the plan, and the need to examine cross-border impacts has been emphasised. The extension of the Climate Act's planning system to include the land-use sector also emphasises that the possible impacts on biodiversity must be considered when preparing climate policy plans. Strengthening biodiversity is a key action in terms of adaptation, and it creates opportunities for strengthening beneficial synergies.

The progress in these areas contributes to a general reduction of vulnerabilities and risks, but it is impossible to quantify the extent of the reductions. To date, there have been no disastrous climate- or weather-based impacts. However, weather extremes cause, for example, economic impacts in the current climate in several sectors (e.g. agriculture, forestry, electricity distribution, transport), but an exact quantification has not yet been possible.[37]

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[36] 2007/60/EC

[37] Tuomenvirta et al. (2018)

4.6.3 Effectiveness of implemented measures

Sound adaptation policy is cost-effective, as expressed in contexts such as the Finnish Climate Act. Policy is cost-effective when the given or desired effect is achieved at minimal cost or, conversely, when the given cost generates the maximum effect. The starting point of Finland's adaptation policy – integrating climate risk management and adaptation into existing organisational structures, planning practices, and approaches – contributes to cost-effective and appropriate implementation. This principle is also reflected in the NAP2030 measures; however, monitoring of NAP2030 has thus far focused more on assessing the measures' adequacy.

Adaptive capacity has generally increased through increased awareness of possible climate change impacts. For example, tangible actions have been taken in the built environment, both at the level of regulation and in the practical implementation of stormwater management in built-up areas.[38] One of the goals of the previous National Adaptation Plan was to increase and improve citizens' awareness of climate change and adaptation activities. To improve the availability of reliable climate information, the update of the Climateguide.fi portal was initiated. Wider awareness of and dialogue about the key issues of climate policy, including adaptation, have been maintained by the expert reports and statements prepared by the Finnish Climate Change Panel.

In Finland, monitoring has previously focused on assessing the progress made in implementing adaptation policy, while information about the impacts of actions and the development of adaptive capacity has been limited. The monitoring system implemented in 2025 and developed by the Finnish Environment Institute aims to strengthen knowledge through comprehensive monitoring activities. The system is described in section 4.6.1.[39] The operation of the system relies on the involvement of the NAP2030 implementation group and its expert secretariat, and the system utilises their expertise in the collection and analysis of the monitoring data. The system is based on the targets of the NAP2030 plan and the supporting report "Risks and Vulnerabilities Related to Climate Change in Finland". The system better enables the assessment and monitoring of the impacts of adaptation actions and supports more effective adaptation by providing data to support planning and implementation.

Moreover, as established in earlier sections, indicators are an important tool for monitoring the progress of adaptation measures and climate risk trends. To increase their use at the national level in Finland, the development of monitoring has been set as one of the objectives of NAP2030. One of the

[38] Mäkinen & Hildén (2020)

[39] Virtanen & Munck af Rosenschöld (2026)

tangible measures in the plan is therefore to make better use of indicators and update the set of indicators. To support this, there was an assessment made of the current state of indicators, focusing on drought risk management and biodiversity issues, and how to further develop the monitoring of climate change adaptation[40]. The assessment also provides an indicator assessment matrix to help evaluate and prioritise indicators. The assessment matrix was used to identify indicators to monitor NAP2030 and can be used more widely for indicator development and assessment in monitoring climate change adaptation across sectors.

In late 2020, the Ministry of Agriculture and Forestry, in cooperation with stakeholder groups involved in the National Implementation Group on Climate Change Adaptation, began publishing a newsletter dedicated to climate change adaptation. The thematic newsletter is issued regularly, approximately four to five times per year, and includes articles and updates on recent adaptation-related research. It is open for subscription to all, and each issue is promoted via social media to reach a broad audience. In addition, the Finnish Meteorological Institute (FMI) publishes a monthly digital magazine (Ilmastokatsaus/Climate Bulletin) and an annual bulletin (Ilmastovuosikatsaus) on weather and climate (see Section 7.5).

In water resources and flood management, the capacity to adjust waterflow and to react to flood risks has been increased by establishing the Flood Centre run jointly by the Finnish Environment Institute Syke and FMI. Flood risk maps are also being produced for areas subject to potential fluvial or sea surge floods. Coastal flood maps are currently being updated. Water levels are now defined according to three different SSP scenarios for 2020 (present situation), 2050, and 2100 for floods of various size.

In the agricultural sector, farmers have diversified crop rotations by introducing novel crops for cultivation, shifting cultivation of crops northwards, and even substantially expanding field areas under minor crops like pea, fava bean, caraway, and oilseed rape. These measures not only improve long term sustainability and diversify agricultural land use but also support improvements in the adaptive capacity and resilience of agricultural systems.

The previous adaptation plan's mid-term evaluation also aimed to assess financial resources for adaptation and climate resilience. When evaluating financial resources, the difficulty of evaluating the funds directly aimed at adaptation again becomes evident. They are not necessarily earmarked at the budget level. Part of the implementation of NAP2030 takes place as part of official duties, but the plan's successful implementation calls for additional resources. The responsible actors specified in the plan undertake to implement the NAP2030 actions as efficiently and appropriately as possible, and to the

[40] Munck af Rosenschöld et al. (2024)

extent possible within the available resources. Each ministry is responsible for the reallocation of resources required in their administrative branch, as well as for proposals for additional resources in accordance with the general government planning processes. The sustainability of actions is therefore increased through the integration of adaptation into all operations.

As adaptation is integrated into organisations' normal operations, they influence the organisations' other development goals. This also ensures that sustainable development considerations are included in adaptation planning and vice versa.

Consultations with representatives of vulnerable groups were held when preparing NAP2030. These groups are listed in Section 4.8.1. These consultations contributed to the targets in NAP2030. In 2027, a national climate risk and vulnerability assessment will be prepared, and the assessment of vulnerabilities will be developed.

4.7 Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

Climate risks and their impacts are described in Section 4.2. Thus far, limited information is available about the theme of loss and damage in Finland. Resilience to extreme weather events is relatively high in Finland, while climate change is not expected to cause enormous changes in their severity or frequency. However, further improvements are needed and planned for preventing damages from extreme events such as flood damage and disruptions to power supply. Considering the high level of extreme weather resilience, from an economic perspective, the guiding principle of adaptation policy should be effectively coping with structural changes in the operating conditions of different sectors and regions. Adaptive actions that increase adaptive capacity and reduce negative impacts are described in more detail in previous sections.

The KUITTI (2020–2022) project analysed the impacts of climate change to specific sectors if no further adaptation was to be implemented. The project estimated effects on the forest sector and agriculture, effects of fluvial and coastal flooding, and effects of disruptions in electricity distribution, which are subsequently propagated throughout the economy. Effects were included based on a prior review of likely significance and available data. However, several potentially significant risks such as for health and healthcare could not be accounted for. Although Finland may be economically less affected than

the global and European average, it pays to adapt to the foreseeable effects of climate change in a timely manner. The study found that proactive adaptation reduces losses incurred by climate change more effectively than reactive adaptation.

The VIHKA project (Assessment of the economic impacts of climate change and biodiversity loss: current state and proposals for action) aims to assess the economic impacts of climate change mitigation and biodiversity loss.[41] In 2022, a joint development project between the Finnish Meteorological Institute and the National Emergency Supply Agency compiled a database of weather and climate impact data from past decades.[42] Impact data with sufficient temporal and spatial accuracy and linkability to weather were selected for the database. Real-time impact data have been combined with other meteorological observations and forecast data to monitor the development and accumulation of the weather impacts in different parts of Finland.

After the database's compilation, a large amount of historical weather forecast data and part of the impact database were selected as training material for a machine learning method. Many of the event time series are years long and nationwide, so the data collected are rare, even at a global scale. Impact forecast products help safety- and security-critical actors prepare for dangerous weather situations in a timely manner and with appropriate resources.

The Arctic is particularly vulnerable to the impacts of climate change, and climate change has already affected the environment, livelihoods, and culture of the Saami people.

4.8 Cooperation, good practices, experience, and lessons learned

A strategic communications and engagement plan for NAP2030 was developed in 2025. The plan was prepared in close collaboration with members of the NAP implementation group, the expert secretariat, and the Government's climate communications coordination group. Its purpose is to provide a common framework, terminology, and communications approach for actors involved in implementing the NAP. It supports sectors in tailoring their adaptation communications while ensuring that messaging across the Government remains consistent, coherent, and aligned in promoting a shared understanding of adaptation. The plan's implementation began in the autumn of 2026.

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41 Spolander et al. (2026)

42 National Emergency Supply Agency (2022)

The shared learning environment for central Government[43] has courses intended for the adaptive capacity building of government agencies and other organisations. More information can be found in Section 4.8.2. Other capacity building efforts coordinated by the Climate Unit of the Economic Development Centres includes regular "adaptation morning coffee" information sharing online meetings for all interested. The sessions have an adaptation-related theme with presentations and discussion. The unit also runs a LinkedIn group which enables information sharing between its members. The group is also open to anyone.

The administrative sectors have different structures, regulation systems, and practices to implement the interaction between different administrative levels. Administrative sectors where legislation requires planning at different levels (for example, water resources management and water supply and sewage, flood protection, land-use planning, and transport planning) also have ready-made procedures for interaction that can be utilised for adaptation issues. This can also be seen in the implementation of local adaptation activities, for example.

In many adaptation issues and practical activities such as land use and flood protection, planning and decision making take place in several linked administrative structures, which means that the responsible authority can be national, regional, or municipal. For example, flood risk management and related water regulation is a key adaptation-related task, and the implementation requires cooperation between several different actors. The Ministry of Agriculture and Forestry, regional level organisations, municipalities, companies, and the Finnish Environment Institute (Syke) are involved. In the management of stormwater floods, local measures are emphasised, but regional and national land-use and infrastructure planning also play an important role. Flood protection has been found to be an example of a particularly well-functioning area of cooperation between different organisations in Finland.[44]

Networks play an important role in the implementation of climate action. Networks are important sources of peer support, exchange of good practices, knowledge, and experiences. Networks also motivate climate action, as their activities often involve preparation of climate plans and reporting of actions. National networks and regional cooperation are guided by the responsible ministries. Some of the existing networks are described below.

An example of sharing information about policy innovations is Finland's development of an integrated drought monitoring and early warning system combining meteorological and hydrological indicators (e.g. SPI[45], soil moisture,

[43] eOppiva

[44] Gregow et al. (2021)

[45] Standardized Precipitation Index

groundwater levels) through national services such as waterinfo.fi and the Flood Centre. These systems provide near real-time drought status and forecasts to support proactive risk management. Lessons learned highlight the importance of combining multiple indicators, ensuring open access to data, and integrating services across institutions to enable effective information sharing and decision making.

Another example is Finland's implementation of pilot projects that co-develop climate risk management tools with farmers and other stakeholders. For example, projects combining research institutions, advisory services, and farmers have focused on identifying climate risks such as drought and developing practical adaptation solutions, including improved water management and risk assessment tools. These pilots involve workshops, stakeholder engagement, and testing of solutions in real farming environments, allowing iterative learning and refinement. Experience shows that co-development approaches increase the acceptance and uptake of adaptation measures, while also improving the relevance of climate information and tools.

4.8.1 Efforts to share information, good practices, experience, and lessons learned at the national level

The NAP2030 implementation group and secretariat are an important information-sharing mechanism. The group consists of representatives from ministries, government agencies, and research institutes. The tasks of the implementation group are to:

1. Ensure the implementation of the National Climate Change Adaptation Plan across all administrative sectors, coordinating implementation with sector-specific adaptation programmes and plans;
2. Strengthen the perspective of climate risk management in the Government's strategic planning, contribute to comprehensive security, and ensure the broad utilisation of scientific knowledge and sectoral expertise in adaptation work;
3. Support the coherent cross-sectoral consideration of European Union initiatives related to climate change adaptation across different EU policy areas and in their national implementation;
4. Monitor the international operating environment and policy developments related to adaptation;
5. Promote awareness and public discussion of climate risks and their management through communication and stakeholder engagement, and support capacity building;

6. Strengthen the systematic and appropriate integration of adaptation into the work of regional and local authorities;
7. Promote the development of the adaptation monitoring system and strengthen the consistency of sectoral monitoring systems with the national monitoring framework;
8. Ensure that reliable information is available from different administrative sectors for national, EU-level, and international reporting on adaptation measures; and
9. Participate in the mid-term review of the adaptation plan required under the Climate Act.

The group meets four times a year. Its work is supported by the expert secretariat, which mainly consists of representatives of research institutes and government agencies. The secretariat provides support and background materials for the implementation group regarding implementation and monitoring, for example.

To promote the implementation of the Sendai Framework for Disaster Risk Reduction in Finland, the Ministry of the Interior reactivated a broad cross-sectoral cooperation network in 2021, involving a wide range of relevant organisations.

The network for flood and drought risk management is coordinated by the Finnish Environment Institute. The members include the regional government authorities, who are responsible for the implementation of the flood directive in their region. Under the Finnish Flood Risk Management Act, there are also Flood Management Groups for significant flood risk areas.

An example of good practice is that during the preparation of NAP2030, consultations with a broad range of stakeholder representatives, including vulnerable groups such as young people, the elderly, the disabled, and the Indigenous Saami people were held:

- Digital Panel for young people in June 2022
- Meeting with councils for people with disabilities
- Meeting with councils for older people
- Meeting with the Saami Parliament

Another example of good practice in sharing information and collaborating with vulnerable groups, the Act on the Saami Parliament,[46] was amended in 2025 to strengthen the obligation of the authorities to negotiate with the Saami Parliament when preparing legislation, administrative decisions, and other measures that may be of particular importance to the Saami people. This requirement will need to be taken into account in the preparation of the next NAP.

[46] 974/1995

4.8.2 Efforts to share information, good practices, experience, and lessons learned at the subnational level

The former internal climate expert network of the ELY Centres supported communication and cooperation on climate mitigation and adaptation across environmental, economic development (including rural development), and transport domains. The network was discontinued at the end of 2025 following the reorganisation of the ELY Centres' responsibilities into two new authorities: the nationwide Finnish Supervisory Agency and ten regional Economic Development Centres. These authorities are now working closely together to establish a shared climate network for regional actors.

The Climate Unit of the Economic Development Centres coordinates a national EU Adaptation Mission network for researchers and practitioners working and interested in implementing and strengthening climate adaptation. The network offers opportunities for peer-to-peer learning, information sharing, and partner searches for potential funding applications. Additionally, it strengthens partnerships between regional and local actors and the private sector. Finland's Regional Councils have also formed a collaboration network on climate issues.

The National Climate Unit is also tasked with giving guidance, training, and capacity development on adaptation. Two publicly open web courses, the ABC of climate adaptation and the ABC of catchment-based water management, were published in 2025, and they serve as a basic course for everyone who wants to understand climate risks and climate-smart water management. The courses have received much positive feedback, and they are being used as a first learning module in courses run by certain universities of applied sciences, for example.

In the Tampere region, several regional collaboration measures have been defined in the Climate Strategy of the Tampere City Region 2030: Preparing cooperation models for municipalities and sectors for extreme situations, defining adaptation measures and recommendations for different sectors of municipalities, and planning and agreeing on cooperation between different sectors and municipalities. In the Tampere region, there is an active, regularly gathering climate group which focuses on the region, that is, the city of Tampere and its surrounding municipalities and cities. Various climate action tools and programmes have been created in collaboration.

Savonia University of Applied Sciences coordinates the climate security business network in North Savo. The network provides information on extreme weather events, and adaptation to climate change, especially in agriculture and forestry. The region of North Savo is also a good example of effective

collaboration in adaptation planning between central government, represented by the Economic Development Centre, and the Regional Council, as well as higher education institutes and private companies.

The Helsinki Metropolitan Area has had a regional monitoring group for climate change adaptation since 2013. In 2022, the monitoring group evolved into a network of adaptation experts and practitioners in metropolitan cities. The Adaptation Network will initiate the collection of new data and information requirements necessary for effective adaptation planning, follow the implementation of externally funded adaptation projects (e.g. by the EU), and share best practices and lessons learned at the city-level integration of adaptation into urban planning.

The Helsinki Region Environmental Services Authority hosts a biannually updated dataset on land cover in the Helsinki Metropolitan Area. In the detailed dataset, the land area is classified into impermeable surfaces such as streets and buildings, and permeable surfaces such as vegetation of different heights. For example, it is used in stormwater management planning. The dataset's newly published version was done in collaboration with a company providing solutions powered by artificial intelligence. AI was used to enhance the classification of sand and asphalt, which had been recognised as an essential target for the dataset's development.

4.8.3 International cooperation to share information and strengthen science, institutions, and adaptation

Climate research, systematic climate observation, and early warning system development are quite advanced in Finland due to a long-term commitment and development efforts which have led to active capacity-building support for developing countries as well. More information about international cooperation in research and systematic observation is available in Chapter 6.

The Finnish Environment Institute (Syke) is a member of the European Topic Centre on Climate Change and Adaptation (ETC CCA) of the European Environment Agency. During the next term (2027–2030), Natural Resources Institute Finland (Luke), the Finnish Meteorological Institute (FMI), the Geological Survey of Finland, and the National Land Survey of Finland will join Syke as Topic Centre Organisations (TCOs). The TCOs support the EEA in carrying out several important tasks for managing the collection, verification, and assessment of environment and climate data that EU Member States report to the EEA under EU legislation and other requirements. Syke is also a member of the European Environmental Protection Agencies' interest group on climate change adaptation (EPA IG CCA). Syke has contributed to reports

and analyses in these capacities, most recently and significantly, the European Climate Risk Assessment (EUCRA).[47] Syke has also been involved in the strategic planning supporting the "Connecting Climate Knowledge for Europe" Joint Programming Initiative and in several EU-funded research projects focusing on climate change impact modelling and adaptation.

Syke is also involved in sharing information and research findings in international expert panels and in their related activities (e.g. thematic expert meetings), such as the Intergovernmental Panel on Climate Change (IPCC), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Service (IPBES).

The Finnish Meteorological Institute (FMI) participates actively in international cooperation, both in research and consultancy. The FMI supports capacity building and the development of meteorological and climate services in various countries, especially in the global south (more information in Chapter 6).

The Finnish Transport and Infrastructure Agency (FTIA) has participated actively in international cooperation in enhancing climate resilience in the field of transport. FTIA participates in the work of the International Union of Railways (UIC) and the World Road Association (PIARC), among others.

Finland contributes to the World Meteorological Organization's Global Atmosphere Watch.[48] Finland participates in WMO climate activities mainly through the Commission for Climatology (CCl) and its Open Panel of CCl Experts (OPACE), especially climate data and data management (see Section 6.3.1).

Natural Resources Institute Finland, Syke, the FMI, and the Finnish Institute of International Affairs (FIIA) participate in the European Environment Agency EIONET network with an expert in the adaptation group.

Finland actively supports and participates in adaptation science and knowledge development in the Arctic and the Baltic Sea region. The key mechanisms of cooperation are the Arctic Council and the Council of the Baltic Sea States. Finland's participation in the multilateral regional cooperation is guided by the goals set in Finland's strategy on Arctic policy, the EU policy for the Arctic, Finland's Strategy for the Baltic Sea Region, and the EU Strategy for the Baltic Sea Region. Previously, Finland was also a member country of the Barents Euro-Arctic Council, which has an action plan for climate change with measures and projects. However, Finland's withdrawal from the Council came into effect in 2026.

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[47] European Environment Agency (2023)

[48] http://www.wmo.int

The Ministry for Foreign Affairs administers the appropriations allocated for cooperation in the Baltic Sea and Arctic Regions. The Baltic Sea States Subregional Co-operation Vision 2030 is to facilitate dialogue, partnerships, and strengthen interregional cooperation in line with the SDGs. Several of the goals of the Arctic Council Strategy 2021–2030 advance climate change adaptation in collaboration between countries in the Arctic, for example, the goal of Arctic Climate and that of Healthy and Resilient Arctic Ecosystems.[49] Nordic cooperation on adaptation is coordinated through the Nordic cooperation group for climate and air. The cooperation programme (2025–2027) has an enhanced focus on resilience and climate change adaptation.

Water expertise and the development of internationally climate-action-relevant technical solutions are promoted that improve the water efficiency and resilience of systems, including through synergies with research and innovation, for example. The "Growth and Exports from Water" programme serves as a roadmap for strengthening business, value creation, and exports based on Finnish water expertise and solutions during the period between 2026 and 2030. The programme continues the work of the Water Expertise Growth and Internationalization Program (2022–2025), building on its lessons learned, established foundation, and operational frameworks.

Finland has contributed to the European Climate and Health Observatory by sharing the Climate Change Adaptation Plan for the healthcare and social welfare sector. The Observatory is a joint initiative of the European Commission, the European Environment Agency, and many other organisations which aims to support Europe in preparing for and adapting to the impacts of climate change on human health by providing access to relevant information and tools and fostering information exchange and cooperation between relevant actors. The Finnish Institute for Health and Welfare (THL) also actively participates in the International Association of Public Health Institutes' (IANPHI) work on climate change and health in developing health indicators, for example.

Finland participates in the adaptation working groups under the Nordic Council of Ministers. Finland is actively involved in Nordic cooperation on climate change adaptation. In 2025, Finland chaired the programme committee of the Nordic Climate Change Adaptation Programme (NCAP). The Seventh Nordic Climate Change Adaptation (NOCCA) Conference was held in Rovaniemi; this is a significant cross-sectoral Nordic forum for promoting adaptation to climate change. The Nordic Climate Adaptation Programme, operating under the framework of the Nordic Council of Ministers, supports Nordic cooperation on adaptation by funding adaptation projects and organising workshops, for example. Finland also promotes adaptation in the Arctic. The benefits of regional cooperation for Finland and its neighbouring areas include improved security and wellbeing, a better state of the environment, a

[49] https://arctic-council.org/explore/goals/#healthy-resilient-arctic-ecosystems

lower level of harmful atmospheric emissions, and better health and improved business opportunities for people. The emphasis in regional cooperation is on environmental and climate matters.

AdaptationHubs is an EU-funded initiative that aims to establish 27 National Adaptation Hubs across Europe. By doing so, AdaptationHubs is boosting coordination in climate adaptation while helping national and local governments share solutions and strengthen their approaches to managing climate risks. Finland's National Adaptation Hub is coordinated by the National Climate Unit under Economic Development Centres. The AdaptationHubs project brings together experts specialising in strengthening multilevel governance on adaptation, enabling the National Climate Unit to network with and exchange best practices with peer organisations in other EU countries.

As part of regional transboundary cooperation, adaptation questions have been discussed particularly within the framework of cooperation concerning transboundary waters with Sweden, Norway, and Russia, with a special focus on water protection and the management and use of transboundary waters, including water regulation, flood risk management, dam safety, and combating invasive alien species. With Russia, due to the political situation, there has been only the bare operational minimum since 2022, notably in necessary management of discharges.

Finland supports climate change adaptation internationally through official development assistance (ODA) and its different instruments, including:

- Multilateral funds such as the Green Climate Fund (GCF), the Nordic Development Fund (NDF), the Systematic Observations Finance Facility (SOFF), and the Climate Risk and Early Warning Systems Initiative (CREWS)
- Bilateral development cooperation projects in long-term partner countries
- The Public Sector Investment Facility (PIF)
- The Inter-Institutional Cooperation Instrument (ICI)
- Through civil society project and programme funding.

Additionally, Finland participates or has participated in the following international partnerships:

- the Risk-informed Early Action Partnership (REAP)
- the Champions Group on Adaptation Finance
- the Water and Climate Coalition.

4.9 Appendix 1 – Methods of estimating uncertainties

Between 2021 and 2022, climate projections for Finland were updated to correspond to the Shared Socioeconomic Pathway (SSP)-based atmospheric composition scenarios, considering nearly 30 global climate models (GCMs) that participated in Phase 6 of the Coupled Model Intercomparison Project (CMIP6). Projections are provided for three future 30-year periods and four of the five SSP scenarios from which enough GCM data were available.[50] In 2022, projections of temperature and precipitation from the CMIP6 climate models were used to analyse anticipated declines in the sum of winter frost and increases in the frequency of precipitation falling as rain in mid-winter.[51] CMIP simulations have been used to analyse heatwave projections[52] and extreme cold days and spells[53] in Finland. Scenarios of future snow conditions have also been produced.[54] In addition, methodologies to incorporate RCM-simulated spatial details into climate change projections derived from global climate models have been developed.[55]

One approach for obtaining ensemble impact estimates is to combine multiple climate projections with multiple impact model projections across multiple assumptions.[56] Challenges associated with this approach include the possibility that the wide range of outcomes produced with an ensemble of scenarios may make decision making based on the results more difficult. Another approach constructs impact response surfaces for depicting the sensitivity of a system to changes in key climate variables, using one or more impact models,[57] and combining them with probabilistic climate projections[58] to estimate the likelihood of exceeding critical impact thresholds.[59] A third approach for more robust estimates of future risks of rare events such as droughts is to emulate observed weather time series using weather generators that can produce much longer series, which can then be subjected to more robust statistical analysis in search of win-win adaptation solutions.[60]

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[50] Ruosteenoja & Jylhä (2022)

[51] Hoikkaniemi (2026)

[52] Ruosteenoja and Jylhä (2023)

[53] Ruosteenoja and Jylhä (2025)

[54] Räisänen et al. (2025)

[55] Ruosteenoja & Räisänen (2024)

[56] An example with Finnish crop yields by Tao et al. (2018)

[57] Pirttioja et al. (2015)

[58] e.g. Räisänen & Ruokalainen (2006)

[59] e.g. Pirttioja et al. (2019); Fronzek et al. (2022); Carter & Fronzek (2022)

[60] e.g. Ahopelto et al. (2020)

The global SSP framework has been the basis of recent scenario development work. For climate projections, SSPs (used in CMIP6) have superseded Representative Concentration Pathways (RCPs – used in the earlier CMIP5), though both sets strive to span a representative range of future uncertainties in atmospheric composition and are readily comparable. Work is proceeding to downscale some of these climate projections to a finer spatial resolution.

The socioeconomic drivers described by global SSPs, as well as influencing atmospheric composition, are also important for describing alternative future trends in society that affect climate change risks. For example, trends in population, economic development, societal preferences, and technology can affect exposure and vulnerability to future climate change. Recent participatory research in Finland has focused on co-developing regional and sector-based SSP narratives that interpret these global trends in a Finnish context. National SSP-based narratives are already available for the agriculture and food, and the health and social welfare, sectors. The co-creation of subnational system-level SSP-based scenarios and narratives for two regions in Finland was conducted in the FINSCAPES project (2021–2024).[61] Such scenario downscaling activities are currently being applied in several regional adaptation-related projects.

Scenarios are used to project future conditions that are too uncertain to provide confident predictions. Examples of scenario-related activities supporting climate change analysis include:

The FMI's construction of projections of future climate at various temporal resolutions based on global (Coupled Model Intercomparison Project Phase CMIP5 and CMIP6) and regional (EURO-CORDEX) climate model ensemble simulations. These are conditional on the future composition of the atmosphere (i.e. greenhouse gases and aerosols that affect the climate), which is influenced by human activities.

The Finnish Environment Institute (Syke) has carried out joint work with other research institutes (Natural Resources Institute Finland (Luke), the Finnish Meteorological Institute (FMI) and the Finnish Institute for Health and Welfare (THL)) on the application of the SSP-based global framework of socioeconomic scenarios for Finland, focusing on agriculture and food, health and social welfare, and regional extensions, for example. The Finnish Institute for Health and Welfare (THL) has participated in joint work carried out by Syke on the application of the SSP framework for the health sector.[62]

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[61] Finnish Environment Institute (2024)

[62] Lipsanen et al. (2025)

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Photo: Julia Warley

5

Financial, technology development and transfer and capacity-building support provided and mobilized

Finland supports developing countries in their efforts to mitigate climate change and adapt to its impacts. This chapter provides information on Finland's financial contributions to multilateral funds and programmes as well as on bilateral support to developing countries. In addition, this chapter provides information related to private sector cooperation, and support to technology development and transfer and capacity building.

5 Financial, technology development and transfer and capacity-building support provided and mobilized

This section aims to give an overview of the financial, technological and capacity-building support to developing country Parties provided by Finland. Financial support provided with exact figures is reported in CTF Tables III.1 and III.2 for 2023 and 2024. The provision of technology development and transfer support and capacity-building support is summarised in CTF Tables III.4 and III.5.

5.1 National circumstances and institutional arrangements

5.1.1 The role of the Ministry for Foreign Affairs

The Ministry for Foreign Affairs of Finland (MFA) administers the exclusive ODA (official development assistance) budget item, i.e. the development cooperation appropriations under the State budget. Climate finance is part of the ODA (please see section 5.2.2). Finland does not have a separate agency for development cooperation. The Ministry for Foreign Affairs is responsible for reporting on the provision and mobilization of support.

Development cooperation appropriations are included in the annual public budget cycles and the rolling 3-year financial frames of the Government. The Parliament approves the annual budgets every year in December. The ability to commit for longer term i.e. to make multiannual commitments is used, for instance, at the level of multilateral institutions, like the Global Environment Facility (GEF) and the Green Climate Fund (GCF), and for individual projects. However, in practice even these longer-term commitments are still subject to the annual parliamentary approval. The actual disbursements are reported in various reports, as appropriate, including in the CTF tables of this report.

Development cooperation is guided by development policy. "Climate action" continues to be a priority theme in Finland's development policy which is currently guided by the Report on International Economic Relations and Development Cooperation[1] (2024). All channels under the development

[1] https://julkaisut.valtioneuvosto.fi/items/9df60fcb-b716-4320-9503-a86db7ff0bb2

cooperation appropriations can be used for climate finance, as appropriate. Besides providing funds to the operating entities of the financial mechanism of the UNFCCC and the Paris Agreement, Finland has provided support through bilateral, regional and other multilateral channels, including support to civil society organizations (CSO) as well as development policy loans and investments.

5.1.2 Challenges and limitations

The main challenges in reporting on the provision and mobilization of support are the limited human resources of the MFA as well as the high share of core funding through multilateral channels. Since the previous reporting period, the human resources of the MFA have further decreased. While the amount of climate finance disbursed each year is rather easily tracked and reported, further details can be challenging to report, especially because most of Finland's climate finance is channelled as core contributions through multilateral organizations. Below is a list of general challenges encountered, some of which may not be relevant for this report.

- Many programmes and projects include various types of activities, including capacity building and/or technology transfer – however, it is difficult to track the share of each type of activity in each project. In the case of projects financed by multilateral organizations and funds, it would be impossible for an individual donor country to track and report on diverse type of activities.
- Most multilateral organizations and funds operate in multiple sectors, thus it is difficult to report on distribution of finance to certain sectors.
- Most multilateral organizations and funds operate globally, thus it is difficult to report on the geographical distribution of finance (including support to LDCs and SIDS[2]).

Tracking private climate finance portraits additional challenges. These include, for instance, the following:

- The so-called Rio-markers (OECD DAC)[3] have been developed for grant-based finance in which the donors themselves screen projects against the criteria of the markers. Private sector partners may not be so skilled in identifying eligible projects nor in screening the projects against the criteria of the markers.
- From the perspective of international development finance institutions, data reported in accordance with the OECD may include commercially sensitive information, for example on different financing terms. Thus, they might only be willing to report aggregated figures, not data on individual investments.

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2 LDCs =Least Developed Countries, SIDS= Small Island Developing States

3 OECD Development Assistance Committee, see also Section 5.2.1 for Rio markers

- In blended finance, climate marking is carried out based on an ex ante assessment based on the fund's investment strategy. However, actual investments may be very different from what was thought at the assessment stage.

Regarding experience and good practices in relation to public policy and regulatory frameworks in Finland to incentivize further private climate financing and investment:

- There are no climate-specific instruments for private sector financing and investment that refer to public policy and regulatory frameworks in Finland.
- There are some instruments for private sector financing and investment that refer to public policy and regulatory frameworks in Finland but they are not specific for climate finance. If a company uses any of these instruments for climate-related projects, the MFA reports the appropriate share of the project finance as climate finance. However, it is not possible for the MFA to monitor whether those instruments would lead to further climate financing or investment from other sources of finance.
- Due to the reasons outlined above, relevant experiences or good practices cannot be reported.

5.2 Assumptions, definitions and methodologies

5.2.1 Tracking climate finance

Finland uses the "Rio markers" developed for the OECD Development Assistance Committee's Creditor Reporting System (OECD DAC CRS) to track adaptation and mitigation-related 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 to obtain quantitative results. Depending on whether adaptation or mitigation is the principal or a significant objective of a project/intervention, the share usually varies between 10 and 100 per cent. Based on the project document or other relevant documentation from the implementing organisations (e.g. budget information or agreed strategies), the desk officer responsible for the respective project/intervention gives a value for the markers. The shares of adaptation or mitigation of the core support for multilateral organisations are based on data provided by the organisation on exact thematic budget allocations, e.g. as agreed for each replenishment.

To avoid double-counting, an important element of this phase is to ensure that the total sum of all Rio markers does not exceed 100 per cent. It is worth noting

that all four Rio markers are considered, thus Finland does not for example double-count climate and biodiversity finance.

5.2.2 Climate finance

Finland continues to channel climate finance as part of its ODA budget. 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 (grant) in 2009 was approximately EUR 26.8 million. While the fast-start finance period is now over, the international public climate finance provided by Finland has continued to be higher than in the base year used for fast-start finance.

Besides providing funds to the operating entities of the financial mechanism of the UNFCCC, Finland provides support through bilateral, regional and other multilateral channels. Funding is directed both at climate change mitigation and adaptation. In addition to grant funding, Finland uses investment-based and loan-based funding to accelerate private sector investment in climate solutions. Research, cooperation with universities and inter-institutional cooperation are supported to strengthen national capacity building in developing countries (please see also the Section 5.3). Most Finnish climate finance is provided as core contributions through multilateral channels (CTF Table III.2).

From 2022, Finland has also started to report climate finance that was channelled as other official flows (OOF). According to the definition by the OECD DAC[4], other official flows (OOF) are official sector transactions that do not meet official development assistance (ODA) criteria. OOF include grants to developing countries for representational or essentially commercial purposes; official bilateral transactions intended to promote development, but having a grant element of less than 25 per cent; and, official bilateral transactions, whatever their grant element, that are primarily export-facilitating in purpose.

The total allocation in 2023 was about EUR 172 million, out of which EUR 168 million was ODA and EUR 4 million OOF (approximately USD 182 million and USD 4 million, in total USD 186 million). In 2024 the total allocation was EUR 162 million, out of which EUR 124 ODA and EUR 38 million OOF (approximately USD 134 million and USD 41 million, in total USD 175 million). Details are provided in CTF Tables III.1 and III.2.

[4] https://www.oecd.org/en/data/indicators/other-official-flows-oof.html

The division between mitigation and adaptation support varies according to year, but Finland aims for balance. In 2023, the division was 62 per cent for mitigation and 38 per cent for adaptation. In 2024, the division was 52 per cent for mitigation and 48 per cent for adaptation.

5.2.3 Needs and priorities of developing country Parties

Finland's development cooperation is based on the development needs defined by the partner countries and their own development plans. The Ministry for Foreign Affairs has prepared a Country Programme for each of its long-term partner countries. Country Programmes have identified the areas of cooperation, forms of support, objectives and indicators. Country Programmes have built on the partner countries' own development plans, and their guidelines have been discussed with the authorities of the partner countries and with other cooperation partners operating in them, including civil society organisations (CSOs). During the reporting period Country Programmes covering the period 2021–2024 were under implementation.

However, most Finnish climate finance is channelled as core contributions through multi-lateral funds and organizations. Many of these support climate-resilient and low emission pathways, e.g. development and implementation of Nationally Determined Contributions (NDC) and National Adaptation Plans (NAP) in developing countries. One example is the Green Climate Fund (GCF) and its Readiness and Preparatory Support programme, which finances the formulation and implementation of NDCs and NAPs.

According to the evaluation of Finland's international climate finance[5] (2023), the Ministry for Foreign Affairs' (MFA) interventions are strongly aligned with policy ambitions and priorities of development countries.

5.2.4 Alignment with the Paris Agreement

The Guideline for the Cross-Cutting Objectives in the Finnish Development Policy and Cooperation[6] acknowledges that the Paris Agreement, among other multilateral environmental agreements, is binding on Finland and instrumental in achieving the Sustainable Development Goals. Finland's development policy and cooperation have five cross-cutting objectives, including climate

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5 https://um.fi/development-cooperation-evaluation-reports-comprehensive-evaluations/-/asset_publisher/nBPgGHSLrA13/content/evaluation-of-finland-s-international-climate-finance-2016-2022/384998

6 https://um.fi/documents/35732/0/Guideline+for+the+Cross-Cutting+Objectives+in+the+Finnish+Development+Policy+and+Cooperation.pdf/e9e8a940-a382-c3d5-3c5f-dc8e7455576b?t=1618230452564

resilience and low emission development. The "do no harm" is the minimum standard for the implementation of the cross-cutting objectives. Furthermore, opportunities to advance the cross-cutting objectives are proactively sought and supported through mainstreaming, targeted action and policy influencing.

Finland participates in various donor coordination groups that advocate for the alignment of development cooperation and finance with the Paris Agreement. One example is the "Network on Environment and Development Co-operation" (Environet) that assists the OECD's Development Assistance Committee (DAC) in ensuring that all development co-operation contributes to sustainable development, by building on and integrating principles of sound environmental management and by contributing to low carbon, climate-resilient and equitable growth and development pathways, with a view to support the implementation via effective and impactful development co-operation of the 2030 Agenda for Sustainable Development, the Paris Agreement, the Rio Conventions on climate change, biodiversity and desertification as well as the Sendai Framework on Disaster Risk Reduction. Other examples are the "Like-minded Group on MDB Paris Alignment" that is a group of donors engaging with and influencing the multilateral development banks and the informal donor coordination group "Friends of Early Warnings" that is a group of bilateral donors who share the commitment to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems and unequivocally support the UN Secretary General's call to action, i.e. the Early Warnings for All (EW4All).

Finland considers it crucial to ensure that all financial flows are in line with climate goals. Finland is the founder of the Coalition of the Finance Ministers for Climate Action[7], a 90+ member global alliance that aims to accelerate climate action by mainstreaming climate change into fiscal and economic policy. Finland was the co-chair of the Coalition between 2018–2022.

According to the evaluation of Finland's international climate finance[8] (2023), the Ministry for Foreign Affairs' (MFA) interventions are highly consistent with major global commitments under the Paris Agreement and UNFCCC processes.

5.2.5 Multilateral finance

Official financing mechanisms for international climate agreements, UN agencies, development finance institutions and multilateral climate funds play an important role in the mitigation of and adaptation to climate change. Finland

7 https://www.financeministersforclimate.org/

8 https://um.fi/development-cooperation-evaluation-reports-comprehensive-evaluations/-/asset_publisher/nBPgGHSLrA13/content/evaluation-of-finland-s-international-climate-finance-2016-2022/384998

defends the multilateral system and international law and recognises the significant results obtained through multilateral cooperation.

A large part of Finland's international climate finance is therefore channelled through multilateral organisations and funds as core funding. The strengths of multilateral cooperation are its wider coordination of climate finance and larger common funding base, which also has great potential for effectiveness.

The multilateral finance reported by Finland is based on the inflow contributions to the multilateral institutions. To determine the share of climate-specific finance, the shares agreed in each replenishment are used.

5.3 Technological development and transfer support, capacity-building support

Finland has specific programmes and financial arrangements for transferring environmentally sound technology to developing countries, thus enhancing access to it (examples in CTF Table III.4). These activities can 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. The differences between these types of technologies are not always clear, and some activities have characteristics of both.

Many climate funds which Finland supports provide funding for technology transfer among other project types. These could be installation of renewable energy equipment in new areas or grey technology for adaptation, such as flood barriers. However, it is rarely reported separately in their project portfolios.

Finland is a global leader in weather observation technology and systems. Over the years, Finland has transferred technology related to weather observation and climate services through bilateral and regional cooperation as well as concessional credit arrangements (CTF Table III.4). One example of Finland's support is the project "Improving meteorological observation infrastructure and forecasting capabilities of the National Meteorological Agency (NMA)" in Ethiopia which is financed through the Public Investment Facility (PIF) instrument.

Projects involving the transfer of technology related to weather observation and climate services have been implemented in close collaboration with the national meteorological and hydrological services of partner countries, including capacity building activities. Thus, the projects have developed and

enhanced the endogenous capacities in the developing countries. However, these projects have not focused on technological innovation.

Finland supports capacity building through its climate finance to developing countries through several instruments (CTF Table III.5). Most of the Finnish bilateral projects that have a climate-related objective as their principal or significant objective also include a capacity-building component as a response to existing and emerging capacity building needs in our partner countries. Several multilateral climate funds (such as GCF and GEF), which Finland supports, include a strong capacity-building component in their activities. This can be in the form of capacity building for developing country stakeholders for developing mitigation and/or adaptation projects to apply for funding or capacity development in a specific climate change theme. In general, capacity building is an inherent part of most cooperation projects and programs, as it is one of the key measures to ensure the sustainability of activities.

In addition, Finland has some funding instruments specifically aimed at capacity building. The institutional cooperation instrument (ICI) is used to support Finnish government agencies' and public bodies' participation in development cooperation (please see the Section 6.4). The projects' objective is to strengthen the skills and knowledge of state actors, such as ministries and government agencies, in developing countries.

One example of the use of the ICI, is the project "Increasing Climate Resilience of Zanzibar with Integrated Marine Management and Sustainable Blue Economy (BLUE-ZAN)"[9], implemented by the Finnish Environment Institute (Syke), in collaboration with the Department of Environment (DoE), Zanzibar Environment Management Authority (ZEMA), Department of Marine Conservation (DMC), and Zanzibar Fisheries and Marine Resources Research Institute (ZAFIRI). The objective of the project is to increase climate resilience through improved marine and coastal resources management and sustainable blue economy in Zanzibar. The activities of BLUE-ZAN will contribute to implementation of the Tanzanian Nationally Determined Contribution (NDC), in the sector of marine and coastal environment and fisheries. In particular, the project will increase capacities of the government officials in implementing the adaptation measure of strengthening management of coastal and marine resources and monitoring systems.

Finland continues to be one of the world's leading donors supporting capacity building for partner countries' National Meteorological and Hydrological Services (NMHS). During the reporting period 2023–2024, ICI projects aimed at strengthening weather, climate and early warning services were implemented in 10 countries: Kenya, Tanzania, Rwanda, Nepal, Vietnam, Indonesia,

[9] Increasing climate resilience of Zanzibar with integrated marine management and sustainable blue economy (BLUE-ZAN)

Kyrgyzstan, Tajikistan, Uzbekistan and Ukraine. Furthermore, the technology transfer project, "Improving Meteorological Observation Infrastructure and Forecasting Capabilities of the National Meteorological Agency (NMA)" in Ethiopia also includes capacity-building activities. Finland also contributes to capacity building in the sector through multilateral channels, for instance financing the Systematic Observations Financing Facility (SOFF). Additionally, the Finnish Meteorological Institute (FMI) provides technical assistance and capacity building as a peer adviser to National Meteorological and Hydrological Services (NMHS) in SOFF beneficiary countries. The FMI has also collaborated on capacity-building efforts with the Climate Risk and Early Warning Systems (CREWS) initiative (please see details about the FMI's collaboration with SOFF and CREWS in Section 6.3.5).

During the reporting period, the Higher Education Institutions Institutional Cooperation Instrument (HEI ICI) was used to support cooperation projects between higher education institutions (HEIs) in Finland and developing countries, with the aim of strengthening their subject-specific, methodological, educational and administrative capacities. The last HEI-ICI projects were implemented during the period 2020–2024. Since 2024, a similar instrument, the Higher Education Partnership (HEP), has replaced the HEI ICI, with the first HEP projects covering the period 2024–2026. List of the HEI-ICI and HEP projects is included in Section 6.4.

Year 2024 marked the 20th anniversary of the annual course on Multilateral Environmental Agreements (MEAs)[10], supported by Finland and organized by the University of Eastern Finland in collaboration with the United Nations Environment Programme (UNEP) since 2004. This prestigious two-week course focuses on international environmental law-making and diplomacy. Each year, the course explores a specific theme within international environmental law, with both the venue and theme changing annually. The course transfers 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 industrialized countries and thus support international environmental negotiations. Between 2004–2024, a total of 578 persons from over 130 countries has participated in this training course.

As explained in the section "Needs and priorities of developing country Parties", Finland's development cooperation is based on the development needs defined by the partner countries and their own development plans. According to the evaluation of Finland's international climate finance[11] (2023), the Ministry for

[10] Course on Multilateral Environmental Agreements (MEAs) - The Center for Climate Change, Energy and Environmental Law

[11] Evaluation of Finland's International Climate Finance 2016-2022 - Ministry for Foreign Affairs

Foreign Affairs' (MFA) interventions are strongly aligned with policy ambitions and priorities of development countries. However, Finland continues to lack a strategy for allocating its international climate finance, including a strategy for prioritizing and allocating its capacity-building support.

Gender equality is one of the cross-cutting objectives of Finland's development policy and cooperation. Typical ways to enhance gender equality in capacity building projects are ensuring equal participation of women and men in training and events as well as advancing women's leadership. Results data, for example number of persons trained, are disaggregated by gender.

Literature

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Report on international economic relations and development cooperation (2024) Publications of the Finnish Government 2024:39. 48 p. https://julkaisut.valtioneuvosto.fi/items/9df60fcb-b716-4320-9503-a86db7ff0bb2

Guideline for the cross-cutting objectives in the Finnish development policy and cooperation (2023) Ministry for Foreign Affairs. 6 p. https://um.fi/documents/35732/0/Guideline+for+the+Cross-Cutting+Objectives+in+the+Finnish+Development+Policy+and+Cooperation.pdf/e9e8a940-a382-c3d5-3c5f-dc8e7455576b?t=1618230452564



Photo: Layla Höckerstedt

6

Research and systematic observation

This chapter describes Finnish research on climate change and systematic observation systems. Policies, framework and financing of the research, international research cooperation and major research programmes and research organisations are presented. Studies on climate processes and systems, climatic modelling and prediction, research that supports the greenhouse gas inventory as well as research on impacts, mitigation and adaptation are also covered. Atmospheric, ocean, terrestrial and cryosphere climate observing systems are portrayed.
In the end of the chapter there is a summary of the Finnish contribution related to capacity building in developing countries, supplementing reporting in Chapter 5.

6 Research and systematic observation

6.1 General policy on research

6.1.1 Domestic activities

In 2024, Finland's research and development (R&D) expenditure was EUR 8.9 billion, or 3.2 per cent of the country's gross domestic product. This is a higher-than-average percentage than that among the OECD and European Union countries. National R&D expenditure has been rising since 2016, and R&D expenditure grew by 5.4 per cent from 2023. In 2024, 68 per cent of R&D expenditure was in the private sector, around eight per cent in the public sector, and around 24 per cent in the higher education sector. The funding of systematic observation is discussed in Section 6.3.

Regarding the financing of public-sector R&D (EUR 708 million in total in 2024), 41 per cent was financed from central government budget funds. Research organisations' own finances accounted for seven per cent. The architecture of public research funding is described in Figure 6.1-1. The distribution of public-sector R&D funding in 2024 is presented in Figure 6.1-2. Figure 6.1-2 does not include higher education sector. Higher education sector R&D funding in total was EUR 2.1 billion in 2024, largest funding sources being government budget funds (44 per cent), the Research Council of Finland including the Strategic Research Council (18 per cent) and the European Union (11 per cent). Higher education sector comprises universities, universities of applied sciences and university hospitals.

In 2024, 86,937 people worked in R&D positions, of whom 51 per cent worked in companies, 41 per cent in higher education institutions, and eight per cent in the public sector.

Figure 6.1-1
Public research funding architecture.

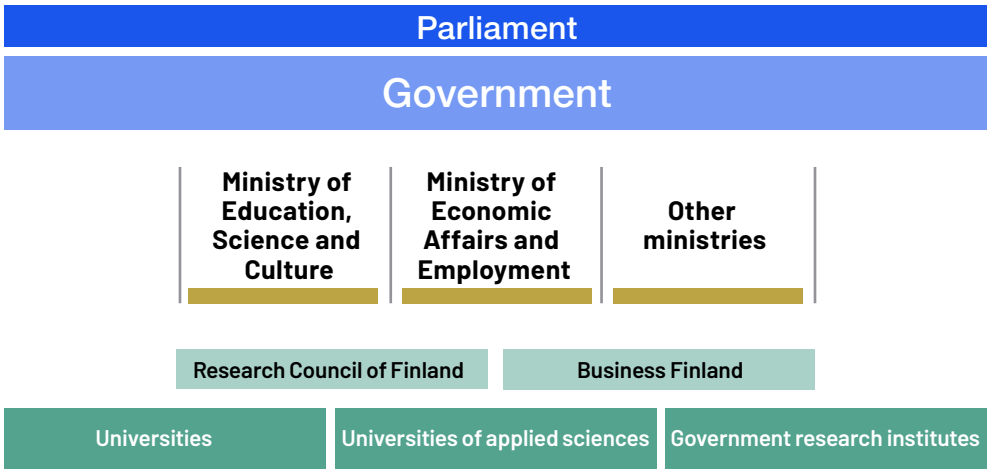
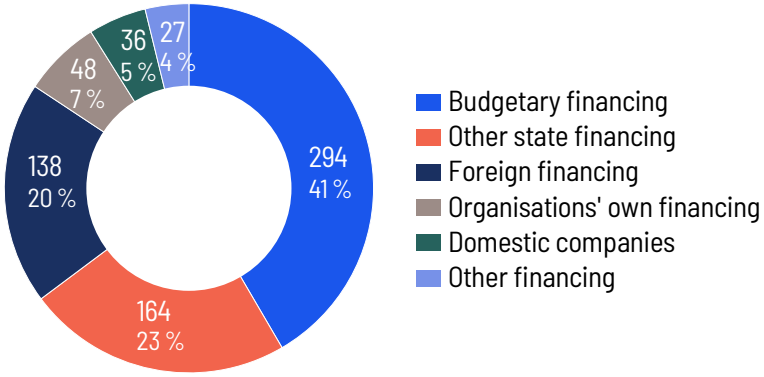


Figure 6.1-2
Public research financing in Finland in 2024 (EUR million; per cent)



The Research and Innovation Council, chaired by the Prime Minister, supports the Government in developing and combining visionary science, technology, and innovation (STI) policy. The Research Council of Finland (RCF) is an expert organisation in science and research within the administrative branch of the Finnish Ministry of Education, Science and Culture. It funds high-quality scientific research (EUR 542[1] million in 2024[2]). The Strategic Research Council (SRC) established within the Research Council of Finland funds high-quality research of great societal relevance and impact. Business Finland is a business operator consisting of a financing centre providing internationalisation and financing services, and a company carrying out customer activities. Business Finland offers funding services for research groups that cooperate with companies or want to build their research into a new business and commercialise ideas (research funding of EUR 175 million in 2024). Research

1 The sum also includes the Strategic Research Council's EUR 55 million, mentioned below.

2 By Statistics Finland.

activities supporting the Government's decision making, known as VN Tutkiva, ensure that there is a strong cross-government knowledge base to serve societal decision making (annual funding approximately EUR 6 million).

Climate change has been recognised as an important topical subject in Finnish research policy for decades. Climate change research policies are cooperatively implemented by several ministries, and climate change continues to be a priority area in many research programmes and projects (see Section 6.2 for details). Large cross-sectoral climate change programmes have aimed to increase understanding of the scientific basis of climate change, as well as the impacts and options for mitigation and adaptation, including the addressing of environmental and socioeconomic questions. Research in general has been partly shifted to concern larger views and to promote knowledge-based decision making and management. In addition, the crosscutting nature of climate change has been integrated into many environmental, sectoral, and technology research programmes and projects.

In 2026, Finland adopted new strategic national choices for research, development, and innovation, setting long-term priorities that guide how different administrative branches and actors develop and target their RDI activities. The choices aim to strengthen the national RDI policy framework and communicate Finland's priorities more clearly to international partners, shaping RDI efforts well into the future. One of the five strategic choices is climate, the environment, and the Arctic dimension. This choice emphasises research on climate change mitigation and adaptation, low-carbon transitions, biodiversity protection, and the sustainable use of natural resources. It also highlights the importance of advancing knowledge on rapidly changing Arctic conditions. Climate-related research is positioned as a driver of innovation and resilience, supporting technological development, cross-sectoral collaboration, and the transition to a carbon-neutral and climate-resilient society.

Research activities supporting the Government's decision making (VN TEAS 2014–2025; VN Tutkiva started in 2025) generates information that supports decision making, working practices, and management by knowledge. Climate change related research subjects have been on the plan from the beginning. Subjects are clearly linked to the information needs and topics in the Government's decision-making processes.

The Saami Climate Council, established in Finland under the Climate Act[3], is tasked with providing information about climate change from the perspective of Saami traditional knowledge and scientific research to the authorities and the Saami community for decision making and raising awareness of the impacts of climate change on Saami culture.[4]

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3 423/2022

4 https://saamelainenilmastoneuvosto.fi/en/saami-climate-council/

Box 6.1
The Saami Climate Council

The Saami Climate Council is an independent expert body that brings together Saami traditional knowledge holders and representatives of scientific researchers to strengthen the role of Saami perspectives in climate policy. The first Saami Climate Council consists of representatives from research fields covering climate change adaptation and mitigation, health, legal, anthropological, and sociological backgrounds. Its mandate, grounded in Finland's Climate Act, is to provide statements on national climate policy plans and to produce a robust knowledge base that supports climate policymaking from the perspective of safeguarding indigenous Saami culture, languages, and livelihoods.

The Council integrates scientific research with traditional Saami knowledge, creating a dialogue between academic experts and Saami communities. Its work highlights the unique vulnerabilities of Saami culture to rapid Arctic warming and provides guidance on climate change mitigation and adaptation in the Saami homeland Sápmi. It provides knowledge of climate impacts on

Saami livelihoods such as reindeer herding, handicrafts, fishing, and land-based practices, and supports decision makers by identifying culturally grounded and scientifically informed solutions, including through collecting traditional knowledge.

In addition to issuing formal statements on climate policy plans, the Council raises awareness of climate impacts on Saami culture. With its diverse membership, of whom half are holders of traditional Saami knowledge, the Council contributes a uniquely Indigenous-led perspective to national climate governance.

There has been increasing interest in research infrastructures in Finland in recent years, and more competitive funding has become available. The Research Council of Finland coordinates national research infrastructure investments. It also represents Finland in most European and international research infrastructures, and supports national activities in them. The role of research infrastructures in the green and digital transitions has been recognised. Indeed, responsibility and sustainable development, as well as digital platforms and data, have been named among the six strategic development areas identified in the Strategy for National Research Infrastructures, 2020 to 2030.[5] The Integrated Carbon Observation System (ICOS) and Aerosols, Clouds and Trace Gases Research Infrastructure (ACTRIS) have been headquartered in Finland since 2014 and 2023 respectively. Finland is also a leader in the eLTER ESFRI[6] project on long-term ecosystem observations (eLTER=Integrated European Long-Term

[5] Strategy for National Research Infrastructures in Finland, 2020 to 2030. https://www.aka.fi/globalassets/1-tutkimusrahoitus/4-ohjelmat-ja-muut-rahoitusmuodot/4-tutkimusinfrastruktuurit/aka_tik_strategia_2019_en_digi_a.pdf

[6] EU's European Strategy Forum on Research Infrastructures.

Ecosystem, critical zone and socioecology Research infrastructure). See Section 6.1.2 for more information.

Another of the six strategic development areas identified in the Strategy for National Research Infrastructures 2020 to 2030 is open access and collaboration. This, with the objective of digital platforms and data (mentioned in Section 6.1.1), seeks to advance the openness and accessibility of research infrastructure services and the data produced with them. Research Infrastructures are expected to have a publicly available Data Management Policy that outlines the location and accessibility of data. LUMI (Large Unified Modern Infrastructure) is a European Commission EuroHPC Joint Undertaking supercomputer located in the data centre of the CSC – IT Center for Science in Kajaani in Finland. Since 2022, LUMI has been used by the Destination Earth Climate Change Adaptation Digital Twin initiative to deliver multi-decadal climate projections.

The open science policy aims to remove barriers to the free international exchange of research data and information. A central goal is to publish research results in peer-reviewed international venues while promoting open access. In addition, according to the Constitution of Finland, documents in the possession of the authorities are public unless their publication has been specifically restricted for compelling reasons by an act. This provision demonstrates the wide openness and publicity of society in Finland.

In Finland, open-access publishing has become an established part of research practices. The majority of peer-reviewed articles are now published openly, either directly or through parallel archiving: some 80 per cent of peer-reviewed articles written in 2024. The Journal.fi platform serves as the main channel for Finnish open-access journals, and national consortia such as FinELib support open publishing agreements with international publishers.

The opening of research data has also advanced significantly. National services support data management, sharing, and long-term preservation across all disciplines. Finnish organisations actively contribute to European open science infrastructures – for example, the European Open Science Cloud (EOSC).

Potential barriers of openness and the reuse of research data include a lack of well-functioning and established infrastructures such as data repositories and platforms for sharing research data in some fields of research, as well as a lack of knowledge of and training in open data practices. However, the active open science policy endorsed in Finland has provided some incentives and means to overcome this barrier. Open research data policies and practices are supported at the national level by the National Open Science and Research Coordination, which operates in the Federation of Finnish Learned Societies. For example,

the "avoindata" (open data) portal[7] provides direct links to the available open data sources throughout Finland, including research institutes and national authorities. Research institutes have also established data portals of their own (see an example in Box 6.2). Another example of the advancement of open research data is the requirements from the Research Council of Finland (RCF), stating that the research data of RCF-funded projects must be made freely available as soon as possible after the research results have been published. Sites of research must therefore provide researchers with the necessary guidance and ensure that they have access to suitable storage infrastructure. The data must be made open access via a national or international archive or storage service. The degrees of data openness may justifiably vary, ranging from fully open to strictly confidential.

Research on the impacts of and adaptation to climate change may face information barriers, as socioeconomic data on vulnerability and damage are fragmented, poorly standardised, and frequently not publicly accessible. To address these gaps, researchers have established data use agreements to access company-held confidential data, for example.

Finland continues to invest in research infrastructures, especially in environmental and climate research, where open data, shared platforms, and international collaboration play a key role.

In addition to the open science policy within the country, Finland has been operating extensive capacity-building programmes to promote the free and open exchange of information and expertise, as well as to support endogenous capacities and capabilities in developing countries. Capacity-building programmes have focused on climate observations, research, higher education cooperation relevant to climate change mitigation and adaptation, and the sustainable use of forests (see Section 6.4). Free and open international exchange of data and information has been further promoted by participation in several international research programmes, networks and data collection schemes, and databases (see Chapters 6.1.2, 6.2, and 6.3).

Box 6.2
Open Datasets Example

The realising of open science objectives is exemplified by the Finnish Meteorological Institute (FMI) and the Finnish Environment Institute (Syke), which have established online services that make it possible to search for, browse, and download the Institutes' datasets in machine-readable format free of charge. Open data services are part of the implementation of the open data policy of the Finnish Government and the EU INSPIRE[8] directive. The climate and weather-related data of the FMI and Syke, including information about surface and groundwater, the Baltic Sea, and ecosystem change, are utilised in various economic sectors in Finland such as transport, natural resource management,

7 https://www.avoindata.fi/data/en_GB/dataset

8 http://inspire.jrc.ec.europa.eu/

energy, IT, and education. Besides data, services also include calculators, tools (application programming interfaces, APIs), and mapping services. Access to the available sources can be gained through the dedicated www pages, http://www.syke.fi/opendata and https://en.ilmatieteenlaitos.fi/open-data-manual, or the general Finnish open data portal, https://www.avoindata.fi/data/en_GB/dataset.

Communication on new research information to decision makers, other stakeholders, and the general public is very important (see also Chapter 7). The Finnish Climate Change Panel has been providing science-based advice for climate policymaking since 2011. The role and tasks of the Finnish Climate Change Panel are defined in the Climate Act, which provides a legal mandate for the Panel's work. The Finnish Climate Change Panel has been an active knowledge producer and partner in the field (Box 6.3). Furthermore, several initiatives have fostered engagement between societal actors and research to contribute to policy requirements (Box 6.4).

Box 6.3
The Finnish Climate Change Panel

The Finnish Climate Change Panel[9] is a scientific and independent panel of experts supporting planning and decision making related to climate policy. The role and tasks of the Panel are defined in the Finnish Climate Act. The Panel promotes dialogue between science and policy on issues connected with climate change, and compiles research data and issues recommendations to support decision making. The Panel is made up of 15 distinguished researchers from key scientific disciplines relevant to climate policy and has a secretariat to assist with the Panel's work.

The Panel is tasked with assessing climate policy documents and the sufficiency of the implemented measures to respond to the challenges of climate change. The Panel's reports and position papers are based on scientific evidence, drawing on its multidisciplinary expertise. The reports and statements are published on the Finnish Climate Change Panel's website, with the information produced by the Panel openly available to various stakeholders.

In recent years, the Panel has been advising the Finnish government on various national and EU-level policy areas. It has focused on key issues in advancing climate action in Finland to meet the 2035 greenhouse gas neutrality target: how to advance technological carbon sinks; what is necessary to decarbonise transport; how to increase forest carbon sinks; and addressing the problem of continuous peat and peatlands use. In addition, the Panel has produced economic analyses of alternative EU climate policy architecture options for achieving the 2040 target regarding emissions trading schemes.

9 https://ilmastopaneeli.fi/en

According to the Finnish Science Barometer 2024,[10] the public's expectations are optimistic about science and the worldview. Science is believed to be the answer to many important issues. For example, the Barometer's argument that "the progress of climate change is a real and serious threat, which requires efficient action from political decision makers" is supported by a majority (74 per cent). The percentage had decreased by eight percentage points since 2016. The percentage of those who disagree increased between 2016 and 2024 from six to 22 per cent.

Box 6.4
Interaction and Cooperation as Cornerstones of Impactful Research

A major development in the field of research is the increasing emphasis on societal impact and interaction with various societal stakeholders. It is now broadly accepted that the urgency of complex societal challenges such as climate change requires closer interaction between researchers and decision makers. Several initiatives have fostered engagement between societal actors and research to contribute to policy needs.

The Strategic Research Council (SRC) is one of the key science policy measures on this front (see 6.2.1). Every project funded by the SRC includes resources specifically devoted to interaction with society, and the programmes that specify the topics of projects to be funded focus on developing interaction with societal stakeholders. In addition, a new research instrument supporting the Government's decision making (VN Tutkiva) funds research that serves policy needs as defined by the ministries. This instrument replaced the previous Government's VNTEAS analysis, assessment, and research activities instrument in 2025. Research on climate change has been one of the focal areas for SRC and VNTEAS and VN Tutkiva (see 6.2.1). Furthermore, research institutes and universities are increasingly paying attention to social interaction, including collaboration with industry and businesses, and in other partnerships such as doctoral training.

An important area in knowledge brokering has been the new activities on science-for-policy at the Finnish Academy of Science and Letters. They bring together the Finnish science-for-policy actors. The goal is to ensure the effective utilisation of research in policymaking. The Finnish Academy of Science and Letters creates channels to communicate research to policymaking, as well as platforms for interaction between researchers and policymakers. For example, "science sparring" was used between researchers and preparers for the National Climate Change Adaptation Plan 2030 (2022). Science sparring is a customisable model for organising a dialogue that is based on the co-production of knowledge.

The science-for-policy interface has also been strengthened in legislative processes to address climate change. In 2021, the Ministry of the Environment therefore published a guide to the assessment of climate impacts in legislative

[10] https://www.tieteentiedotus.fi/files/Tiedebarometri_2024.pdf (in Finnish)
https://www.tieteentiedotus.fi/files/Sciencebarometer_2024.pdf (in English)

proposals. It is distributed as general guidance for improving the quality of the mandatory impact assessment of legislative proposals.

In 2021, the Ministry of Education and Culture, the Research Council of Finland, and the Federation of Finnish Learned Societies conducted a joint initiative, "The Year of Research-Based Knowledge". The initiative aimed to increase awareness of research and the importance of research-based knowledge among the general public, decision makers, and the private sector.

There are also many other initiatives and actors in the field. Some are more recent; some are well established. The Forum for Environmental Information is an exemplary well-established non-profit organisation in the field of environmental research that focuses on transferring scientific information to national policymaking and advances the interaction between researchers and the users of information. It organises seminars, workshops, and other events concerning timely environmental questions. It is funded by the Maj and Tor Nessling foundation (see also Foundations in Section 6.2.1).

6.1.2 International activities

Finnish researchers have collaborated actively with the international research community in the form of joint projects and programmes. Finland has participated in international programmes such as the World Climate Research Programme (WCRP). The Finnish Meteorological Institute has been strongly involved in research activities coordinated by the WCRP and in particular by APARC (Atmospheric Processes and their Role in the Climate) and its activities on the stratosphere-troposphere system, interactions between atmospheric dynamics and climate change, long-term ozone trends, and solar influences, for example.

Finland has built an archive of systematic atmospheric, oceanic, and terrestrial observations based on the regulations of corresponding international organisations. Finland participates in the World Weather Watch at an operational level through the synoptic network of surface and upper-air stations, as well as in Global Atmosphere Watch. Finnish experts also contribute to the International Committee On New Integrated Climate change assessment Scenarios (ICONICS[11]), which develops, updates, promotes, and evaluates global scenarios (Shared Socioeconomic Pathways) that are extensively applied in interdisciplinary climate change analysis worldwide, including in Finland, and by the Intergovernmental Panel on Climate Change (IPCC).

Finland has actively participated in the work of the Intergovernmental Panel on Climate Change (IPCC). Several experts from Finland serve as authors or

[11] https://depts.washington.edu/iconics/

review editors for the three Working Group (WG) reports of the IPCC Seventh Assessment (AR7), including a special Appendix to the WG II report updating the 1994 IPCC Technical Guidelines on Climate Change Impacts and Adaptations and the Special Report on Climate Change and Cities. Finnish experts also served as authors of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, and participate and have participated in the work on the other Methodology Reports during the AR6 and AR7 cycles.

Experts from Finland have also contributed to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) through scientific leadership, the authorship of assessment reports, and participation in national working groups to facilitate a science policy dialogue. They are actively involved in promoting nature-positive business solutions, assessing transformative change, and incorporating Indigenous and local knowledge into global reports. Experts from Finland also acted as members of the IPBES Bureau. The IPBES addresses climate change by analysing its role as a primary driver of biodiversity loss and assessing nature-based solutions for mitigation and adaptation.

In another major effort, Finland is overseeing the implementation of the ICOS (Integrated Carbon Observation System) organisation, which is a European distributed infrastructure for the online in-situ monitoring of greenhouse gases (CO_2, CH_4, and N_2O) necessary for understanding present and future sinks and sources. The ICOS Head Office is in Helsinki. The ICOS puts the GHG observations within the global GCOS (Global Climate Observing System) and GEOSS (the Global Earth Observation System of Systems) networks in Europe into effect, and the data can be used to verify greenhouse gas inventories. The partners of ICOS Finland are the University of Helsinki, the Finnish Meteorological Institute (FMI), the University of Eastern Finland, the University of Oulu, and Natural Resources Institute Finland. Finnish funding for the ICOS is around EUR three million annually (for more on ICOS activities, see Section 6.3.1).

Finland is also leading the implementation and establishment of the ACTRIS (Aerosols, Clouds and Trace Gases Research Infrastructure) organisation, which is a European distributed research infrastructure for near-surface monitoring and research on short-lived climate forcers in the atmosphere. These are the other crucial group of components, besides greenhouse gases, for determining the atmospheric component of climate warming. ACTRIS has been operative since 2023. ACTRIS links research, education, and innovation to promote data use, technological developments, and demonstrations related to the atmospheric components of aerosols, clouds, and trace gases. The ACTRIS Head Office is in Helsinki, with a secondary node in Rome. The partners of ACTRIS-Finland are the FMI, the University of Helsinki, the University of Eastern Finland, and Tampere University of Technology. In addition to the Head Office,

Finland hosts several National Facilities, a Data Centre Unit for Cloud Remote Sensing, and two calibration nodes on in-situ aerosol particles and trace gases in ACTRIS. Finnish funding for ACTRIS was around EUR five million annually during the reporting period (ACTRIS is also presented in Section 6.3.1 under atmospheric observations).

The European Environment Agency (EEA) works with specialist European Topic Centres (ETCs), including the ETC on Climate Change Mitigation (ETC CM) and the ETC on Climate Change Adaptation and LULUCF (ETC CA), both operating under the 2022 to 2026 mandate. Finland participates in several ETCs through national research institutes, contributing expertise on greenhouse gas inventories, mitigation analysis, adaptation, sustainable transitions, and land-use sector assessments in northern and Arctic regions, for example. This work also feeds into major EEA assessments such as the first European Climate Risk Assessment (EUCRA), published in 2024. The Finnish Environment Institute (Syke) played a prominent authorship role in EUCRA, ensuring that boreal climate risks and northern vulnerabilities were reflected, for example. There was also a review input from the University of Helsinki. This was the single most heavily cited report ever published by the EEA.

Climate change is and has been a very important priority for the Horizon 2020 framework programme and the Horizon Europe funding programme, which is the EU's key funding programme for research and innovation from 2021 to 2027.

Finnish research organisations, universities, companies, and other organisations actively participated in climate-change-related research and innovation activities under the Horizon Europe framework programme for research and innovation. Between 2021 and 2025, 220 Finnish organisations participated in Horizon Europe projects, winning a total of EUR 324 million in Horizon Europe Funding, which is three per cent of total funding in this area. Finnish companies are very active in this field: 147 companies received funding. The largest recipients of Horizon Europe funding in climate-change-related research and innovation activities were the Technical Research Centre of Finland Ltd VTT (EUR 67 million), Natural Resources Institute Finland (Luke) (EUR 33 million), and the University of Helsinki (EUR 14 million).

Climate change is strongly reflected in several co-funded European Partnerships under Horizon Europe. Finland actively participates in these partnerships through national funding agencies, research organisations, companies, and cities, contributing expertise in renewable energy, sustainable urban development, water and marine management, biodiversity research, and climate-resilient northern agriculture. The key climate-relevant co-funded partnerships in which Finland participates are Driving Urban Transitions

(DUT), Water4All, Biodiversa+, Agroecology, the Sustainable Blue Economy Partnership (SBEP), and the Clean Energy Transition Partnership (CETP).

The most climate-relevant Horizon Europe Missions are Adaptation to Climate Change, which supports European regions and communities in strengthening climate resilience, and Climate Neutral and Smart Cities, guiding 100 cities towards climate neutrality by 2030. The Restore our Ocean and Waters Mission plays a growing role by addressing climate-driven impacts on marine and freshwater systems, while the Soil Mission contributes to climate mitigation and adaptation through improved soil health, carbon sequestration, and sustainable land management. Finland is actively involved in all these Missions, with Finnish ministries, research funders, cities, regions, and research organisations participating in implementation, piloting, and research activities, for example.

Several longstanding European research cooperation structures from the previous framework programme, such as JPI Climate and FACCE-JPI[12], continue to operate, although many of their themes have now been integrated into Horizon Europe's cofunded partnerships. These JPIs and networks still play a role in coordinating research agendas and supporting collaboration on climate-related challenges, and Finnish researchers have been successful participants in their joint calls. Finland remains actively engaged through national funders and expert networks. The Research Council of Finland's international cofunding activities are described in Section 6.2.1.

Destination Earth is a flagship initiative of the European Commission to develop a high-resolution digital model of the Earth (a digital twin of the Earth) to model, monitor, and simulate natural phenomena, hazards, and related human activities. These features assist users in designing accurate and actionable adaptation strategies and mitigation measures. Supercomputer LUMI and CSC (IT Center for Science Ltd) play a major role in the production of climate projections and regularly updated, globally consistent Earth system information at scales of a few kilometres for the Destination Earth project.[13]

The Research Council of Finland (RCF) participated in two Nordic collaborative programmes related to climate change, the NordForsk Nordic Bioeconomy Programme (2015–2022) and the NordForsk Sustainable Agriculture and Climate Change call (2022–2026). Nordic Bioeconomy sought to generate new knowledge about how to promote and advance the transition to a bioeconomy-based society in the Nordic countries. Sustainable Agriculture and Climate Change call has four thematic areas, including research on plants and soil as

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[12] The Joint Programming Initiatives "Connecting Climate Knowledge for Europe" (JPI Climate) and on Agriculture, Food Security and Climate Change (FACCE-JPI)

[13] https://csc.fi/en/media-release/supercomputer-lumi-and-csc-play-a-major-role-in-the-production-of-climate-simulations-for-the-destination-earth-project/

a carbon sink, and increased local and regional protein production. In addition to the Nordic funders, Estonia and Lithuania fund this call. In 2024, NordForsk established two new calls in this area, also funded by the RCF: Green Transition; and Sustainable Development of the Arctic. The projects started in 2025.

The Nordic Climate and Air Programme (NKLP) oversees and coordinates the implementation of the Nordic Co-operation Programme on the Environment and Climate under the Nordic Council of Ministers. The work utilises different types of project activities, studies, policy briefs, and workshops to support the Nordic countries in their preparations for the UNFCCC climate negotiations. Part of the mandate is to showcase Nordic climate action, serving a broader interest of Nordic and international climate negotiators and other stakeholders. Appropriate support is also provided for the Nordic COP Pavilion. Finland actively participates in the work of the NKLP. In 2025, a new programme on Climate Adaptation was started under the Nordic Council of Ministers.

Finland is actively engaged in the work of the Arctic Monitoring and Assessment Programme (AMAP), which is one of the permanent working groups of the Arctic Council. AMAP provides reliable information about the status of and threats to the Arctic environment by collecting monitoring data and assessing levels of pollutants and their effects on the Arctic environment. Monitoring and assessing the impacts of climate change on the Arctic environment is also one of the priority areas. Based on the scientific work, AMAP provides policy-relevant information to support Arctic governments in their efforts to take remedial and preventive action related to contaminants and climate change. AMAP publishes scientific assessment reports with summaries for policymakers that serve the scientific community, decision makers, and the general public. For example, in 2024, AMAP published the "AMAP Arctic Climate Change Update 2024: Key Trends and Impacts" and in 2025, the "AMAP Policy Brief: Black Carbon as a Climate Forcer" reports. Finnish experts have participated in the work of AMAP, including its assessments and recent reports related to climate change. More details on the climate research carried out in the Arctic can be found in Box 6.5.

Previously, Finland has also been a member country of the Barents Euro-Arctic Council, which has had an action plan for climate change with measures and projects. However, Finland´s withdrawal from the Council came into effect in 2026.

The Organisation for Economic Co-operation and Development (OECD) has a broad environmental research portfolio, conducting relevant climate-related work as a data compiler and provider of analytical products, policy recommendations, and national policy reviews. Finland is a member of the OECD and has promoted the organisation's climate work, including the joint OECD International Energy Agency (IEA) Climate Change Expert Group, which

has the mission of supporting the enhancement of the collective understanding of specific topics relevant to the climate negotiations and the Paris Agreement.

Capacity building in developing countries related to climate change research and systematic observation is described in Sections 6.3.4. and 6.4.

Box 6.5
Climate Research in the Arctic

Arctic Research Policy and Goals

International cooperation is seen as very important. Finland is an active member of the Arctic Council and its Working Groups. For example, Finland has contributed significantly to the Arctic Council's Arctic Monitoring and Assessment Programme, AMAP, and to its recent reports related to climate change.

Arctic Research Funders

Many sectoral ministries are involved in the funding and steering of Arctic research in higher education and research institutes.

As a national research funding agency, the Research Council of Finland funds high-quality scientific research projects. The Research Council of Finland is also a stakeholder in Arctic research priorities.

As part of its operations, Business Finland can provide growth and financing services and carries out customer activities related to business activities and opportunities.

Major Arctic Research Initiatives

The Universities of Lapland and Oulu strategically prioritise the Arctic region. Most Finnish universities and other academic institutions have research programmes focusing on the Arctic, the North, and cold climate regions.

The Arctic Centre, University of Lapland, conducts internationally highly regarded multidisciplinary research in the Arctic region. Its emphasis is on science communication and education. The Centre's public exhibitions improve the visibility of Finland's Arctic expertise and increase international access to Arctic information.

The Finnish Meteorological Institute's (FMI) research focuses on understanding various climate forcing mechanisms and feedback in the Arctic, as well as linkages between Arctic warming and mid-latitude weather. Processes in the atmospheric boundary layer and snow, and atmosphere–sea ice–ocean interactions are studied to improve capabilities of modelling the weather and climate. An example of important findings is a highly cited article demonstrating that between 1979 and 2022, the Arctic warmed nearly four times faster than the rest of the globe.[14]

The Finnish Environment Institute (Syke) brings expertise in research to various projects in northern areas and in the Arctic Council's work. The Institute's expertise in environmental research jointly focuses on the impacts and scenarios of climate change and ways of securing sustainable development in Arctic areas with other research organisations such as Natural Resources Institute Finland (Luke), which has particular expertise in the use and management of renewable natural resources.

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[14] Rantanen, M., Karpechko, A. Y., Lipponen, A., et al. (2022) Communications Earth & Environment 3, 168. https://doi.org/10.1038/s43247-022-00498-3

Arctic Research Infrastructure

The several field stations operated by universities and research institutes are bases for field campaigns and long-term follow-up studies with an Arctic focus and in the Arctic area. Long-term continuous measurements provide unique monitoring and research material on greenhouse gases, atmospheric aerosols, clouds, and trace gases by FMI at Pallas in Finland, and by the University of Helsinki at Värriö in Finland, for example. The University of Turku (Kevo) and University of Oulu (Oulanka) also operate research stations providing facilities for natural and environmental research in Arctic and subarctic settings. Similarly, operational observations are required to study feedback processes like polar ozone and Arctic snow and land-use trends, and trade-offs between commercial interests and Indigenous peoples' livelihoods.

The Finnish National Satellite Data Centre in Sodankylä, north of the Arctic Circle, is an excellent location for receiving data from all polar orbiting spacecraft. The centre collaboratively provides Arctic satellite data and products for international research and operational entities.

The Finnish Marine Research Infrastructure (FINMARI) supports polar oceanography and sea ice research, including ocean and sea ice processes and climate interactions in the polar oceans to support the development and improvement of forecasts and operating models and services.

R/V Aranda is an ice-reinforced research vessel (ice classification Super A1) that mostly operates in the Baltic Sea, but it has also made expeditions to the Arctic Ocean. Finland has a fleet of icebreakers, several of which are multipurpose vessels capable of offshore tasks, including serving as research platforms. Finland also has special infrastructure for large-scale laboratory studies of Arctic conditions. Aalto University operates a large-scale ice tank infrastructure which can produce sea ice at model scales. In addition, there is a special test facility for icebreakers, operated in Helsinki by a privately owned shipyard.

6.2 Research

6.2.1 Major overarching research programmes and funding organisations

Research supporting the Government's decision making

In 2014, the Government adopted an approach based on annual plans for analysis, assessment, and research[15] (VN TEAS), which underpins policy decision making and steers studies and research towards specific priority areas selected by the Government. The annual resources available for implementing the plan were approximately EUR 10 million. Between 2021 and

[15] https://valtioneuvosto.fi/en/governments-research-activities

2023, there were 20 projects whose various topics were directly related to climate change. The projects have provided the required new knowledge for policymaking in the various administrative sectors. The projects have been conducted by many different organisations such as universities, research institutes, and consultants, cumulatively amounting to several million euros in research funding. VN TEAS was terminated in 2023.

Since 2025, the Government has adopted VN Tutkiva, research activities supporting the Government's decision making.[16] VN Tutkiva ensures that there is a strong cross-government knowledge base to serve societal decision making. The ministries first identify their information needs and submit them to the Prime Minister's Office, which then drafts an annual government research plan and presents it to the government plenary session for approval. The annual sum allocated to implementing the research plan and to meeting any information needs that may be identified later is EUR 6 million. This far, three projects have been directly related to climate change. To select the research projects, the Government launches an open call for proposals intended for higher education institutions, research institutes, and other organisations engaged in research and development, or consortia formed by them. Research projects supporting the Government's decision making must be transparent, and their outcomes must be as widely applicable as possible.

In addition, the Prime Minister's Office has funded a specific project (2025–2027) to strengthen the capacity to monitor the development of land-use sector carbon balances and to evaluate the impacts of climate policy (see Box 6.6).

Box 6.6
Project example: Holistic infrastructure for knowledge on land-use sector carbon sinks and emissions tracking (HIKET)

Significant uncertainties are associated with the development of carbon sinks in the land-use sector, which complicate climate policy planning and impact assessments. In 2025, Prime Minister Orpo's government decided to allocate EUR 8.1 million to a project called Holistic Infrastructure for Knowledge on Land-use sector Carbon Sinks and Emissions Tracking (HIKET), running until the end of 2027. The project strengthens the knowledge base of Finland's climate policy regarding land-use sector carbon sinks and greenhouse gas balances, and supports the implementation of national climate targets not only by producing new research data but by developing methods and research infrastructure to improve the assessment and monitoring of carbon balances. The project consortium consists of the University of Helsinki, the Finnish Meteorological Institute, and Natural Resources Institute Finland (Luke). In addition, other Finnish research institutions and universities participate in the project.

[16] https://tietokayttoon.fi/en/what-we-do

The HIKET project will establish new continuous field measurement stations and upgrade the functionalities of the existing measurement network. The project will combine data generated by the new measurement stations with previously collected measurement data using various computational approaches, enabling independent evaluation methods for assessing Finland's land-use sector carbon balance, separate from the greenhouse gas inventory. The project also aims to produce a new statistical modelling method for peatland soils that can account for the effect of water table levels on peat decomposition and thus on soil greenhouse gas emissions from peatland forests and peat soils under cultivation. Additionally, it will generate understanding of how peatland management, climate change, and other environmental factors affect the carbon balances of peatland forests.

The HIKET project will also foster research collaboration and information exchange between different research fields and organisations. For example, the project will develop an interface solution to enable access to carbon balance data and calculation methods across the consortium's organisations. The methods and analyses developed within HIKET will strengthen the capacity to monitor the development of land-use sector carbon balances and to evaluate the impacts of climate policy in the future as well.

Research Council of Finland's research funding

The Research Council of Finland (RCF) is a science and research organisation within the administrative branch of the Finnish Ministry of Education and Culture. In 2024, it funded high-quality scientific research amounting to EUR 542 million.[17] In addition, it provides expertise in science and science policy, and strengthens the position of science and research in Finland. The provision of funding for excellent scientific research is at the core of the Research Council of Finland's activities. The research is also expected to have a major scientific and social impact and follow the principles of responsible science.

Between 2021 and 2023, the RCF granted EUR 42 million to topics related to aerosols, climate, forests, and the Arctic in the main funding schemes of the RCF's Spark funding category. This was an increase compared with 2018 to 2020, when EUR 29 million was allocated to the same topics in the same funding instruments.[18] In addition, several of the RCF's climate- and energy-related programmes were ongoing during the reporting period:

- The Climate Change and Health (CLIHE) research programme (funding EUR 9.7 million, 2020–2023) examined and anticipated the health risks and uncertainties caused by climate change and the social consequences of its health impacts. The programme sought ways to combat adverse health effects and to adapt to climate change. The CLIHE programme also involved international cooperation with the Belmont Forum, in which the Research

[17] The sum also includes the Strategic Research Council's EUR 55 million, mentioned below.

[18] According to the RCF's Dashboard on research themes.

Council of Finland participated with EUR one million for Finnish projects, funding three consortia under the Climate, Environment, and Health theme. In addition, the Research Council of Finland participated in the EU "Connecting Climate Knowledge for Europe" Joint Programming Initiative (JPI Climate) for EUR 700,000.

- The C1 Value Academy Programme (funding: EUR 6 million, 2020–2023) sought solutions for industrial green chemistry manufacturing from CO_2 emissions. The programme's research fields included synthetic chemistry and catalysis research, process engineering and systemic studies, industrial ecology and biotechnology, and modelling based on them.
- The Academy Programme on a biobased economy (BioFuture2025, 2017–2025) was launched to support the creation of a new knowledge base and promote major scientific breakthroughs through new ways of doing science. A biobased economy promises solutions that will help curb climate change and excessive natural resource consumption. Funding in the first call totalled EUR 10.3 million euros between 2017 and 2020, since when a few international calls have continued the programme, including ForestValue – Innovating Forest-based Bioeconomy ERANET, co-funded for EUR 1.36 million, and the ForestValue Joint Call 2021 for EUR 0.75 million.
- There was special funding for system-level research on climate change mitigation and adaptation (funding EUR 10 million, 2021–2024) to increase the impact of the conducted research. The aim was to examine the entirety of several subsystems (e.g. food, transport, energy, community systems) and interdependencies between the systems in terms of mitigation of and/or adaptation to climate change. It was also to provide funding for the pooling of research already carried out and based on this for conducting new research, while increasing the impact of research outside the scientific community.
- The Research Council of Finland is also responsible for funding Finland's Antarctic research projects. In accordance with Finland's Antarctic Research Strategy (2014), the funding supports interactive and multidisciplinary research. EUR 2.5 million was granted in an Antarctic research call for 2021 to 2024.

In addition, several research projects of the Research Council of Finland's Forge funding category, with no pre-set thematic focus (Centres of Excellence, the Finnish Flagship Programme, and research infrastructures), concern climate change, its impact, and mitigation:

- Centres of Excellence: Tree Biology (2022–2029, EUR 6.6 million granted by 2024) and the Virtual Laboratory for Molecular-level Atmospheric Transformations (2022–2029, EUR 4.6 million granted by 2024);

- Flagships: Atmosphere and Climate Competence Center (ACCC, 2020–2028, EUR 17.7 million granted by 2024), Forest-Human-Machine Interplay (UNITE, 2020–2028, EUR 19.6 million granted by 2024), and Digital Waters (DIWA, 2024–2031, EUR 11.3 million granted by 2024);
- Research infrastructures: Integrated Atmospheric and Earth System Science Research Infrastructure (INAR RI). INAR RI is an umbrella research infrastructure coordinating the national nodes of European environmental research infrastructures (ICOS, ACTRIS, eLTER, and AnaEE). See further details in Section 6.3.

To tackle this multitude of climate change research, the Research Council of Finland established the Academy Programme for Climate Change and Carbon Neutrality Research (Climate-Synergy) (no additional research funding, 2022–2023). The Climate-Synergy coaction programme pooled research on climate change and carbon neutrality funded through various Research Council of Finland and Strategic Research Council (SRC) grants, incorporating it into a broad network-based programme. As its name indicates, the Climate-Synergy programme aimed to create synergies and strengthen the impact of climate change and carbon neutrality research, promoting the utilisation of research in society. Through the programme, the RCF sought to increase support for high-quality, innovative, and high-impact research, promote national and international research cooperation, and enhance the societal impact of research in the field.

The Research Council of Finland also supported the implementation of Finland's national Recovery and Resilience Plan (RRP) (see Box 6.7) as part of the Sustainable Growth Programme for Finland, with approximately EUR 90 million in 2021 to 2025 to promote the twin digital and green transition. The green and digital transition aimed to support structural changes in the economy and the development of a carbon-neutral welfare society through digital solutions. The research project funding (EUR 44 million) was provided for research promoting solutions related to carbon neutrality and adaptation to climate change, as well as associated digital technologies. In addition, the competitive funding calls for local and national infrastructures (in total, EUR 45 million) enabled by the Recovery and Resilience Facility were expected to accelerate their twin transition.

Programmes of the Strategic Research Council

The Strategic Research Council (SRC) is an independent body that was established within the Research Council of Finland in 2014. The SRC funds high-quality long-term research of great societal relevance and impact. SRC-funded research seeks tangible solutions to grand societal challenges that require multidisciplinary approaches. An important element of the strategic research is active and ongoing collaboration between producers and users of knowledge throughout the project cycle.

Each year, the SRC prepares a proposal on key strategic research themes for the next SRC programmes to be decided by the Finnish Government. For further details on the SRC theme and programme preparation, see Finland's Eighth National Communication, Section 8.2.1. The SRC's annual funding budget was around EUR 55 million in 2024.

The SRC had several programmes relevant to climate change during the reporting period:

- The Adaptation and Resilience for Sustainable Growth (ADAPT, 2018–2023, EUR 34.4 million granted by 2024) programme aimed to identify the best ways of supporting comprehensive resilience by using the resources of society, communities, and individuals and by new ways of combining these resources.
- The Towards a Sustainable, Healthy and Climate-Neutral Food System (FOOD, 2019–2025, EUR 21.3 million granted by 2024) programme sought a solution for moving towards a sustainable, healthy, and climate-neutral food system.
- The Climate Change and Humans (CLIMATE, 2020–2026, EUR 27.7 million granted by 2024) programme seeks solutions to how people can make and implement their decisions related to mitigating or adapting to climate change, and how society can facilitate this decision making sustainably and equitably.
- The Environmental and Social Links to Biodiversity Loss (BIOD, 2021–2027, EUR 21.1 million granted by 2024) programme focuses on biodiversity as a prerequisite for welfare, and on how the loss of biodiversity can be halted and ecosystems revived through research-informed solutions.
- Energy Solutions as Part of a Just Green Transition (JUST ENERGY, 2023–2029, EUR 13.4 million granted by 2024) focuses on how the energy system can be developed to deliver a just green transition in a changing operating environment.
- Societal Solutions in a Just Green Transition (JUST TRANSITION, 2023–2029, EUR 13.4 million granted by 2024) focuses on societal solutions essential for the green transition from the perspective of various institutions and actors.

In addition, several ongoing Strategic Research Council (SRC) programmes (2019–2031) include research consortia relevant to climate change. These programmes encompass themes such as the sustainable use of resources by societies, communities, and individuals, the halting of biodiversity loss with research-informed solutions, and steering social development.

Box 6.7
Recovery and Resilience Funding has also Boosted Green Research

The Recovery and Resilience Plan (RRP), including an RDI funding package, supported the green transition. Finland's RRP was intended to accelerate green transition solutions to facilitate significant reductions in greenhouse gas emissions in Finland to support the national carbon neutrality target. This has also boosted research. The green transition requires robust expertise and related investments, and the design and delivery of key technologies for the low-carbon circular economy and the green transition through research, partnerships, and corporate investment.

The Research Council of Finland implemented a substantial Research, Development and Innovation Programme as part of Finland's RRP. In total, the programme allocated around EUR 90 million to research and research infrastructures supporting the green and digital transition between 2021 and 2025. The programme significantly advanced climate-related research by supporting work on low-carbon technologies, sustainable energy systems, resource efficiency, digital and data-driven solutions enabling emissions reductions, and scientific expertise for climate mitigation and adaptation.[19] It complemented Business Finland's RRP-funded innovation measures, strengthening Finland's long-term climate-related R&D capacity.

Finland's RRP also included a EUR 40 million Low Carbon Built Environment Programme implemented by the Ministry of the Environment in cooperation with Business Finland. Active between 2021 and 2025, the programme supported the development, piloting, and scaling of low-carbon solutions for the built environment and strengthened climate change adaptation. Business Finland awarded around EUR 30 million to more than 60 projects, while national calls organised by the Ministry provided EUR 13.6 million for 46 projects. The programme combined applied research, innovation, and deployment to promote low-carbon products, technologies, and practices that reduce emissions and enhance the competitiveness of Finnish companies.

REPowerEU is an additional energy transition chapter that Finland integrated into its RRP in 2023. It expanded the Finnish plan with targeted measures that reduce dependence on fossil fuels, strengthen energy security, and accelerate the deployment of clean energy. REPowerEU supported research by directing funding, policy focus, and market incentives at the development and scaling of new clean-energy technologies. Because the programme is designed to accelerate Europe's shift from fossil fuels, it relies on research to generate the innovations that enable this transition.

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[19] Impacts of funding from the Research Council of Finland's EU Recovery and Resilience Facility (RRF) programme on sustainable growth: https://www.aka.fi/globalassets/2-suomen-akatemian-toiminta/4-julkaisut/julkaisut/aka_eu-rrf-raportti_en_web.pdf

In Finland, the REPowerEU chapter of the RRP includes a green transition R&D package built around three research projects implemented by the VTT Technical Research Centre of Finland, the Finnish Environment Institute (Syke), the Geological Survey of Finland (GTK), and Natural Resources Institute Finland (Luke). The total R&D package amounts to approximately EUR 40 million. It included Clean Energy System Transition (REPower-CEST), a Syke-led EUR 14 million 2.5-year project launched in early 2024 to develop a strategic roadmap for Finland's sustainable clean energy transition. The REPower project of the Natural Resources Institute Finland also developed a strategic roadmap for energy transition; it focused on land use and resources, regional development and geopolitical dimensions. Together, the three REPowerEU R&D projects, implemented between 2024 and 2026, strengthen Finland's scientific and analytical capacity in areas such as fair transition, clean energy technologies, industrial decarbonisation, renewable hydrogen, energy system modelling, and the sustainability of large-scale solar and wind deployment.

Programmes of Business Finland

Business Finland (and its predecessor Tekes) has continued to invest significantly in the long-term development of low-carbon solutions. Business Finland financed low-carbon energy solutions and climate change mitigation solutions with an estimated EUR 800 million between 2021 and 2025. Renewable energy sources, energy efficiency, and CO_2 capture have been the key targets. Adaptation to climate change has focused on developing systemic and sustainable solutions.

Business Finland's programmes are important instruments for combating the effects of climate change and promoting carbon neutrality. During the period between 2021 and 2025, the following programmes made a major contribution to climate change mitigation:

- The Decarbonized Cities programme (EUR 87 million thus far, 2022–2028) promotes solutions for cities' carbon neutrality needs. The goal is to strengthen Finland's future export potential and increase our carbon handprint internationally.
- The Hydrogen and Batteries programme (EUR 177 million thus far, 2023–2028) promotes the creation, development, and international growth of the Finnish hydrogen and battery industry's production value chains, technologies, solutions, and services.
- The Flexible Energy Systems programme (EUR 44 million thus far, 2024–2030) supports future pioneering solutions that increase the flexibility of energy systems. The main focus is on three different energy sectors: electricity; heating (and cooling); and fuels.

- The Bio and Circular Finland programme (EUR 268 million, 2019–2022) supported the development of competitive bio- and circular economy solutions and ecosystems that offered solutions to global environmental challenges and potential for significant global markets.
- The Sustainable Manufacturing Finland programme (EUR 170 million, 2020–2023) focused on renewing business models and increasing productivity, while actively seeking solutions to the challenges of climate change.
- The Smart Mobility and Batteries from Finland programme (EUR 195 million, 2018–2022) aimed to mitigate climate change and find flexible new mobility and logistics low-emission solutions. The programme helped Finnish companies benefit from business opportunities in transport, logistics, and mobility services and create a significant Finnish battery industry.

Around EUR 300 million of RRF funding (EU's Recovery and Resilience Facility) has been directed through Business Finland to projects related to the green transition.

Climate-change-related programmes by ministries

Ministries channel their research funding to climate-change-related topics through the research and expert organisations in their administrative sector, such as Business Finland, whereas some, like the Ministry of Agriculture and Forestry and the Ministry of the Environment, have also allocated funds through specific research and development programmes or calls.

Through its research and development activities, the Ministry of Agriculture and Forestry of Finland has aimed to proactively produce knowledge, expertise, and innovations to support decision making, promoting the competitiveness of economic activities and ensuring the sustainable use of renewable natural resources. In 2020, the ministry launched the "Catch the Carbon" package as part of the various additional measures for the land-use sector under the Government Programme. The aim of the Catch the Carbon Programme was to strengthen the competence and knowledge base related to climate work in the land-use sector and to support agricultural producers, forest owners, and other parties making land-use decisions in developing and introducing climate change resilient practices.

The Catch the Carbon package also included a research and innovation programme, an information programme with projects focusing on strengthening the knowledge base for future climate measures in the land-use sector, as well as more practical development projects. More than 150 projects were funded under the total Programme from 2020 to 2024. The last projects were completed by the end of 2025.

The research and innovation programme aimed to produce new research information that anticipates changes in the operating environment, as well as solutions for climate action in the land-use sector and the sustainable use of renewable natural resources. It comprised 15 multidisciplinary projects focusing on the reduction of greenhouse gas emissions, strengthening carbon sinks and reservoirs, and thus strengthening climate change resilience in agriculture, forestry, and other types of land use. The research and innovation programme continued until 2024. Its volume was EUR 15 million, and the main actors in the projects were universities (e.g. the University of Helsinki, the University of Oulu, the University of Eastern Finland) and research institutes, particularly Natural Resources Institute Finland. Several universities of applied sciences and some companies were also involved as partners. The programme emphasised close stakeholder cooperation to ensure information was effectively transmitted to serve as the basis for decision making and practical actions.

Strategic LIFE projects are top-down instruments for implementing EU environmental and climate objectives, coordinated in Finland by the Ministry of the Environment. The Ministry also provides part of their national funding. The most significant climate-focused example is the "Accelerating Climate Efforts and Investments (ACE)" project, launched to support the national Medium-term Climate Plan to 2035 by targeting emissions reductions in agriculture, heavy duty transport, and industrial processes. The project develops solutions such as value chains for paludiculture, plant-based proteins, and biogas, promotes low-emission energy use and energy efficiency in heavy transport and machinery, and advances clean, smart electrification in small and medium-sized industrial enterprises. Running from 2024 to 2030, ACE contributes to achieving the goals of the Paris Agreement and the EU's emissions reduction commitments by producing proposals and tools for more effective climate policies and funding in Finland.

Sitra, the Finnish Innovation Fund

With its partners, Sitra, the Finnish Innovation Fund, develops solutions to future challenges. The organisation advances Finland's wellbeing and drives sustainable economic growth. Sitra seeks ways to create a good life, prosperous businesses, and a sustainable economy, while respecting nature's limits.

Between 2021 and 2025, Sitra's work in promoting ambitious and cost-effective climate and nature policy addressed such questions as: what environmental objectives mean for forest use and what economic impacts they will have; how we can better anticipate the impacts of accelerating climate change and integrate adaptation into decision making; and which complementary polices and measures along with the EU Deforestation Regulation (EUDR) could enhance the EU's ability to cut its global deforestation footprint. Between

2021 and 2025, Sitra allocated approximately EUR 7.7 million to ecological sustainability initiatives.

Foundations

Several Finnish foundations support environmental and climate research, actively participating in the mitigation of climate change. These foundations have placed considerable emphasis on the promotion of the interaction between environmental research and society. The Finnish Association of Finnish Foundations has established a "Climate and Environmental Measures of Foundations" website that includes examples of the operating models and tools implemented by the active foundations. Here is an indicative list of the biggest Finnish foundations supporting climate and environmental research: the Finnish Cultural Foundation; the Jane and Aatos Erkko Foundation; the Swedish Cultural Foundation in Finland; the Kone Foundation; the Maj and Tor Nessling Foundation; the KAUTE Foundation; the Maa- ja Vesitekniikan Tuki Foundation; the Finnish Natural Resource Research Foundation; the Weisell Foundation; the Åbo Akademi University Foundation; the Tiina and Antti Herlin Foundation; and the Walter and Andrée de Nottbeck Foundation.

6.2.2 Climate process and climate system studies

The Finnish Meteorological Institute, FMI, has a staff of around 200 scientists working on climate change and related problems. Regarding climate process and climate system studies, the emphasis of the programme is on:

- Climate research and services (climate data production; studies of atmospheric radiation and extreme events; climate modelling and scenarios; impact and adaptation studies, including socioeconomic aspects; and climate change communication);
- Greenhouse gases (measuring greenhouse gas concentrations and fluxes, and interpreting the measurements using modelling tools);
- Aerosols, clouds, trace gases, and climate (measuring properties of aerosols, clouds, trace gases, and their interactions both in situ and remotely, modelling aerosol dynamics and aerosol-cloud interactions).

Aerosol climate research at the FMI focuses on two main areas: the climatic influences of anthropogenic aerosols in both polluted and pristine regions; and the role of natural boreal forest aerosols in clouds and the climate.

The research relies on field measurements at selected sites in Finland and international hotspots, modelling, and laboratory work and satellite retrieval.

The FMI's greenhouse gas research focuses on the high-precision concentration of GHGs and the exchange fluxes between ecosystems and the atmosphere, typically of forests, peatlands, and agricultural soils. The FMI operates both types of measurements at the Pallas-Sodankylä GAW station and on Utö island in the Baltic Sea. There are also several flux measurement sites across Finland, many of which have CO_2 flux time series longer than 25 years.

The universities of Helsinki, Tampere, and Eastern Finland and the FMI constitute the Atmosphere and Climate Competence Center (ACCC), the Finnish Flagship that works to address climate change and air quality issues (see also Section 6.2.1).

Palaeoclimatology

The palaeoclimatological studies of Finnish universities and research institutes are primarily based on the abundant natural archives in Finland and polar areas, and they contribute to international research programmes such as hemispheric and global scale reconstructions (see Box 6.8).

Box 6.8
Palaeoclimatology Research in Finland

At the Environmental Change Research Unit (ECRU), University of Helsinki, the central research theme is the development and application of empirical, computational, and modelling tools to detect global climatic and environmental changes and analyse their ecological and societal impacts. ECRU focuses on centennial- to millennial-scale climatic changes, especially in Arctic environments. The research is largely based on proxies stored in natural archives such as peatlands, lake and marine sediments, and ice cores. Research themes include carbon cycling, past climate development, and extreme events, Arctic sea ice history and past black carbon deposition, and past peatland, lake, and marine ecosystem dynamics.

At the Geosciences Research Unit, University of Oulu, the objectives are to produce important threshold values in geochemical and sedimentological proxy information about past climate warming events and related loss of ice, especially in polar settings in time scales from hundreds to hundreds of thousands of years. Influential research on the glaciation history of Eurasian Arctic and East Antarctica has been conducted. A special emphasis has been to study the dynamics of past ice sheets and the evolution of landscape and high-latitude oceans with modern sedimentological techniques and laser scanning imageries of glacial landforms. The studied marine sediment records from the Central Arctic Ocean and the Baltic Sea also document transitions between different climate states well, including abrupt events on timescales of decades to a few centuries. The research is conducted in relation to international research programmes such as the International Ocean Discovery Program

(IODP). **The Space Climate Research Unit of the University of Oulu** studies the evolution (over a few hundred years) of the sun and the effects of solar magnetic activity. The solar wind affects Earth's atmosphere, especially at high latitudes. Studies are related to questions like how the atmosphere is influenced, and how relevant it is to climate change.

The Laboratory of Chronology (LC) of the Finnish Museum of Natural History analyses the isotopic and elemental compositions of samples from environmental archives. LC has led efforts to construct radiocarbon and stable isotope chronologies from Finnish subfossil materials for the late and mid Holocene. Furthermore, abrupt climatic and environmental anomalies are tracked down using multiproxy methodologies, and the interaction between nature and people is addressed.

Natural Resources Institute Finland (Luke) has constructed one of the longest tree-ring chronologies in the world (5634 BCE to 2021 CE), based on living trees and mega-fossils recovered from lake bottoms and lakesides. Tree-ring material and its carbon isotope data have been used for reconstructions of past summer temperatures, cloud cover changes, and ocean-atmospheric circulation variability since the last glaciation period in cooperation with LC. Palaeoclimatological data are used to analyse the impacts of natural forcing factors such as solar activity and explosive volcanism.

The Department of Geography and Geology at the University of Turku works on reconstructing and understanding Earth's past climate and water cycles (temperature, precipitation, river flows, and lake levels) using natural, physical, and chemical evidence, known as palaeoproxy records. Today, the research builds on the Digital Waters flagship (DIWA) funded by the Research Council of Finland.

The Geological Survey of Finland (GTK) studies high-resolution lacustrine and marine sediment records (varves), with an emphasis on short- and long-term climate and environmental change. Today, one of the focuses is the process by which lakes capture, store, transform, and release organic and inorganic carbon within their bottom sediments. The GTK's continued research on climate change effects on the marine environment indicates that climate long-term warming has weakened winter mixing and deepwater ventilation in the Baltic Sea deep basins, and increased stratification has led to a major ecological shift. These have caused the onset of widespread hypoxia, as well as rapid change in sedimentation patterns, for example.

6.2.3 Climatic modelling and prediction

In cooperation with the Universities of Helsinki and Eastern Finland, the Finnish Meteorological Institute, FMI, contributes to climate change research by using global climate models to study the physical and chemical processes of Earth's climate system. Global climate modelling at the FMI focuses on the use and development of the European Community Earth system model, EC-Earth, as part of a Europewide consortium. FMI's main responsibility in the development of EC-Earth is to improve its atmospheric component, with a particular focus

on the aerosol scheme in the European Centre for Medium-Range Weather Forecasts' Open Integrated Forecasting System (OpenIFS). Through EC-Earth, FMI has contributed to the CMIP6 Coupled Model Intercomparison Project of the World Climate Research Programme (WCRP) and is currently preparing the next-generation model for upcoming CMIP7 simulations. These CMIP simulations provide an important basis for future climate projections in the IPCC Assessment Reports. In addition, the FMI is developing aerosol models for the Climate Digital Twin version of IFS (Integrated Forecasting System), as well as for the IFS version used in the European Centre for Medium-Range Weather Forecasts' CAMS (Copernicus Atmosphere Monitoring Service) Global Production System. Although most climate model development focuses on IFS-based versions, other global climate models such as NorESM and UVic are also used for research purposes.

For example, research projects aim to better understand the ongoing climate change in the polar regions, biosphere-aerosol-cloud feedback, radiative transfer in the atmosphere, and the applicability of negative emissions technologies in climate change mitigation. Single components of Earth system models such as the atmospheric component Open-IFS, land surface component LPJ-Guess, and ocean component NEMO of the full earth system model EC-Earth are used and developed to address specific research goals such as ensemble predictions in weather forecasting, the role of global forests as a carbon sink, and sea ice characteristics in the Baltic and Arctic Seas.

The FMI also develops and uses the regional climate model HARMONIE-Climate (HCLIM) as a member of the HCLIM consortium, which consists of several European partners with a strong Nordic contribution. The model produces high-resolution climate change projections, particularly for extreme weather, and provides an important basis for adaptation work. Its data have also been used in several applications to assess the societal impacts of climate change. In addition, the HCLIM model has been used for climate attribution research. With its Nordic partners, the FMI is producing the next generation of Nordic convection-permitting climate projections, which will provide high-resolution baseline data for future analyses and applications. As HCLIM is the climate version of the HIRLAM–ALADIN Research on Mesoscale Operational Numerical Weather Prediction in Euromed (HARMONIE) system, its development is closely linked to advances in HARMONIE.

The FMI also investigates aerosol-cloud interactions with a large eddy simulation model for aerosol–climate interactions, UCLALES-SALSA, which it has developed. The model has been used to develop new parameterisations for large-scale models, improving the understanding of cloud microphysical processes and interpreting field observations related to strong aerosol particle sources such as forest fires and ships, for example.

The FMI uses and develops models (e.g. the JSBACH land surface model, the LDNDC ecosystem model, the PEcAn modelling and data assimilation platform) to study carbon sinks and sources in forests, peatlands, and agricultural lands under management and in a changing climate, as well as feedback between the land carbon cycle, nutrient availability, water cycle, and atmosphere. The FMI also produces information about global biospheric and anthropogenic greenhouse gas emissions in recent years by using atmospheric inverse modelling (Carbon Tracker Europe, Community Inversion Framework) with atmospheric GHG data from satellites and in situ measurements. The FMI participates in joint international GHG modelling efforts like the Global Carbon Project which feed into IPCC work.

6.2.4 Research in support of the national greenhouse gas inventory

Research in support of the national greenhouse gas inventory has aimed to develop methodologies and emission factors or other parameters to improve the accuracy and reduce the uncertainties of the greenhouse gas inventory. This research has largely been funded by the Ministry of the Environment and the Ministry of Agriculture and Forestry. Funding has also been provided by various consortia, including other ministries, national funding organisations such as the Research Council of Finland, and the private sector.

In recent years, the focus of research in supporting the greenhouse gas inventory has been on developing and improving methods and country-specific parameters for estimating carbon stock changes, particularly in soils, in the land-use, land-use change, and forestry (LULUCF) and agriculture sectors. The Finnish Yasso model for estimating carbon stock changes in soils (developed by the European Forest Institute, the Finnish Environment Institute, Natural Resources Institute Finland (Luke) and the Finnish Meteorological Institute) has gained international recognition and is also applied in inventory preparation in other countries. Recently, new tree biomass models have been developed and implemented in the inventory calculations, resulting in improved estimates of biomass carbon stocks and their changes, and providing a more reliable basis for estimating above- and below-ground biomass dynamics. In addition, a project for further developing infrastructure for knowledge of land-use sector carbon sinks and emissions tracking was started (see Box 6.6)

Several research projects conducted by universities and research institutes have provided emission factors and research results to estimate CO_2, N_2O, and CH_4 emissions from organic soils and peat extraction areas. A revised method has been developed and introduced to the GHG inventory for estimating carbon dioxide emissions from drained organic forest soils that account for climate-driven changes in decomposition. The effects of paludiculture and continuous

cover forestry are also actively studied to facilitate the reporting of the potential GHG mitigation resulting from novel management options. Research has been carried out in programmes such as the research and innovation programme under the Catch the Carbon package (Section 6.2.1/ climate-change-related programmes by ministries).

In addition, a development project was carried out to derive a country-specific estimate for the fraction of nitrogen leached[20] for agricultural lands using the national VEMALA–ICECREAM modelling system. The estimate has been further refined for the GHG inventory to account for cover crop use, resulting in a time-varying value that reflects observed management practices. Furthermore, an ongoing project with the Finnish Environment Institute (Syke) as the Finnish partner, funded by the Nordic Council of Ministers, aims to improve F-gas inventories in the Nordic countries through joint comparison and verification of the emission estimation methodologies, emission factors, and other parameters and assumptions used in different countries.

International collaboration in research to support the national greenhouse gas inventories is exemplified by Finnish experts' participation in the Global Greenhouse Gas Watch (WMO-G3W). The WMO-G3W is a new global greenhouse gas monitoring initiative under the World Meteorological Organization that aims to support mitigation actions undertaken to implement the Paris Agreement. One of its objectives is to provide a platform that delivers greenhouse gas observations and modelling products for international exchange. Data services are aimed at specific user communities, including support and verification for national greenhouse gas inventories.

Efforts to disseminate the research results have been made in various fora to support other countries in their inventory preparation efforts: at the annual meetings of the Nordic GHG inventory experts; at EU-level meetings; and at sector-specific capacity-building meetings for developing and developed countries. In addition to publishing the results on research supporting the GHG inventories in international journals and Finnish experts' participation in the preparation of the IPCC guidelines for national greenhouse gas inventories, emission factors and parameters have been provided to the IPCC Emission Factor Database (EFDB).

6.2.5 Research on the impacts of climate change, adaptation, and mitigation

This sub-chapter mainly focuses on research performed since the publication of the Eighth National Communication. The text aims to provide an overview: the descriptions are not exhaustive. More information about the research

[20] That is, lost from managed soils through leaching and runoff

activities is available on the websites of the research institutes and universities (see the list at the end of Chapter 6).

Many research institutes and universities carry out research on climate change impacts, adaptation, and mitigation in Finland. Several research organisations have established their own climate-change-related programmes or research units. Close cooperation among research organisations is a characteristic feature of Finnish research on climate change impacts, adaptation, and mitigation.

National research programmes (see Section 6.2.1) have provided funding and common goals for the research.

The Ministry of Agriculture and Forestry has funded several projects that have co-benefits with emissions reduction in agriculture and in the land sector. A tangible example is the MATO2 programme, which was launched in 2023 to promote the environmental objectives of the new Strategic Plan of the EU's Common Agricultural Policy (CAP). Climate change mitigation and halting biodiversity loss have been set as crosscutting objectives of the programme. There is no separate funding for the programme. Instead, its objectives outline the research funding of the Ministry of Agriculture and Forestry and the Ministry of the Environment. The Ministry of Agriculture and Forestry also runs a development fund for agriculture and forestry that grants R&D funds for activities that benefit the agri-food sector across a broad front. The main focus is on research concerning the sustainable development of the profitability and competitiveness of livelihoods. The projects also include the theme of adaptation.

In research on climate change, natural sciences no longer dominate, and economics, law, the social sciences, and the humanities are increasingly contributing to the knowledge required for tackling climate change in terms of mitigation or adaptation. For example, issues of justice and a fair transition to a resilient low-carbon society, as well as energy security, have become important research topics.

An overall objective of the research on climate change is to better understand complex interactions between a wide range of climate change impacts and adaptation and mitigation measures. Active research on possible measures to address climate change has emerged. The interactions between mitigation and adaptation actions are also increasingly recognised. Inter- and transdisciplinary approaches are increasingly employed to deal with the complexity of the challenges. In addition, practitioners' active participation is required; for example, practitioners such as farmers contribute important practical knowledge to the development of verification system for carbon sequestration in arable lands.

Climate change research is also closely connected with other themes such as the bioeconomy and circular economy, resilience, studies of societal transitions, energy research, transport research, consumer studies, and ecological research. The education and training of experts are an integral part of research activities.

Research on climate change impacts and adaptation

Research on climate change impacts and adaptation has become a recognised topic in Finnish R&D activities. Most of the research is based on project funding, ranging from short-term studies to long-term research projects. Finnish research organisations and researchers also actively participate in European research projects.

Key themes of the research include:

- preparation of climate and related projections until 2100 nationally and for Finnish regions, based on downscaling of global and European climate model projections. These include projections for the climate (both averages and extremes), relative sea level, and air pollution;
- exploration of low probability, high-impact "wildcard" climate scenarios such as a slowing or cessation of the Atlantic Meridional Overturning Circulation (AMOC) that could lead to severe cooling over western and northern Europe;
- co-creation of socioeconomic pathways until 2050 and beyond for sectors and/or systems in Finland, based on elaborations of the global Shared Socioeconomic Pathways (SSPs). These are designed to be used alongside climate projections to describe alternative future conditions as a context to serve adaptation planning. SSP extensions have been co-created for agriculture[21] and health,[22] as well as for key systems in regions;[23]
- modelling and evaluation of impacts of climate change in different sectors, systems, and regions (for example, agriculture, forestry, health, buildings and other infrastructure, hydropower, ecosystems, the Arctic);
- risk assessments, including the analysis of exposure and vulnerability at a national, regional, or local scale; analysis of the costs of inaction in the face of the changing climate;
- cross-border impacts of climate change and relevant policy responses, for which Finnish researchers have contributed methodological frameworks

[21] Lehtonen et al. (2021). Shared socioeconomic pathways for climate change research in Finland: co-developing extended SSP narratives for agriculture. Regional Environmental Change 21, 7, https://doi.org/10.1007/s10113-020-01734-2.

[22] Lipsanen et al. (2025). Socioeconomic narratives for future healthcare and social welfare in Finland to inform climate change adaptation. Regional Environmental Change 25, 102, 10.1007/s10113-025-02435-4.

[23] https://www.syke.fi/en/projects/finscapes

for research[24] and policy,[25] as well as detailed examples focusing on risks propagating from impacts originating from warming in the Arctic;[26]

- adaptation and resilience, including the use of nature-based solutions (e.g. for flood or storm water management), new methods for evaluating the social justice dimensions of adaptation decisions,[27,28] and development of adaptation pathways and their evaluation;
- development of wildfire application into the Climate Change Adaptation Digital Twin of Destination Earth to estimate fire risk and the efficiency of fire mitigation plans.

Research on climate change mitigation, including technologies

As with research on climate change impacts and adaptation, many research organisations conduct studies on mitigation, as well as analyses of mitigation policies. Key themes include:

- identifying, developing, and assessing technological solutions for mitigating climate change in different sectors, including renewable energy production, electrification, and e-fuels or synthetic fuels;
- energy efficiency in different sectors (e.g. industry, buildings, transport), short- and long-term energy storage solutions, and demand-side management;
- socioeconomic analyses of energy transitions, especially the shift to low-carbon futures and climate neutrality at different levels of governance and managing intermittent energy sources;
- developing and analysing scenarios for emissions reductions, including technological, energy systems, and economic modelling;
- examining ways to maintain and increase sinks in the land-use sector, as well as permanent carbon dioxide removals through BECCS and DACCS;[29]

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[24] Carter et al. (2021). A conceptual framework for cross-border impacts of climate change. Global Environmental Change 69, 102307, 10.1016/j.gloenvcha.2021.102307.

[25] Kivimaa et al. (2025). Evaluating policy coherence and integration for adaptation: the case of EU policies and Arctic cross-border climate change impacts. Climate Policy 25, 59–75, https://doi.org/10.1080/14693062.2024.2337168.

[26] Mosoni et al. (2024). Cross-border dimensions of Arctic climate change impacts and implications for Europe. WIREs Climate Change 15, e905, https://doi.org/10.1002/wcc.905.

[27] Juhola, S., Heikkinen, M., Pietilä, T., Groundstroem, F., Käyhkö, J. (2022). Connecting climate justice and adaptation planning: An adaptation justice index. Environmental Science & Policy 136, 609–619, https://doi.org/10.1016/j.envsci.2022.07.024.

[28] Paauw et al. (2025). Recognition of differences in the capacity to deal with floods: A cross-country comparison of flood risk management. Journal of Flood Risk Management 18, e12965, https://doi.org/10.1111/jfr3.12965.

[29] BECCS = Bioenergy with Carbon Capture and Storage; DACCS = Direct Air Capture and Storage

- assessing the economically optimal way for managing forests when simultaneously accounting for sustainable wood production, and the needs to mitigate climate change and improve biodiversity;
- developing, analysing, and evaluating policy instruments for achieving energy and climate goals;
- the exploration of links between mitigation, resource efficiency, and biodiversity conservation.

The overall goal is to strengthen the knowledge base for systemic transitions to a low-carbon, resource-efficient, and resilient society. Examples of related research projects are the Clean Energy System Transition (REPower-CEST) project (2024–2026), which produced a comprehensive analysis of the means of phasing out fossil fuels and prepared a roadmap for implementing the transition in Finland and another REPower project which also developed a strategic roadmap for energy transition but with a focus on land use and resources, regional development and geopolitical dimensions (see also Box 6.7).

An increasing number of studies have assessed climate change problems from a transdisciplinary perspective and integrated socioeconomic aspects. For example, the Strategic Research Council has funded large consortia in which research institutes, universities, and other actors, including the private sector, join forces in dealing with technology and energy disruptions and resource efficiency. Other broad inter- and transdisciplinary research efforts have addressed the mitigation of emissions from the land-use sector, and dealt with opportunities to increase sinks in forests and forestry and agriculture. Funding from Business Finland plays an important role for technology developers seeking business opportunities in mitigation technologies.

The EU's Integrated Life Projects have supported demonstration projects for upscaling. An example is the support for Carbon Neutral Municipalities and Regions (Canemure, 2018–2024). Another significant EU Life project with mitigation focus is "Accelerating Climate Efforts and Investments (ACE)" project (2024–2030), launched to support the national Medium-term Climate Plan to 2035 by targeting emissions reductions in agriculture, heavy duty transport, and industrial processes (see Section 6.2.1).

Some actors in the field of mitigation research and examples of their research are presented here below:

Research, development, and innovation (RDI) in both universities and universities of applied sciences combine multidisciplinary expertise with the needs of cooperation partners and society. New solutions are widely sought to help society and businesses in their sustainable renewal by supporting the transition to a carbon-neutral society in all sectors, for example.

Cooperation and co-creation with both companies and the public sector also enhance long-lasting partnerships. Funding is provided by the European Social Fund (ESF), the European Regional Development Fund (ERDF), ministries' programmes, and Business Finland in many cases, while financing from municipalities and companies also plays a significant role.

VTT Technical Research Centre of Finland Ltd (VTT) is conducting applied research in areas that must be solved to achieve a carbon-neutral economy and society. These areas are carbon-negative process industry, low-carbon and smart mobility, safe and sustainable nuclear energy, a smart and sustainable built environment, a sustainable food system, a carbon-neutral and flexible energy system, competitive hydrogen, and carbon capture, utilisation, and storage (CCUS) solutions.

Some examples of achievements are VTT's establishment of innovation ecosystems in smart energy and smart transport, where companies, research actors, the public sector, and citizens can co-create and pilot new technologies and services. VTT has also led development in sustainable fuels and their utilisation in various forms of mobile and stationary applications. VTT hosts a science-based deep-tech incubator VTT LaunchPad. For example, research on alternative proteins with a lower carbon footprint has resulted in four startups. VTT has also worked on the development of a small modular nuclear reactor for residential heating, leading to a spin-off company. In addition, VTT has supported ministries to formulate medium- and long-term climate and energy scenarios, and carried out an assessment of the impacts of national climate and energy policies and measures in collaboration with other research institutes.

The Finnish Environment Institute (Syke) carries out research on climate change mitigation by analysing the economics and management of renewable intermittent energy sources, the legal basis for low-carbon transitions, the practices of low-carbon consumption, and business development, and by developing methods and processes for estimating and analysing consumption-based greenhouse gas emissions as a complement to the area-based estimates that Syke has produced for all municipalities in Finland. Syke also carries out research on the security aspects of the energy transition.

Natural Resources Institute Finland (Luke) has organised its research activities into three programmes, namely Renewing primary production, Crisis-resilient biosociety and Multifunctional natural resources use. In the latter research programme, climate change mitigation and adaptation is one of the designated research focus areas, but climate change is a key impact driver also in other research programmes. Furthermore, the Natural Resources Institute Finland also has a programme for statutory and expert services, which is responsible for the greenhouse gas inventory for agriculture and land use, land-use change, and forestry sectors, for example.

Research on assessing, evaluating, and monitoring climate action

Policies and other societal actions to strengthen mitigation and adaptation are regularly reported to the UNFCCC and the EU, but dedicated research also aims to create more systematic and controlled information about the contribution of policies to transformative societal change. In particular, such assessments and evaluations of policies have been initiated by the Strategic Research Council (SRC) and the dedicated Government's analysis, assessment, and research activities (VNTEAS). For example, the latter have included a research-based assessment of the Government's Climate and Energy Strategy and a research-based evaluation of the national Climate Change Adaptation Plan 2015–2022.[30] These operational studies for policy development have been linked with more strategic research on climate and energy issues through studies focusing on technological disruption in energy. Projects under the SRC CLIMATE Programme deepen the understanding further by analysing the perceived legitimacy and fairness of current and potential policy instruments, for example. They have evaluated current systems and provided assessments of alternative future pathways. Recent work has proposed a national monitoring system[31] for all adaptation targets in Finland's Adaptation Plan to 2030, along with the formulation of criteria to select indicators for monitoring adaptation.[32]

Climate justice and just transition-related research

Finland's research landscape on climate justice and just transition has expanded considerably in recent years, with several major initiatives addressing different dimensions of fairness in the green transition. The Strategic Research Council's JUST ENERGY programme examines how Finland's energy system can shift to sustainability in ways that remain socially fair, resilient, and inclusive, while the JUST TRANSITION programme focuses on the institutional, economic, and societal conditions that support an equitable and stable transition across regions, sectors, and population groups (see also Section 6.2.1). Alongside these programmes, the 2035Legitimacy project (2021–2026) studies public trust, acceptance, and perceptions of fairness in Finland's pathway to carbon neutrality. With the Finnish Climate Change Panel's[33] justice assessment framework and the two REPowerEU

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[30] KOKOSOPU project, Hilden et al. (2022). https://tietokayttoon.fi/julkaisu?pubid=42102

[31] Virtanen, K., Munck af Rosenschöld, J. (2025). Towards Systematic and Comprehensive Monitoring of Climate Change Adaptation: A Proposal for a National Monitoring System for Finland (in Finnish, with English abstract). Reports of the Finnish Environment Institute 44. Finnish Environment Institute, Helsinki, 124 p., http://hdl.handle.net/10138/625089.

[32] Munck af Rosenschöld et al. (2024). Current Status and Development Needs of Indicators for Monitoring Climate Change Adaptation in Finland (in Finnish, with English abstract). Reports of the Finnish Environment Institute 38. Finnish Environment Institute, Helsinki, 112 p., http://hdl.handle.net/10138/588104.

[33] see Box 6.3

chapter projects in Finland (REPower-CEST and Luke's REPower) (see Box 6.7), these efforts illustrate the breadth of ongoing work to integrate justice, legitimacy, and societal perspectives into Finland's climate governance and transition planning. The Ministry of the Environment has cooperated with research groups in relation to the use of new participatory methods in youth participation, for example. Climate justice in adaptation has been studied in the SOLARIS project (SOLidarity in climate change Adaptation policies: Towards more socio-spatial justice in the face of multiple RISks) by analysing sociospatial inequalities in flood risk management and climate adaptation policies across four countries, including Finland. The research focused on identifying marginalised groups, evaluating distributive and procedural justice, and facilitating participatory, fair decision-making processes for adaptation.[34]

6.3 Systematic observations

The routine surface and upper-air weather observations made by the Finnish Meteorological Institute (FMI) are the primary source of atmospheric observations relevant to climate change, including atmospheric composition. The FMI also carries out physical marine observations. The Finnish Environment Institute (Syke) conducts or coordinates climate-related observations of hydrology, and the chemical and biological state of inland and marine waters, as well as of terrestrial biodiversity. Climate-related observations of forests, agricultural areas, and fisheries are made by Natural Resources Institute Finland (Luke). Several universities also have activities in this area. The data collected by the Finnish Museum of Natural History (Luomus) provide data for understanding long-term changes in the biota.

INAR RI (Integrated Atmospheric and Earth System Research Infrastructure) acts as an umbrella research infrastructure (RI), taking care of the implementation and national coordination of the ESFRI (European Strategy Forum on Research Infrastructures) infrastructures in the environmental domain in Finland: ICOS; ACTRIS; eLTER (Integrated European Long-Term Ecosystem, Critical Zone & Socio-Ecological Research Infrastructure); and AnaEE (Infrastructure for Analysis and Experimentation on Ecosystems). The members of INAR RI are the University of Helsinki (coordinator), the University of Eastern Finland, the University of Turku, CSC – IT Center for Science, the Finnish Meteorological Institute, the Finnish Environment Institute, Natural Resources Institute Finland, the University of Oulu, Tampere University, and the University of Jyväskylä.

[34] Paauw, M., Smith, G., Crabbé, A., Fournier, M., Munck af Rosenschöld, J., Priest, S., Rekola, A. (2025). Recognition of differences in the capacity to deal with floods: A cross-country comparison of flood risk management. Journal of Flood Risk Management, 18(1):e12965, https://doi.org/10.1111/jfr3.12965.

INAR RI is on the National Research Infrastructure Roadmap and selected as a "Lighthouse" research infrastructure in 2025. Lighthouse status was granted to research infrastructures that lead the way in all key infrastructure areas such as service provision, impact, functionality, and shared use. The interdisciplinary approach of INAR RI allows the study of interactions and feedback between Earth components: the biosphere; the atmosphere; the hydrosphere; the upper parts of the lithosphere; and the anthroposphere: how human impacts affect natural systems.

The cornerstone of INAR RI is the network of advanced field stations such as Pallas-Sodankylä and the SMEAR (Station for Measuring Earth Surface – Atmosphere Relations) stations, which provide services and co-location of measurements for the environmental ESFRIs and set an example at the global level for co-located measurement stations. INAR RI integrates multidisciplinary comprehensive environmental measurements, and its services include open access to long-term observation data, access to research facilities, and instrument development.

Most systematic long-term observational activities depend on regular budgetary funding, but many important data series on biota (birds, insects) are collected by amateur observers. Observations carried out as part of research projects are also funded significantly by external R&D funding. The total funding for systematic observations related to climate change is difficult to determine because most observations are primarily made for other monitoring purposes (such as weather forecasting and resource management), although the observations are also applicable to tracking climate change. Budgetary funding for some of the regular monitoring programmes has partly been reduced. During 2025, some meteorological observation stations were closed. After a slow increase in the number of observing stations during the reporting period, the number of stations has returned to the same level as in 2020. There is also a need to invest in both virtual and physical infrastructure to ensure the maintenance and accessibility of the long-term data that are important for understanding the gradual effects of climate change.

The sections below present the atmospheric, ocean, terrestrial, and cryosphere observation systems. The observation systems covered are those providing climate observations, as well as other observations relevant for research on climate change impacts, adaptation, and mitigation.

6.3.1 Atmospheric observing systems

The FMI's meteorological observation network is comprised of 63 precipitation stations and 185 automatic weather stations (AWS), of which two include upper-air observations. AWSs offer a comprehensive set of parameters essential for climate studies (e.g. temperature, pressure, relative humidity,

precipitation, wind, solar radiation). Observation records are mainly distributed as synoptic weather messages every ten minutes, and hourly via the Global Telecommunication System. The FMI has been responsible for the aviation weather observations of Finnish airports since 2012. Twelve dual polarisation Doppler radars provide comprehensive coverage of Finland, offering a wide range of climate and operative applications for society.

The FMI participates in the Global Climate Observing System (GCOS) Surface Network (GSN) with three stations. One station (Sodankylä) is also part of the GCOS Upper-Air Network and the GCOS Reference Upper-Air Network (GUAN and GRUAN). Since 2013, the FMI's datasets have been free for public use via an online service (see 6.1.1 and Box 6.2).

For example, Finnish climate observations have been included in the European Climate Assessment & Dataset (ECA&D), which is a European collection of reliable long-term climate observations for climate change research. In addition, daily precipitation data are in use at the Global Precipitation Climatology Centre (GPCC).

The FMI has maintained a climatological database since 1959, including data from climatological normal values to near-real-time values for certain observations. Despite progress in the digitisation of old climate observations, a significant amount of climatological data dating back nearly 200 years are still in paper format.

The FMI is actively participating in the activities of the network of European Meteorological Services (EIG EUMETNET). The activities of EUMETNET include observing systems, data processing, basic forecasting products, research and development, and training.

Finland is a participant in the Global Atmosphere Watch (GAW) programme of the World Meteorological Organization (WMO), the purpose of which is to observe greenhouse gas concentrations and the long-range transport of pollutants in the atmosphere. Greenhouse gas measurements are made available at the World Data Centre for Greenhouse Gases (WDCGG) at the Japan Meteorological Agency, and other global and European data banks.

The FMI maintains a GAW station at Pallas-Sodankylä in Lapland, where greenhouse gas concentrations are measured on a mountaintop in a national park. Carbon dioxide, methane, nitrous oxide, ozone, air pollutants, and aerosols are measured continuously at the station. Continuous measurements of carbon dioxide started in 1996, and of methane in 2004.

Finland is participating in the Integrated Carbon Observation System (ICOS) (see also Sections 6.1.1 and 6.1.2), which is a European research infrastructure for quantifying and understanding the greenhouse gas balance of the

European continent and adjacent regions. Both atmospheric concentrations and fluxes over different ecosystems are measured, with measurements taken over oceans and the Baltic Sea.

The mission of the ICOS is:

- to provide the long-term atmospheric and flux observations required to understand the present state and predict the future behaviour of the global carbon cycle and greenhouse gas emissions;
- to monitor and assess the effectiveness of carbon sequestration or greenhouse gas emissions reduction activities on global atmospheric composition levels, including the attribution of sources and sinks by region and sector;
- to set new standards for research instrumentation, measuring protocols, and data processing.

The ICOS Finland network consists of 18 stations in ecosystem, atmospheric, and oceanic domains. The four atmospheric stations are Hyytiälä SMEAR II, Pallas, Puijo, and Utö. They continuously measure high-accuracy concentrations of carbon dioxide, methane, and carbon monoxide. Weekly sampling includes a broader selection of species similar to that of the GAW programme. The host institutes of ICOS Finland (the FMI, the Universities of Helsinki, Eastern Finland, and Oulu, and Natural Resources Institute Finland (Luke)) also maintain nine ICOS ecosystem stations that measure greenhouse gas fluxes above forest, wetland, lake, and urban environments. There is also one coastal station, Tvärminne, which contributes to both ocean and ecosystem domains, and one "Ships of Opportunity" station on Silja Serenade, which operates a regular service between Helsinki and Stockholm, monitoring Baltic Sea carbon variables. The Stations Measuring Ecosystem-Atmosphere Relationship (SMEAR), run by the Institute for Atmospheric and Earth System Research of the University of Helsinki, all contribute to ICOS Finland. They support research on biosphere-aerosol-cloud-climate interactions and the biogeochemical cycles of carbon, nitrogen, sulphur, and water in the boreal climate zone. Several ICOS stations also contribute to other atmospheric and environmental research infrastructures, ACTRIS, eLTER, and AnaEE, allowing synergistic data interpretation (see also 6.3.3).

For ACTRIS, the Finnish site selection (called National Facilities) includes the FMI Pallas and Utö sites, the University of Helsinki INAR sites in Hyytiälä, Värriö, and Helsinki, and a University of Eastern Finland site in Puijo. In addition, the FMI operates overseas the ACTRIS station in Marambio (Antarctica). The ACTRIS sites contribute to aerosol, trace gas, and cloud in-situ observations, as well as to the cloud remote sensing components of ACTRIS.

Furthermore, the FMI leads the ACTRIS Data Centre Unit (CLU) for cloud remote sensing[35]. The University of Helsinki contributes to the ACTRIS central calibration facilities in aerosol in-situ and trace gases. The headquarters of ACTRIS ERIC[36] are in Helsinki (see Section 6.1.2).

Additional climate-related observational activities carried out at the FMI are as follows:

The FMI is responsible for national background air quality monitoring. The monitoring network consists of twelve measurement stations. Most of the measurements are part of international monitoring and research programmes.

Background air quality monitoring started at the beginning of the 1970s. Today, the measurements include major ions, polycyclic aromatic hydrocarbons (PAHs), heavy metals and mercury in the air and in precipitation, ozone, sulphur oxides, nitrogen oxides, volatile organic compounds, and fine particles. In October 2024, the EU released a new Air Quality Directive[37]. Changes include stricter new limit values for selected pollutants such as fine particles, appointing focused supersites in the network, and monitoring new pollutants such as black carbon and ultrafine particles.

The FMI has assisted in establishing and enhancing measurements of atmospheric composition at stations in India, China, South Africa, and on polar research cruises.

The Integrated Monitoring programme, which is coordinated by the United Nations Economic Commission for Europe (UNECE), refers to the simultaneous measurements of the physical, chemical, and biological properties of an ecosystem over time and across compartments at the same location (stations in Kotinen and Hietajärvi). The objective of HELCOM (Baltic Marine Environment Protection Commission, or the "Helsinki Commission") is to protect the marine environment of the Baltic Sea (station at Hailuoto).

The FMI also maintains a monitoring and warning system for tropospheric ozone concentrations in accordance with the European Union's Ozone Directive. Air quality issues in the EU are coordinated by the European Environment Agency and the European Topic Centre on Air Quality.

Multilateral collaboration is ongoing within the PEEX program (Pan-Eurasian Experiment), which, since 2022, has refrained from collaboration with Russian organisations. However, connections with China have been strengthened and have yielded the construction of several high-quality observation stations in Nanjing, Beijing, and Suzhou, launching a training programme for atmospheric

[35] https://cloudnet.fmi.fi/

[36] European Research Infrastructure Consortium

[37] 2024/2881

scientists from BSc to doctoral level, and many high-impact scientific results, including on air quality in megacities.

Finland is a member of the European Space Agency (ESA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). The FMI hosts EUMETSAT's Satellite Application Facility on Ozone & Atmospheric Chemistry Monitoring, O3SAF.

6.3.2 Ocean observing systems

Finnish research institutes with significant marine components have started a national marine research infrastructure consortium (FINMARI), coordinated by the Finnish Environment Institute (Syke). The aim is to facilitate efficient international and national use of the marine infrastructure. This is done in close cooperation with other international and national infrastructures, and ESFRIs[38] such as the ICOS, EMBRC, and EURO-ARGO.

The infrastructure includes the research infrastructures of four Finnish research institutes and three university field stations. FINMARI is a distributed infrastructure, consisting of field stations, research vessels, laboratory facilities, FerryBoxes, gliders, fixed measurement platforms, and profiling buoys in the Northern Baltic Sea. FINMARI is listed as a nationally essential research infrastructure in the Finnish national infrastructure roadmap for 2021 to 2024. FINMARI is a hub for the ocean observing system in Finland, providing access to both the infrastructure and the data it produces.

Syke participates in the joint Baltic Sea environmental monitoring programme (HELCOM COMBINE), which has produced long-term data on the state of the Baltic Sea since 1979. The operative state monitoring of offshore sea areas in the Gulfs of Bothnia and Finland, as well as the northern Baltic Proper, is carried out by Syke (chemical and biological parameters, contaminants) and the FMI (physical parameters). Monitoring is conducted at about 55 sampling stations during four annual cruises by R/V Aranda. Offshore monitoring is undertaken in cooperation with the Swedish Meteorological and Hydrological Institute (SMHI), and with Estonian research institutes. The monitoring of coastal waters is carried out by regional environmental authorities with Syke. For example, the marine monitoring data serve the national implementation of the EU Marine Strategy Framework Directive and the Water Framework Directive, and the work of HELCOM. The open data have also been utilised in evaluating the observed climate change effects in the Baltic Sea, for example. Data are also delivered to the databases of the International Council for the Exploration of the Sea (ICES),

[38] EU's European Strategy Forum on Research Infrastructures

the European Environment Agency (EEA), and European Marine Observation and Data Network (EMODnet)/DG MARE[39], for example.

Syke also delivers near-real-time information from several million datapoints annually on the state of the Baltic Sea through the Alg@line monitoring system, which serves research, the general public, the media, and the authorities. Alg@line utilises the Ship-of-Opportunity (SOOP) monitoring system, which uses merchant ships as operating platforms on which measurements are taken using autonomous flow-through systems. The Alg@line project is a pioneer in the field of unattended SOOP monitoring, forming a state-of-the-art environmental monitoring system ranging from data collection and assimilation to internet applications and products.

Syke coordinates VELMU, the Finnish Inventory Programme for Underwater Marine Diversity, which, since 2004, has been collecting data on marine bio- and geodiversity across the Finnish sea area. The unique dataset, consisting of more than 200,000 spatially explicit observations on species and habitats, has been used to identify hotspots of marine biodiversity and ecosystem services, and to inform the development of the marine protected area network towards the 30x30 target of the Kunming-Montreal Global Biodiversity Framework, the national restoration plan, and ecosystem-based maritime spatial planning. The data can also be used to assess which habitats and species (i) are most vulnerable to climate-driven environmental changes; (ii) act as hotspots of carbon storage and sequestration; and (iii) offer nature-based solutions for climate change adaptation and mitigation.

The FMI is responsible for monitoring the physical properties of the Baltic Sea. The FMI's operational measurement network includes 14 tide gauges, 14 wave buoys, Argo floats (TS/O2) in four of the Baltic Sea basins, and several surface temperature buoys along the coast. Regular temperature and salinity soundings are also made in coastal monitoring stations. In addition to the abovementioned ICES, EEA, and EMODnet databases, operational measurements are provided to the Copernicus Marine Service database.

The FMI also contributes to the global Argo programme by providing floats for the Nordic Seas in addition to the Baltic Sea via the Euro-Argo Research Infrastructure. For enhanced climate, marine, and ecosystem research in the Baltic Sea, the FMI and Syke have established the Utö Atmospheric and Marine Research Station (part of FINMARI), which provides high time-resolution data on marine ecosystem atmosphere feedback processes and the carbon cycle.

[39] Department for Maritime Affairs and Fisheries of the European Commission

6.3.3 Terrestrial observing systems

In the following, the terrestrial observing systems in Finland also includes a description of inland waters and hydrology. The observing systems of greenhouse gas measurements over different terrestrial ecosystems and of the interaction of terrestrial ecosystems and the atmosphere are described in Section 6.3.1 above.

Syke is the national centre coordinating and supervising the monitoring of water resources, the hydrological cycle, and the chemical and biological state, including data management, quality control, and the assessment of the chemical and ecological quality of inland waters. Many hydrological data series are unique for their temporal duration (longer than 100 years), particularly those related to the freezing and breakup of rivers and lakes, and the water levels of some large lakes.

Flood forecasting at Syke is based on the Watershed Simulation and Forecasting System (WSFS). Its main component is a model that simulates the entire hydrological cycle and water balance in catchment areas. The forecasts are made several times a day from more than 800 water-level and discharge observation points, and are available on the webpage providing national information about the water situation in Finland (waterinfo.fi). Simulated hydrological data with more than 20 variables from 1962 to the present are available from the system's user interface. The modelling system is used extensively in research projects on climate change impacts in the hydrological cycle and water resources in Finland. Climate-change-related data and simulations are produced on demand, and some information and maps are also available on the national webpages, waterinfo.fi, and ilmasto-opas.fi. The hydrological simulation system also includes a nutrient simulation model (WSFS-Vemala), which can be used to simulate extensive water quality data. The nutrient loading projections can be provided on demand for historical periods, as well as for the future climate change scenarios.

The water quality data acquired and hosted by Syke cover the country and important watersheds, as well as special small-scale watersheds for baseline monitoring. All data are subject to systematic quality control, including the use of standardised methods for analysis.

Finland reports terrestrial hydrological observations to several international databases. For example, runoff data are reported to the Global Runoff Data Centre in Germany and the Nordic Runoff Data Centre in Sweden. Finland has reported lake water temperatures to a global project coordinated by the University of Nebraska.

Syke also carries out monitoring using data from Earth Observation (EO) satellites.[40] These include water quality and temperature in lakes and the Baltic Sea, snow extent, and lake ice, which are currently monitored operationally (i.e. products are generated when new data become available – in practice, almost every day for the moderate resolution satellites such as Sentinel 3). Land cover, land use, and phenology products are generated more slowly: one per year (phenology) for every six years (land cover and land use).[41] Land and cryosphere products are Syke's contribution to the EU's Copernicus services (see Section 6.3.4 for cryosphere observations).

In addition to inland water observations, the monitoring of terrestrial ecosystems aids the detection of changes induced by climate change. Integrated monitoring has indeed become an important approach in environmental sciences. At Syke, the multidisciplinary International Cooperative Programme on Integrated Monitoring (UNECE ICP IM) is one of the activities established under the Convention on Long-range Transboundary Air Pollution (CLRTAP) to develop the necessary international cooperation for assessing pollutant effects and emissions reductions. The key aim is to quantify the integrated effects of air pollution and climate change on the environment by monitoring, modelling, and scientific review using data from catchments or plots in natural or semi-natural forested areas with minimal disturbance. Syke further participates in the UNECE ICP Waters and ICP Modelling & Mapping activities, which also cover the monitoring and assessment of climate change effects.

The Finnish Long-Term Socio-Ecological network (LTER Finland) is coordinated by the University of Helsinki (under the INAR RI umbrella), bringing together the Finnish research sites and scientists conducting research on long-term socioecological processes and problems in a coordinated Finnish research infrastructure. LTER Finland also belongs to the LTER Europe[42] and the international ILTER[43] networks. Important progress in harmonising the long-term ecosystem observations Europewide is ongoing, as the integrated European Long-Term Ecosystem, critical zone, and socioecology research infrastructures (eLTER RI) are being implemented as part of the ESFRI[44] infrastructures and under the lead of Germany. Finland is planning to be a member of eLTER and tentatively co-host the eLTER Topic Centre for Interoperability.

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[40] www.syke.fi/earthobservation

[41] For details, see https://www.syke.fi/en/environmental-data/open-web-services/eo-web-map-services.

[42] https://deims.org/networks/aaae2a46-f355-41d0-8067-c2f0cd52e814

[43] International Long-Term Ecological Research

[44] EU's European Strategy Forum on Research Infrastructures

ELTER observations cover 63 standard parameters in the biosphere, geosphere, hydrosphere, atmosphere, and anthroposphere, providing a basis for a holistic understanding of the drivers and impacts of ecosystem changes. LTER Finland currently consists of 11 highly instrumented sites/research platforms (co-located with the ICP IM and ICOS sites), representing the main ecosystems (marine, terrestrial, lake, subarctic, urban) in Finland. These sites provide a national infrastructure for long-term site-based ecosystem and biodiversity research in Finland, including climate change impacts. LTER Finland provides the eLTER access to Arctic and subarctic research sites and their data, unique to the research infrastructures.

Currently, about 60 national monitoring schemes or projects provide data concerning biodiversity in Finland. This monitoring work involves three research institutes: the Finnish Museum of Natural History; Natural Resources Institute Finland (Luke); and Syke. This work includes collecting information about the changes occurring in ecosystems and habitats, species and species communities, and genes and genotypes. Monitoring data dealing with changes in biodiversity and habitats are compiled on a website. Syke organises national butterfly[45] and moth[46] monitoring schemes, providing information about the effects of climate change on species occurrences. Syke is also coordinating the FinBIF (Finnish Biodiversity Information Facility) research infrastructure project.

Monitoring of disease vectors and zoonoses that can be connected with climate change is performed by the Finnish Food Authority and the Finnish Institute for Health and Welfare.

Luke performs the National Forest Inventories (NFIs), which produce reliable and comprehensive information about land use, forest resources, tree growth, forest health, and biodiversity. These data are essential for monitoring sustainable forest management, carbon sinks, and biodiversity. The NFIs are based on statistical sampling: more than a hundred variables are measured on sample plots across the country, forming the basis for annual forest resource estimates at national and regional scales. The most recent NFI was carried out between 2019 and 2023, and the 14th NFI is currently underway (2024–2028). Since the 1920s, 13 NFIs have been completed, providing internationally unique long-term time series on land use and forest resources development. These data form an essential foundation for the national greenhouse gas inventory of the LULUCF sector and are widely used for numerous other purposes.

Luke participates in UNECE ICP Forests Level II intensive monitoring, which is the key for providing an insight into causes affecting the condition of forest ecosystems and the effects of various stress factors, including climate

[45] since 1999

[46] since 1993

change. The results are reported annually. The forest damage advisory service at Luke is responsible for monitoring forest pests and diseases, and the damage they cause. The service supports the decision making of forest owners and administrators by answering enquiries, and producing diagnoses and prognoses about forest pests and diseases. Luke also collects information about the phenology of tree and forest berries. The extent of climatic warming can thus be assessed based on the time series for the bud burst of different tree species.

Finland is a member of and currently chairs the Sustaining Arctic Observing Networks (SAON). The SAON was established as an initiative of the Arctic Council and the International Arctic Science Committee (IASC). The purpose of the SAON is to support and strengthen the development of multinational engagement for sustained and coordinated pan-Arctic observing and data sharing. The SAON has two committees: the Arctic Data Committee; and the Committee on Observations and Networks. The vision of the SAON is to sustain a comprehensive observing system for the Arctic, and that users should have access to free, open, and high-quality data that will realise pan-Arctic and global value-added services and provide societal benefits. The Arctic Passion EU project, with parallel actions in the United States and Canada, supported strongly the SAON in facilitating the ROADS process,[47] with a key goal to establish Shared Arctic Variables (SAV) to extend observation practitioners to local and Indigenous communities. Today, the SAON runs a ROADS advisory panel to support SAV development, and work will continue in Beyond Arctic Passion starting in 2026, and since 2025 in the CryoSCOPE EU projects.

The surveillance system for invasive alien species has been developed to collect and record data on the occurrence of invasive alien species, estimate how their populations have increased or shifted location, and measure the effectiveness of management measures. Work is mostly done by integrating new elements into the existing inventories and monitoring systems. Citizens can also report their observations of alien species to an internet portal[48] which includes geospatial information.

6.3.4 Cryosphere observing systems

Except for sea ice monitoring, the cryosphere observing system in Finland is organised as part of the hydrological monitoring system. Monitored cryosphere variables include snow water equivalent, snow cover extent, ice cover duration and thickness in lakes and rivers, and seasonal soil frost thickness. This monitoring programme is coordinated by the Finnish Environment Institute

[47] Sustaining Arctic Observing Networks' (SAON) Roadmap for Arctic Observing and Data Systems (ROADS), https://helda.helsinki.fi/handle/10138/341820

[48] https://vieraslajit.fi/

(Syke). Data storage and data quality control, as well as making data available to the public, are done on Syke's premises. All monitoring data can be accessed through the webpage providing the national information about the water situation in Finland.[49]

Field measurements are carried out by the local authorities or citizen observers. The monitoring network consists of more than 200 cryosphere monitoring stations where data are collected fortnightly or more frequently during the winter, and the stations are spread across Finland. Earth Observation (EO) satellite products by Syke are used to operationally monitor snow extent and lake ice. Cryosphere-related services (daily Snow Extent, featuring Fractional Snow Cover, FSC, and daily Lake Ice extent, LIE), are provided under the Copernicus Land Monitoring Service (CLMS). Within this framework, Syke operates with the FMI and ENVEO IT GmbH (Austria). These services cover the Northern Hemisphere but have recently been expanded to a global scale for Snow Cover Extent and Lake Ice Extent. In addition to CLMS, Syke contributes to the European Space Agency's Climate Change Initiative snow project, which produces long-term EO-based datasets on Snow Cover. International data availability and accessibility have been improved through the Arctic PASSION project ("Pan-Arctic Observing System of Systems: Implementing Observations for Societal Needs"), in which the FMI and Syke are partners. Cryospheric data are also reported to the National Snow and Ice Data Center (NSIDC) in the United States.

Based on satellite observations and ground measurements, there are methodologies to reliably estimate the amount of annual snow mass and changes in snow cover in the Northern Hemisphere.[50] These accurate data, starting in 1980, are a significant improvement to the Essential Climate Variables of the WMO's Global Climate Observing System.

To cover the whole Baltic Sea, the most important source for ice observations is satellites. They provide information about ice extent and type, concentration, ice ridges and leads, for example. Sea ice drift in the Bay of Bothnia has been monitored since 2012 using GPS-equipped buoys. Each ice season, in cooperation with the Finnish Transport Infrastructure Agency, Finnish icebreakers deploy up to six buoys, depending on ice conditions. Sea ice monitoring along the Finnish coastline is carried out by the FMI, which has about 20 people observing ice. They observe the ice situation visually and measure the thickness of the ice weekly, providing pointwise in-situ information. The data are available from the FMI. Both in-situ and satellite measurements provide an input to model the structure, thermodynamics, and

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[49] https://www.waterinfo.fi

[50] Pulliainen, J., Luojus, K., Derksen, C., et al. (2020). Patterns and trends of Northern Hemisphere snow mass from 1980 to 2018. Nature 581, 294–298. https://doi.org/10.1038/s41586-020-2258-0

drift of sea ice. The FMI also provides a long time series of the maximum annual extent of ice cover in the Baltic Sea that starts in the winter of 1720/1721.

The Finnish Meteorological Institute coordinates Horizon Europe CryoSCOPE to improve information about the terrestrial cryosphere, including both process understanding and monitoring in the Arctic and the Himalayas. The prime Finnish site for the SAON is the Pallas Supersite,[51] which is a versatile research infrastructure for monitoring and studying the atmosphere and ecosystems and their interactions, but now extends as an SAV[52] development to crowdsourcing about snow to improve the use of satellite-based Earth Observation data. Finland is committed to all its environmental monitoring contributing to the SAON with open data and interoperable data systems.

6.3.5 Support for developing countries in strengthening systematic observation

Climate change and the intensification of extreme weather phenomena will increase the demand for development projects, especially in countries that lack the capacity to develop the required systematic observations themselves. The strengthening of atmospheric and terrestrial observing systems provides basic information for adaptation to changes in climate and environmental conditions.

Finland finances the Systematic Observations Financing Facility (SOFF), launched in 2022, which supports Least Developed Countries (LDC) and Small Island Developing States (SIDS) to generate and exchange basic surface-based observational data critical for improved weather forecasts and climate services. Finland also finances the Climate Risk and Early Warning Systems (CREWS) initiative, which funds risk informed early warning systems for Least Developed Countries (LDC) and Small Island Developing States (SIDS). Furthermore, many other organisations and funds that Finland finances, such as the Green Climate Fund, and Nordic Development Fund, implement projects that strengthen the capacities of developing countries to assess climate risks, develop early warning systems, and take early action.

Examples of projects that support the development of observation systems and are funded by the Finnish Government are described in Section 6.4. Syke, Luke, the GTK[53], and the FMI research institutes provide expertise in the planning and implementation of projects, including work to improve monitoring systems and their use in climate change adaptation.

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51 https://en.ilmatieteenlaitos.fi/pallas-atmosphere-ecosystem-supersite

52 Shared Arctic Variables

53 Geological Survey of Finland

The Finnish Meteorological Institute (FMI) is among the world's leading national hydrometeorological institutes and has provided capacity-building and technical assistance to developing countries. Capacity building includes support for research, systematic observations, and communication, as well as training activities. Besides direct funding from the Government of Finland, the FMI implements capacity projects around the world with international and other funding arrangements. Active FMI undertakings during the reporting period from 2021 to 2024 include 15 Systematic Observations Financing Facility (SOFF) projects and one Climate Risk and Early Warning Systems (CREWS) project. Four projects strenghtening systematic observations have been implemented with other funding resources.

- Systematic Observations Financing Facility (SOFF), Readiness phase, Nepal
  FMI Partner: UNDP
  Project Duration: 2023–2026
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Readiness phase, Timor-Leste
  FMI Partner(s): UNEP, BMKG
  Project Duration: 2023–2024
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Investment phase, Timor-Leste
  FMI Partner(s): UNEP, BMKG
  Project Duration: 2024–2027
  Funder: SOFF
- Climate Risk and Early Warning Systems (CREWS) East Africa, Uganda
  FMI Partner(s): WMO
  Project Duration: 2024–2026
  Funder: CREWS
- Systematic Observations Financing Facility (SOFF), Readiness phase, Barbados
  FMI Partner(s): IDB
  Project Duration: 2023–2026
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Readiness phase, Bahamas
  FMI Partner(s): IDB
  Project Duration: 2023–2026
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Readiness phase, Trinidad and Tobago
  FMI Partner(s): IDB
  Project Duration: 2023–2026
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Readiness phase, Saint Kitts and Nevis
  FMI Partner(s): IDB
  Project Duration: 2023–2026
  Funder: SOFF

- Systematic Observations Financing Facility (SOFF), Readiness phase, Jamaica
  FMI Partner(s): IDB
  Project Duration: 2023–2026
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Readiness phase, Tajikistan
  FMI Partner(s): WB
  Project Duration: 2023–2026
  Funder: SOFF
- SmartMet Weather Forecasting and Early Warning System delivery project, Colombia
  Project Duration: 2023–2026
  Funder: Government of Colombia
- Air Quality and Environment twinning project, Moldova
  FMI Partner(s): Swedish Chemical Agency, Lithuanian Ministry of Environment, Finnish Environmental Institute
  Project Duration: 2024–2026
  Funder: EU
- Systematic Observations Financing Facility (SOFF), Readiness phase, Rwanda
  FMI Partner(s): UNDP
  Project Duration: 2023–2024
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Investment phase, Rwanda
  FMI Partner(s): UNDP
  Project Duration: 2024–2027
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Readiness phase, Maldives
  FMI Partner(s): UNEP, BMKG
  Project Duration: 2023–2024
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Investment phase, Maldives
  FMI Partner(s): UNEP, BMKG
  Project Duration: 2024–2027
  Funder: SOFF
- Weather and Early Warning Information and Communication Technologies (ICT) system Delivery, Georgia
  FMI Partner(s): ELKO
  Project Duration: 2024–2026
  Funder: UNDP-GCF, Government of Georgia
- Systematic Observations Financing Facility (SOFF), Readiness phase, Bhutan
  FMI Partner(s): UNEP
  Project Duration: 2023–2024
  Funder: SOFF
- Systematic Observations Financing Facility (SOFF), Investment phase, Bhutan
  FMI Partner(s): UNEP
  Project Duration: 2024–2027
  Funder: SOFF

- Advancing knowledge for Long-term Benefits and climate Adaptation ThRough hOlistic climate Services and nature-based Solutions (ALBATROSS), Africa
  FMI Partner(s): University of Bologna and 14 other research partners
  Project Duration: 2024–2026
  Funder: EU-H2020
- Aviation QMS development, Bhutan
  Project Duration: 2024–2025
  Funder: Bhutan Government

6.4 Capacity building in developing countries

Finland continues to finance capacity-building projects worldwide in the fields of climate observation, research and higher education relevant to climate change mitigation and adaptation, meteorology as well as sustainable management of forests, water and other natural resources. These projects have contributed to strengthening the endogenous capacities and capabilities of partner countries to address these challenges through enhanced technological resources, institutional development and human expertise.

Finland supports capacity building in developing countries through several instruments. Most of the Finnish bilateral projects include a capacity-building component as a response to existing and emerging capacity building needs in our partner countries. Likewise, many multilateral climate funds, which Finland supports, include a strong capacity-building component in their activities. Identifying opportunities and supporting actions to overcome barriers to the free and open international exchange of data and information is included in many projects financed through bilateral and multilateral channels. One example of such support is the Systematic Observations Financing Facility (SOFF) that supports countries to close the basic weather and climate observations data gap and to internationally exchange surface-based weather and climate observations in compliance with the internationally agreed Global Observing Basic Network (please also see the Section 6.3.5).

Finland also has funding instruments specifically aimed at capacity building. The capacity building projects financed through these instruments are implemented in close collaboration with partners, thus increasing the endogenous capacities in the developing countries.

The institutional cooperation instrument (ICI) is used to support Finnish government agencies' and public bodies' participation in development cooperation. The projects' objective is to strengthen the skills and knowledge of state actors, such as ministries and government agencies, in developing countries.

The Higher Education Institutions Institutional Cooperation Instrument (HEI ICI) was used to support cooperation projects between higher education institutions (HEIs) in Finland and developing countries, with the aim of strengthening their subject-specific, methodological, educational and administrative capacities. The last HEI-ICI projects were implemented during the period 2020–2024. Since 2024, a similar instrument, the Higher Education Partnership (HEP), has replaced the HEI ICI, with the first HEP projects covering the period 2024–2026. The Academy Programme for Development Research (DEVELOP and DEVELOP2) has supported collaboration in research and capacity building.

Samples of projects implemented between 2021–2024 are listed below.

Institutional Cooperation Instrument (ICI) projects active during 2021–2024[54]

Finnish Meteorological Institute (FMI)

- Improving the Adaptation to Climate Change by Enhancing Weather and Climate Services in Kenya, Rwanda, and Tanzania. Partners: Kenya Meteorological Department, Rwanda Meteorology Agency, Rwanda Environmental Management Authority, and Tanzania Meteorology Authority. Ongoing.
- Capacity Building in the Field of Meteorology, FMI-Uzhydromet Meteorology Project. Partner: Centre of Hydrometeorological Service of the Republic of Uzbekistan (Uzhydromet). Ongoing.
- Capacity Building in the Field of Meteorology, Finnish-Kyrgyzstan Meteorology Project. Partner: Agency on Hydrometeorology under the State Committee on Ecology and Climate of the Kyrgyz Republic (Kyrgyzhydromet). Ongoing.
- Capacity Building in the Field of Meteorology, Finnish-Tajikistan Meteorology Project. Partner: The Agency on Hydrometeorology of the Committee of Environment Protection under the Government of the Republic of Tajikistan (Tajikhydromet). Ongoing.
- Meteorology cooperation in Ukraine, UHMC-FMI Meteorology Project. Partner: Ukrainian Hydrometeorological Center (UHMC). Ongoing.
- Enhancing BMKG's Capacity on Weather Climate and Air Quality Forecast and Warnings to Better Serve the Indonesian Society. Partners: Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG). Completed.

[54] The status of each ICI-project (ongoing, completed) refers to its status at the time of reporting in 2026.

- Promoting the Modernisation of Hydrometeorological Services in Vietnam. Partner: Meteorological and Hydrological Administration of Viet Nam. Completed.
- Finnish-Nepalese Project for Improved Capability of the Government of Nepal to Respond to the Increased Risks Related to the Weather-related Natural Disasters Caused by Climate Change. Partner: Department of Meteorology and Hydrology (DHM). Completed.
- Improving the Adaptation to Climate Change by Enhancing Weather and Climate Services in Sudan. Partner: Sudan Meteorological Authority (SMA). Completed.

Natural Resources Institute Finland (LUKE)

- Implementation support of results and data of the first National Forest Resources Monitoring and Assessment at regional and local level in Tanzania. Partners: Tanzania Forest Services (TFS), Tanzanian Forest Research Institute (TAFORI) and Sokoine Agricultural University (SUA). Completed.
- Institutionalising National Forest Monitoring in Myanmar. Partners: Myanmar Forest Research Institute and University of Forestry,Yezin. Completed.

Geological Survey of Finland (GTK)

- Strengthening the Mastering of Natural Resources for National Welfare in Tajikistan. Partner: Main Department of Geology under the Government of the Republic of Tajikistan (MDG). Completed.
- Strengthening the Mastering of Natural Resources for National Welfare in Uzbekistan. Partner: State Committee of the Republic of Uzbekistan on Geology and Mineral Resources (GOSCOMGEOLOGY). Completed.
- Strengthening the Mastering of Natural Resources for National Welfare in the Kyrgyz Republic. Partner: State Committee of Industry, Energy and Subsoil Use of the Kyrgyz Republic (SCIESU). Completed.
- Towards Arsenic Safe Drinking Water in Nepal (NeAs). Partners: Finnish Environment Institute (SYKE) and Department of Water Supply and Sewerage Management (DWSSM) Nepal. Completed.
- Managed Aquifer Recharge to Ensure Sustainable Groundwater Availability and Quality under Ongoing Climate Change and Fast Economic Development in Vietnam. Partners: The Sub-Institute of HydroMeteorology and Climate Change (SIHYMECC) and the Center for Water Resources Warning and Forecast (CEWAFO). Completed.

Finnish Environment Institute (SYKE)

- Increasing Climate Resilience of Zanzibar with Integrated Marine Management and Sustainable Blue Economy. Partners: Department of Environment (DoE), Zanzibar Environment Management Authority (ZEMA), Department of Marine Conservation (DMC Zamzibar) and Fisheries and Marine Resources Research Institute (ZAFIRI). Ongoing.

Higher Education Institutions Institutional Cooperation Instrument (HEI-ICI) projects active during 2021–2024

HEI-ICI funding period 2020–2024

- Strengthening Climate Change Education for Sustainable Development in Myanmar and Vietnam (CLIDEV). The partner institutions are the University of Helsinki and Laurea University of Applied Sciences in Finland, Yezin Agricultural University and the University of Forestry and Environmental Sciences in Myanmar, and Hue University and the Vietnam National University of Forestry in Vietnam. The associate partners are the Food and Agricultural Organization of the United Nations Regional Office, the Joint IUFRO-IFSA task force on Forest Education and the Center for People and Forests (RECOFTC).
- Problem-based-learning bioeconomy entrepreneurship and capacity building programme in Africa (PBL-BioAfrica). The partner institutions are the Häme University of Applied Sciences and Aalto University in Finland, Egerton University, the University of Nairobi, and South Eastern Kenya University in Kenya, Mulungushi University, and the University of Zambia in Zambia. The associate partners are the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), the Finnish University Partnership for International Development (UniPID), the Accelerated Growth for SMEs in Zambia Programme (AGS), as well as local associate partners in Kenya and Zambia.

Higher education partnership (HEP) projects active during 2020–2024

HEP funding period 2024–2026

- Empowering Tomorrow's Food Security Leaders: Strengthening Higher Education Capacity for Sustainable Food Systems in Kenya and Mozambique (FoodLeader). The partner institutions are University of Helsinki (Finland), University of Nairobi (Kenya) and Universidade Lúrio (Mozambique).
- Sustainable Futures – Biogas Value Chain for Circular Economy Competence Growth in Zambia (SF-BioVaC CECoG). The partner institutions are Novia University of Applied Sciences (Finland), University of Oulu (Finland), University of Zambia, Copperbelt University (Zambia) and as associate partner Rural Electrification Authority (Zambia).

The Academy Programme for Development Research (DEVELOP) projects active during 2021–2024

Academy Programme for development research (DEVELOP), funding period 2018–2022

- Water and Vulnerability in Fragile Societies (WATVUL). The partner institutions are University of Helsinki and Aalto University in Finland, Royal University of Phnom Penh and Cambodian Institute for Technology (ITC) in Cambodia, University of Gadjah Mada in Indonesia and Centro de Investigaciones y Estudios Superiores en Antropología Social (CIECAS) and Colegio de la Frontera Sur (ECOSUR) in Mexico.
- Environmental Sensing of Ecosystem Services for Developing Climate Smart Landscape Framework to Improve Food Security in East Africa (SMARTLAND). The partner institutions are University of Helsinki in Finland, Taita Taveta University, Jomo Kenyatta University of Agriculture and Technology, Kenya Forest Research Institute, the Kenya Wildlife Service, Kenya Forest Service, Ministry of Agriculture of Kenya, Duke University, Swedish University of Agricultural Sciences and the International Livestock Research Institute (ILRI).
- Sustainable Livelihoods and Politics at the Margins: Environmental Displacement in South Asia. The partner institutions are University of Helsinki in Finland and Shahjalal University of Science and Technology in Bangladesh.
- Cuban Energy Transformation, Integration of Renewable Intermittent Sources in the Power Systems (IRIS). The partner institutions are the University of Turku and Tampere University in Finland, Universidad de Oriente, Santiago de Cuba Instituto Superior Politécnico Jose Antonio Echeverria, Technical University of Havana, CUJAE CUBAENERGIA and Centro de Investigacion de Energia Solar (CIES) in Cuba.

Academy Programme for Development Research (DEVELOP2), funding period 2023–2026

- The Socio-Ecological and Politico-Economic Dynamics of Ecological Restoration through Tree Planting Schemes in the Global South (TreesForDev). Partner institutions are Hanken School of Economics and University of Helsinki in Finland, University of Antananarivo (Madagascar), Center for Research and Support for Development Alternatives – Indian Ocean (Madagascar), Observatorio do Meio Rural (Mozambique) and National University of Brasília (Brazil).
- Integrating Water Balance and Energy System Models for Improved Benefit Sharing in Transboundary River Basins (TU-NEXUS). The partner institutions are University of Oulu and VTT Technical Research Centre of Finland as well as regional partners in Tajikistan and Uzbekistan.

Literature and internet links



Photo: IStock

7

Education, training and public awareness

This chapter describes how climate change is included in the education system of Finland from basic education to universities. This is followed by a portrayal of international training activities, including the training of experts from developing countries. Finally, the raising of public awareness is discussed. The roles of ministries, local authorities, other public bodies, non-governmental organisations, and other relevant stakeholders are explained. Several climate change or energy saving campaigns are also presented.

7 Education, training and public awareness

7.1 General policy

Climate change is incorporated into the Government's education and public awareness policies and practices. These policies and practices are under continuous development. Climate change issues are included in basic and upper secondary level education as overarching values and as part of sustainable development education. Climate-change-related topics are also addressed by both universities and universities of applied sciences (Section 7.2).

The National Energy and Climate Strategy (2026) states that citizens should be provided with up-to-date information about all aspects of the Government's climate and energy policy. Information, guidance, best practices, and tools are provided to help consumers make climate-friendly choices in their everyday lives (Section 7.4). For example, international training activities are carried out by higher education institutions, and capacity building activities are also carried out as part of development cooperation (Section 7.3).

The national Medium-term Climate Plan, in accordance with the Climate Act, is approved by each Finnish Government, most recently in 2025. The Government submitted the Medium-term Climate Plan to Parliament in December 2025.[1] The plan highlights the raising of education levels and advanced training in various sectors to support citizens in reducing their carbon footprints.

The Ministry of Education and Culture published a policy document in 2020 [2] for the sustainable development of its administrative sector. The policy document guides the activities of the administrative sector on a sustainable basis. Education, research, culture, youth, and sport policies can contribute to all the UN 2030 Agenda for Sustainable Development goals. For example, it entails equal cultural rights, high-quality early childhood education, the raising of skills and education levels, lifelong learning, access to information, cultural rights, and wellbeing and inclusion. Overall, the activities of the Ministry of Education and Culture's administrative sector promote cultural change, which is a prerequisite for the realisation of comprehensive sustainable development.

1 https://julkaisut.valtioneuvosto.fi/items/a95af112-5615-4b4a-a86c-b7b595c1e85a

2 https://julkaisut.valtioneuvosto.fi/items/bd4358c6-891e-4ab4-9a8d-ba5f31fd00b9

The Government approved a strategic programme to promote the circular economy in 2021. It sets out objectives for the use of natural resources and measures by which a society based on a carbon-neutral circular economy will provide a sustainable foundation for our economy in 2035. The programme highlights that knowledge, education, and continuous learning are requirements for a prosperous circular economy, as well as for solutions to climate change challenges.

Under the Glasgow work programme on Action for Climate Empowerment (ACE), launched at the Conference of Parties serving as the meeting of the Parties to the Paris Agreement (Third session, CMA3) in 2021, the Parties are encouraged to engage all stakeholders (e.g. local governments, non-governmental organisations (NGOs), intergovernmental organisations (IGOs), business, and industry) in education, training, public awareness, public participation, public access to information, and international cooperation[3] on climate change, reflecting the elements of Article 6 of the United Nations Framework Convention on Climate Change. ACE serves as a framework for country-driven actions, giving the Parties flexibility in implementing and taking national circumstances and priorities and initiatives into account, while building long-term capacity and expertise in developed and developing countries for implementing ACE, including by promoting strong domestic enabling environments.

The activities this chapter describes Finland's efforts to implement ACE. In particular, the activities of local governments are described in Section 7.4.3, and the activities of NGOs in Section 7.4.5. At the end of this chapter, there are short descriptions and internet links to the projects, networks, and campaigns being carried out by various stakeholders.

7.2 Education

7.2.1 Education policy

All children in Finland receive compulsory basic education (comprehensive school) between the ages of 7 and 16. All 6-year-olds participate in pre-primary education. Having completed comprehensive school education, all students gain an upper secondary qualification. The minimum school leaving age was raised to 18 in 2021. Students continue to general (duration 3 to 4 years) or vocational upper secondary education and training (duration among young students typically 3 to 4 years). The completion of upper secondary education makes students eligible to continue to higher education (Figure 7.1). Vocational

[3] Six elements of ACE.

education and training (VET) is also an important pathway for adult learners, as two thirds of VET students are over 20 years old.

Higher education is offered by universities and universities of applied sciences (UAS). Both sectors have their own profiles. Universities emphasise scientific research and instruction. UASs, also known as polytechnics, adopt a more practical approach. A network of 14 universities and 23 UASs covers the whole country.

At the universities, students first complete the bachelor's degree, after which they may pursue the higher master's degree. As a rule, students are admitted to study for the higher degree. The target time for completing a master's degree is generally five years. Universities also arrange separate master's degree programmes with separate student selections, for which the entry requirement is a bachelor's degree or corresponding studies. At the universities, students can also study for scientific or arts postgraduate degrees, which are the licentiate and the doctorate degrees.

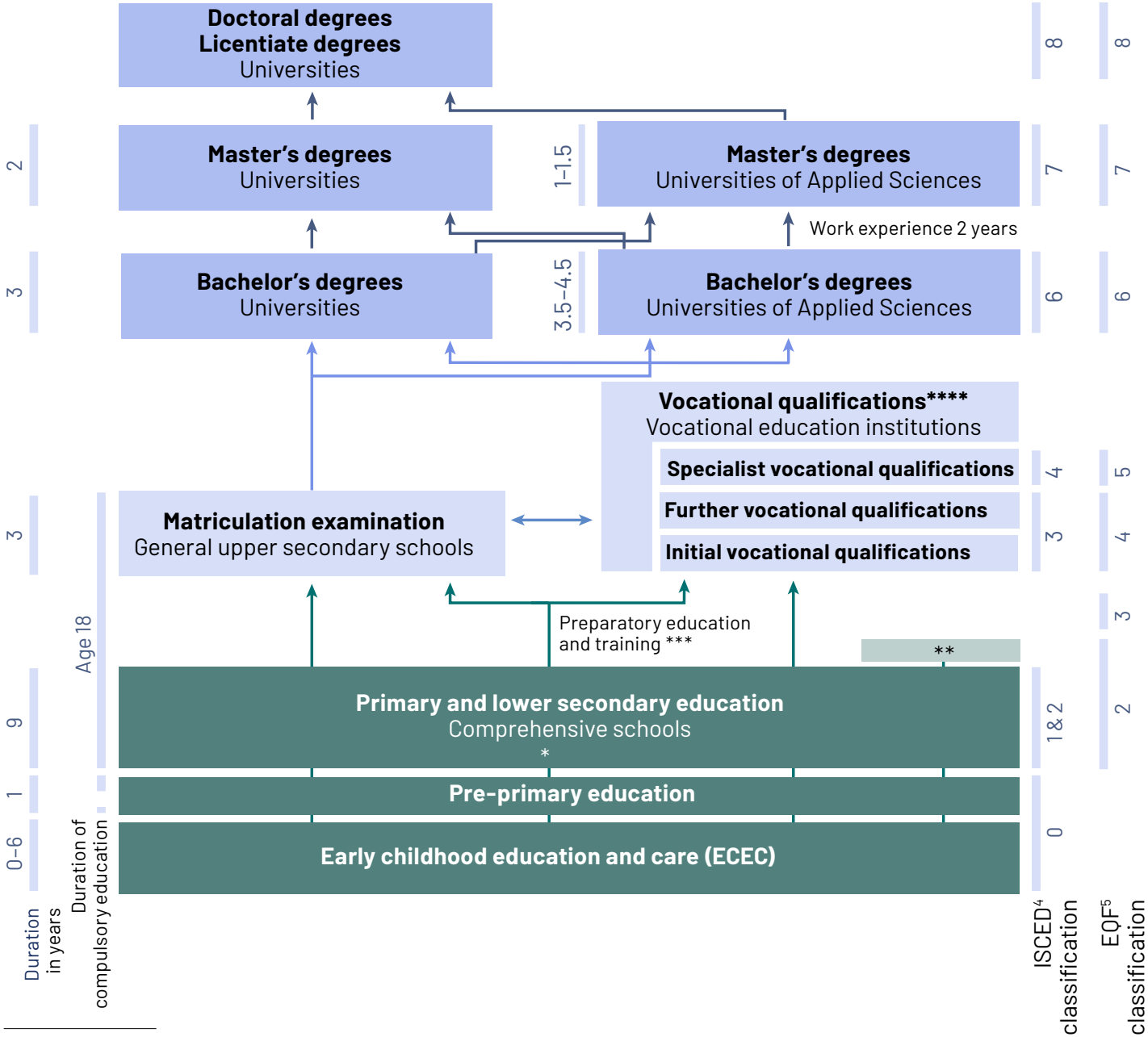
It takes approximately three to four years of full-time study to complete a UAS degree. Degree studies provide a higher education qualification and practical professional skills. Thirty-five thousand students were enrolled in universities in 2024. UASs admitted 54,500 students in 2024.

Educational institutions organise education and training intended for adults at all levels. Adult education comprises education and training leading to a degree or certificate, liberal adult education, and staff development, and other training provided or purchased by employers, as well as labour market training, which is mainly targeted at unemployed people. Efforts have been made to make the provision as flexible as possible to enable adults to study and work at the same time.

One of the basic principles of Finnish education is that citizens have equal access to high-quality education and training. Education is free at all levels, from pre-primary to higher education (degree education). Tuition fees are charged for citizens of non-EU/EEA countries in university and UAS programmes given in a foreign language. All schools in Finland are connected to the internet.

All municipalities have at least one free public library, and there were more than 800 public libraries in 2022. About 70 per cent of Finns use libraries, which is the highest share among EU countries. According to a Study of Journalism by Reuters Institute and Oxford University in 2025, Finnish news remained the most highly trusted among European countries. The news media in Finland is not politically polarised, so any politically based scepticism felt by a minority towards the news media targets all the major news brands. The use of online news sources was unchanged, at almost 90 per cent weekly reach, while television news and the printed press continued their slow decline.

Figure 7.1 Education system in Finland



****Also available as apprenticeship training or by training agreement.

***Preparatory education and training (for those who need it):
- Preparatory education for programmes leading to an upper secondary qualification (TUVA)
- Education at folk high schools for learners of compulsory education age

**Preparatory education and training for work and independent living (TELMA)

*Primary and lower secondary education syllabus for learners over the age of 17

Non-qualification education

Liberal education
- Adult education centres
- Folk high schools
- Summer universities
- Centres of learning /study centres
- Training centres for sports and physical education

Basic education in the arts
- Schools of Architecture
- Schools of Fine Arts
- Schools of Crafts
- Media Arts Schools
- Music Institutes
- Schools of Literary Art
- Schools of Circus Arts
- Dance Institutes
- Theatre Institutes

4 ISCED

5 EQF

7.2.2 Education in sustainable development and climate change in the national curricula

Climate change issues are included in the education given in sustainable development in Finland's compulsory basic education system. Many school subjects deal with sustainable development and climate change, and they are also dealt with as a cross-curricular theme. Teachers decide on the context and manner in which issues are taught. Teaching should form a systematic learning path, one that progresses through the grades.

The current National Core Curriculum for Basic Education entered into force in 2014. With this curriculum, sustainability is not merely one cross-curricular theme supported by some of the values in the value basis. Instead, it is the overarching task of basic education and is strongly embedded in all elements of the core curriculum. The core curriculum, with its focus on promoting a sustainable lifestyle, represents a holistic approach to sustainability. This approach covers all dimensions of sustainability, as well as students' and the school community's developing competences and their safety and wellbeing. Sustainability is also one of the curriculum's seven transversal competences. Climate change is especially involved at the subject level in geography and biology.

The importance of ecological sustainability and climate change should not remain abstract when handled from the global to the local level. The Finnish national core curriculum steers the teaching of ecological sustainability, showing that sustainability issues play a significant role in the curriculum, and that ecological sustainability is expressed in many subjects and in the school's operating culture.

The new National Core Curriculum for Upper Secondary Schools (2019) also highlights several sustainability and climate issues. Students (aged 16 to 19) should be familiar with the main aspects of the ecological, economic, social, and cultural dimensions of sustainable development, and they should be able and willing to act in support of sustainable development in their own lives. Climate change is especially involved at the subject level in geography and biology. In addition, adaptation to climate change and solutions for mitigation are discussed in other subjects.

Vocational education is guided by national qualification requirements for different fields (160 qualifications). Sustainable development has been included in the common parts of vocational upper secondary requirements as a compulsory component. In addition, and most importantly, sustainable development and environmental issues have been integrated into the foundations of professional qualifications as competence requirements and skills requirements for each profession. In some areas, environmentally

conscious activities are crosscutting. For example, agriculture, forestry, and horticulture are based on the wellbeing and sustainability of nature. The circular economy is an important theme in the construction and textile and fashion sectors, for example, while the social and health sector's adaptation to climate change is a required competence. An optional module, Climate responsibility, has been included in all vocational upper secondary qualifications in the autumn of 2022. In addition, many optional units have been added to several qualifications: for example, Circular economy operations are one unit in the vocational qualification in Business. Further vocational qualifications and specialist vocational qualifications offer the opportunity to specialise in resource efficiency and environmental education, for example. Between 2025 and 2027, optional units related to the green transition and the development of circular economy activities will be added to all further vocational and specialist vocational qualifications.

The sustainability work of Finnish vocational education and training (VET) has been developed systematically throughout the 2020s. In the Responsible and Sustainable VET project, education providers jointly prepared a national sustainability roadmap for VET that guides the leadership, pedagogy, learning, learning environments, and cooperation with working life in VET towards sustainability and carbon neutrality. The Finnish National Agency for Education has since developed sustainability indicators for the roadmap's national monitoring, and the first data collection was carried out in 2026. In addition, OECD has examined the green transition as part of Finland's vocational education and training system, and the results of this work are now in the implementation phase.

Supporting programmes and materials

Free and open websites have been published for teachers and educators working on different levels of the education system. These websites present sustainability and climate change from the perspective of subject teaching at school or school culture, and offer photo material, assignments, and general information about sustainability and climate change and sustainability education.

For example, the Finnish National Agency for Education unveiled the **"Sustainable future"** website in 2021. It provides information about and support for the various dimensions of sustainability, and how to carry out their training activities for guidance and professionals in education and training, from primary schools to secondary and liberal arts education. The "Sustainable future" website is regularly updated.
https://www.oph.fi/en/sustainable-future

The Kartalla – på Kartan network implements the sustainability roadmap for vocational education and training. The network supports and highlights the role of educational institutions, their partners, and professionals in the sustainability transition. The network provides tools, support, and peer learning for sustainability work for VET providers.
https://kartallaverkosto.fi/en/

The Teacher's Climate Guide (openilmasto-opas.fi) was launched in 2016, and it serves teachers working in secondary and upper secondary schools. The Class Teacher's Climate Guide (luokanopenilmasto-opas.fi) followed in 2019 and is intended for primary school teachers. It offers information about climate change and climate education, and practical ideas about how to process climate change with primary school children aged between seven and 12. In 2021, the Early Childhood Educator's Climate Guide was published (vakanilmasto-opas.fi), the content of which is quite similar to the Class Teacher's Climate Guide, but for use in the context of early childhood education. The guides have been produced by experienced environmental educators in cooperation with organisations working in the field. The work has been funded by foundations and partly by the state environmental administration.

The OKKA Foundation for Teaching, Education and Personal Development maintains the national Sustainable Development Certification of Educational Establishments. The certification system was established in 2004, and it is applicable to comprehensive and upper secondary schools, vocational institutions, liberal adult education, basic education in the arts, NGOs, and children's cultural centres. The certification system is based on the indicators for a sustainable future, which enable an educational organisation to evaluate how its teaching, operating culture, and management support future-oriented change agency. The indicators and supporting materials can be used to develop an organisation's activities and a sustainable development programme without a certification target. By April 2026, the OKKA Foundation had awarded the sustainability certificate to a total of 146 organisations.

Eco-Schools, the world's largest sustainable schools programme, has been run in Finland under the Vihreä lippu (Green Flag) name for more than 20 years. Currently, more than 350 schools and kindergartens are registered in the programme in Finland. Eco-Schools empowers children to drive change and improve their environmental awareness through the simple Seven-Step framework to achieve the international Eco-Schools Green Flag award. Eco-Schools develops pupils' skills, raises environmental awareness, improves the school environment, and creates financial savings. The Foundation for Environmental Education Finland coordinates the programme in Finland and supports the participants with nine thematic materials. Climate change was included in the themes in 2019.

Many projects, networks, campaigns, or competitions in and between schools support the teaching of sustainable development and climate change; they give pupils an opportunity to use their knowledge and provide teachers with opportunities for in-service training. Environment Online – ENO, RCE Espoo (Regional Centre of Expertise on Education for Sustainable Development) and Finland's Science Education Centre LUMA are examples of such projects. More information and examples can be found at the end of this chapter. Many different public service organisations have funded NGOs to visit schools as climate ambassadors, and to discuss climate change and ways to curb it. This programme has been actively pursued in the present decade, with good results.

The transdisciplinary URGENT project (2019 to 2023), funded by the Research Council of Finland and coordinated by the Finnish Environment Institute, studied how to bring urban and regional planning together with formal education. The 'Urban and regional planning with the young generation – collective and intergenerational learning encouraging sustainability transformations' project explored how education for sustainable development can create innovative and scalable transformative pathways to more sustainable societies. The project established dialogue between schools and planning institutions, and it empowered the learning of students, teachers, planners, and researchers. The project co-developed sustainable education and planning, analysing the impact of these new practices in eliciting the progress towards sustainability and sustainability transformation in society at large.

The Just Food Programme coordinated by the Finnish Environment Institute has developed sustainable school meals with municipalities and schools, involving school students in the planning of climate-friendly meals. The programme established a school meal plan with a six-week rotation, which halves the climate impact of school meals compared with regular meal plans. Pupils are seen as the climate-friendly food consumers of the future, and their opinions need to be carefully considered. Sustainable culinarians of the future can be guided towards better options with small changes – for example, serving vegetarian options in the same manner as meals containing meat.

The University of Helsinki has hosted the international **Teachers Climate Change Forum**[6] since 2017 in collaboration with LUMA and INAR (the University of Helsinki Institute for Atmospheric and Earth System Research). The Forum provides continuous education and a platform for peer learning for teachers of all disciplines, from primary to upper secondary school. Since 2025, the Teachers Climate Change Forum has been organised in collaboration with the Climate Change Teachers' Academy CLIMADEMY. **CLIMADEMY**[7] was established with Erasmus+ funding in 2022 in a collaboration between the University of

[6] https://www.helsinki.fi/en/science-education-and-academic-outreach/teachers/teachers-climate-change-forum

[7] https://climademy.eu/

Helsinki (Finland), the University of Crete (Greece), the University of Bologna (Italy), and the University of Bremen (Germany). CLIMADEMY has collected curated climate change teaching materials in the online platform. Materials include videos, reading materials, pedagogical guidelines for climate change teaching, and instructions for activities in schools in five languages.

The University of Helsinki Institute for Atmospheric and Earth System Research INAR has been active in science education. For example, 800 school students visit Hyytiälä Forest Station every year to learn about forests and climate change. Since 2022, the Värriö Subarctic Research Station has invited all upper secondary school students in Eastern Lapland to visit the station to learn about subarctic climate change and climate change research.

Finland's Science Education Centre LUMA is a network of 11 Finnish universities. Their goal is to inspire and encourage children and young people to study and engage with STEM subjects (science, technology, engineering, and mathematics) through science education. They do this by organising study visits to universities, developing experimental work instructions for schools, and offering science clubs and camps. They also support the lifelong learning of teachers, from early childhood education to higher education, across Finland, and strengthen the research-based development of teaching practices.

LUMA Centre Finland serves as the umbrella organisation for the regional LUMA centres at all Finnish universities of science and technology. Some of the centres are also based in universities of applied sciences. Åbo Akademi is responsible for coordinating the national Swedish-language activities of LUMA Centre Finland. In total, there are 13 regional LUMA centres across the country.

LUMA Centre Finland has been granted a national task by the Ministry of Education and Culture for the period from 2025 to 2028. This nationwide mandate aims to ensure a strong future for STEM competence and teacher education, while enhancing Finland's competitiveness. The funding for the national task is distributed among all 13 LUMA centres. The task is evaluated based on the centres' annual goals, as well as through self-assessments and peer reviews.

The Finnish National Agency for Education coordinated the Climate Change and Sustainability Education Development project (2021 to 2023). The aim was to provide the organisers of early childhood, basic, and secondary education with more focused and integrated support for their environmental sustainability work. The project was founded on the basics of the early childhood education plan and basic and secondary degree education curricula and qualifications. The project supported the change in the operating culture of primary and secondary schools towards a more ecologically sustainable lifestyle, and strengthened knowledge about climate change mitigation.

Seventy-two schools, educational institutions, and education providers from across Finland participated in the project. As key outcomes, the project produced various practical tools and models to support sustainability education, including environmental handbooks, competence goals for a sustainable future, and related pedagogical solutions for different grade levels. In addition, a nationwide Sustainability Atlas for Finnish Upper Secondary Schools was developed to support long-term planning and implementation.

After the project period, the Finnish National Agency for Education organised webinars in which project participants presented their effective practices and models. All the materials and outcomes produced during the project are openly accessible through the national open educational resources library. See: https://aoe.fi/#/materiaali/4273/2024-11-27T10:39:41.244Z

7.2.3 Climate change in higher education and climate change training

All universities in Finland provide climate change education as part of different degree programmes, including environmental studies, environmental technology, chemistry, chemical technology, and energy technology. Some universities also offer postgraduate studies in climate change. Teaching related to climate change is closely tied to the research in this field.

UASs offer higher education related to climate change in their degree requirements and master's degree programmes, including in environmental engineering, energy engineering, and sustainable development.

Examples on activities to include climate change in higher education and in training

Climate University

The Climate University is a network of 29 higher education institutions in Finland that develops and fosters climate and sustainability education in higher education. The network has published 14 open online courses on climate change, sustainability, biodiversity, the circular economy, sustainability leadership, systems thinking, climate communication, statistical tools, planetary health, and climate solutions. The teacher network provides peer support to lecturers teaching these topics. More than 20,000 students have completed Climate University courses in recent years. The Climate University is coordinated by the University of Helsinki.
https://climateuniversity.fi/

Climate.now

One of the Climate University courses is Climate.now, a multidisciplinary study and teaching module on the basics of climate change. It contains written material, video lectures and interviews, assignments, tests, and a guide for teachers that will help anyone familiarise themselves with the basics of climate change. The study module can be completed independently or as part of higher education studies. The scope of the whole module is five credits. In addition to teachers and students, the material can be used by companies, other organisations, and the media. Climate.now is part of the Climate University courses and is currently in the curricula of 12 higher education institutions in Finland. The University of Helsinki has also published a Massive Open Online Course (MOOC) based on the material.
https://courses.mooc.fi/org/uh-inar/courses/climatenow-2025

Specialisation Programme in Climate Expertise

In 2024, the University of Helsinki established a Specialisation Programme in Climate Expertise, a national programme signed by all universities in Finland giving education in science. The Specialisation Programme in Climate Expertise is a two-year continuous education programme for professionals who already have a higher education degree, and who are working with climate topics or are willing to work with them in the future. The total scope of the education is 60 The European Credit Transfer and Accumulation System credits.. The specialisation programme is run in collaboration with the Finnish Meteorological Institute, the University of Eastern Finland, the Climate University network, and the Climate Leadership Coalition. The first 40 students will graduate in the spring of 2026, and the second cohort of 27 students started in January 2026. Education is provided in Finnish.
https://www.helsinki.fi/en/faculty-science/teaching-and-studying/continuous-learning-and-web-based-studies/specialisation-programme-climate-expertise

ClimComp (Research Council of Finland)

Learning the competences of effective climate change mitigation and adaptation in the education system (ClimComp) was a research project funded by the Research Council of Finland between 2021 and 2024. This study investigated the competences society requires to efficiently mitigate and adapt to climate change, and how these competences are learned and taught throughout the education system. This was done in collaboration with climate and education scientists from the University of Helsinki and the Finnish Meteorological Institute. The researchers identified the competences professionals needed in their climate change work, how young people perceived climate change competences, the kind of educational activities that encourage upper secondary students engage in climate change learning, and

how open climate data can be better utilised in climate change education. The project published a policy brief that highlighted the need for climate education development at all levels of society. Its recommendations were presented in a national seminar, as well as at the Conference of Parties to the UNFCCC (COP29).

ClimComp policy recommendations:

1. Young people need to learn to live with the changing climate. They need climate change competences that consist of a set of knowledges, skills, values, and attitudes.
2. Subject-specific education system poses challenges to multidisciplinary climate change education. Teachers in all fields should be supported in climate change education.
3. In higher education, collaboration between various actors and stakeholders is required to increase climate expertise in all sectors of society. Online learning provides opportunities for scalable education.
4. Open climate data are required, and they should be promoted and used more efficiently in decision making. We need more user-friendly interfaces for database connections and data visualisation services. Education in open data usage in decision making should be provided.

https://blogs.helsinki.fi/climatecompetencies/

Atmosphere and Climate Competence Center (ACCC)

The Atmosphere and Climate Competence Center (ACCC) is a Finnish research Flagship constituted by the University of Helsinki, Tampere University, the University of Eastern Finland, and the Finnish Meteorological Institute, funded by the Research Council of Finland. The ACCC aims to increase the overall impact of climate research in Finland. For example, it organises an annual Impact Week, gathering stakeholders and decision makers to meet with researchers and learn more about recent advances in science.
https://www.acccflagship.fi/

Pirkanmaa Climate Action Lab

The Tampere Regional Council funded Pirkanmaa Climate Action Lab between 2023 and 2026 to enhance science collaboration and climate action co-creation in the Pirkanmaa region. The Lab is based at the University of Helsinki's Hyytiälä Forest Station, where multidisciplinary atmosphere-biosphere research is conducted. The Lab has succeeded in bringing together regional climate actors and enhancing new collaboration.
https://www.acccflagship.fi/ilmastotoimintakeskus/pik-in-english/

INAR International education activities

The University of Helsinki Institute for Atmospheric and Earth System Research (INAR) cooperates in higher education internationally. The University of Helsinki started joint education in atmospheric sciences with Nanjing University in 2023, and 184 students started in the joint bachelor's, master's, and doctoral programmes in 2025. INAR has been an active partner in the Environmental Changes in Higher Latitudes joint Nordic Master programme since 2020 and the Una Europa Joint Bachelor's in Sustainability, started in 2025.

INAR participates in and coordinates several European Union projects and nationally funded projects to educate experts, teachers, and university students about climate competences. INAR has been especially active in ERASMUS projects with several Eastern European countries. However, due to the situation in Ukraine, all education collaboration with Russian and Belarus is currently on hold. Another active field of international education collaboration is carried out with universities in China, Cyprus, Iceland, and Sweden.

The universities of applied sciences' programme for sustainable development and responsibility was introduced in 2020. The sustainability and responsibility work of universities of applied sciences is guided by the United Nations (UN) Agenda 2030 sustainable development programme, as well as the Ministry of Education and Culture's guidelines for sustainable development. Agenda 2030 recognises the importance of education and RDI activities in achieving the necessary changes. The Rectors' Conference of Finnish Universities of Applied Sciences, Arene, has published the self-assessment 2025 report on the implementation of the Sustainable Development and Responsibility Programme of Universities of Applied Sciences. It evaluates the progress of the UAS sector in sustainable development and responsibility from the perspective of the universities of applied sciences' joint sustainable development and responsibility programme. All 24 universities of applied sciences participated in the survey, the results of which illustrate the progress of sustainability work.

Climate University for Virtual Exchanges (CLUVEX): Erasmus+ Virtual Exchange programme for 2023 to 2026, where more than 1,000 students have studied online climate change topics and tools and interacted internationally. The partners come from Ukraine, Armenia, Denmark, and Finland. https://www.atm.helsinki.fi/cluvex/

Una Europa Virtual Exchanges for Sustainability (UnaVEx): Erasmus+ funded programme for 2024 to 2027, connecting students from Africa and Europe in working on sustainability topics together. Five online exchanges for five days each have been organised between 2025 and 2026. https://www.atm.helsinki.fi/unavex/

Una Europa Micro-credential in Sustainability: Una Europa European Universities Alliance provides a micro-credential for all learners on the basics of climate change, sustainability, biodiversity, and other topics. Micro-credential consists of six individual MOOCs (Massive Open Online Courses), three of them based on Climate University materials. The total scope of the micro-credential is ten ECTS. Una Europa Micro-credential in Sustainability is led by the University of Helsinki.
https://www.una-europa.eu/study/microcredential-sustainability

Eastern Mediterranean Middle East Climate and Atmosphere Research Centre (EMME-CARE): The University of Helsinki is collaborating with the Cyprus Institute to build the Eastern Mediterranean Middle East Climate and Atmosphere Research Centre (EMME-CARE). The project has funding from the EU for 2018 to 2026. The collaboration includes higher education development, in addition to research collaboration and science outreach.
https://emme-care.cyi.ac.cy/

Multilevel Local, Nation-, and Regionwide Education and Training in Climate Services, Climate Change Adaptation and Mitigation (ClimEd): Erasmus+ Programme for Capacity Building in the Field of Higher Education Action.
https://climed.network/

Modernisation of Doctoral Education in Science and Improvement Teaching Methodologies (MODEST): Erasmus+ Capacity Building in the Field of Higher Education Programme. https://www.emodest.eu/

REOPEN: EU Interreg funded project to educate 300 young people from Latvia, Estonia, and Finland in labour market skills, including green skills (2025–2028).
https://centralbaltic.eu/project/reopen/

Universities, UASs, and several training institutes provide continuing education programmes and vocational training in climate change and related issues, including sustainable development, energy efficiency, and environmental technology, for individuals and companies to mitigate and adapt to climate change, and how these competences are learned and taught throughout the education system is studied in collaboration with climate and education scientists from the University of Helsinki and the Finnish Meteorological Institute.

7.3 International training activities

Finnish higher education and research institutions play an active role in international education and research cooperation, working with partner institutions and public authorities worldwide to support capacity building, sustainable development, and the global knowledge base. International

engagement is now a core part of institutional strategies and is closely linked to Finland's talent, research, innovation, and development cooperation objectives.

The Policies to Promote Internationalisation in Finnish Higher Education and Research (2017–2025) have been largely implemented, and responsibility has shifted to institutional steering, performance-based funding, and strategic partnerships. Internationalisation is increasingly driven by long-term collaboration, research excellence, and global impact rather than standalone policy instruments.

The Team Finland Knowledge network is an established mechanism supporting international cooperation in higher education and research. Its specialists, based in key partner regions, facilitate mobility, joint education, and research initiatives, providing policy intelligence to Finnish institutions. Ongoing cooperation is prioritised with strategically important regions, including Africa, Asia, Latin America, and North America.

Finland's higher education system remains open to international participation. The share of international students has increased since the late 2010s. By the mid-2020s, international students represent roughly eight to nine per cent of all higher education students, with particularly strong growth in universities of applied sciences and in English-language university programmes.

Universities are expected to utilise their research and education capacity to address global challenges such as climate change, biodiversity loss, and sustainable resource use, while strengthening expertise and institutional capacity in partner countries. These objectives are advanced through international degree programmes, doctoral education, and participation in global and regional research networks.

The training of experts from developing countries in managing forests and other natural resources is an integral part of the agricultural and forest science programmes at the University of Helsinki. An example is the Viikki Tropical Resources Institute (VITRI), which is part of the Faculty of Agriculture and Forestry; the institute has maintained a strong focus on rehabilitating degraded natural and human-made production systems, including agroforestry systems, and on the various products and services provided by these systems across the different ecological zones in Asia, Africa, and Latin America. More than half the doctoral students come from developing countries such as Sudan, Thailand, and China.

The Sustainable Global Technologies (SGT) programme is a multidisciplinary educational programme at the Aalto University School of Engineering. The SGT programme aims to increase awareness, education, and research in the fields of sustainability, development, and technology. It offers a special module in

Sustainable Global Technologies at Aalto University. The SGT programme is an example of a UN Habitat Partner University Initiative.

Aalto University is also collaborating with the United Nations Environment Programme (UNEP). Aalto University is also one of the partnering universities in the Enviroeconomical Pathways for Sustainable Energy Services (SELECT) master's degree programme. SELECT is part of the Erasmus Mundus Programme, an EU-funded cooperation and mobility programme that aims to enhance the quality of European higher education and to promote dialogue and understanding between people and cultures through cooperation between universities in different countries. SELECT will also be extended to include a doctoral programme.

Cooperation with developing countries in higher education and research as well as in capacity building implemented through development cooperation financed by the Ministry for Foreign Affairs (see also Chapters 5 and 6). The main financing instruments are the Institutional Cooperation Instrument (ICI), the Higher Education Institutions Institutional Cooperation Instrument (HEI-ICI) (2020–2024), the Higher Education Partnership Programme (HEP) (2024–2026), and the Academy Programme for Development Research (DEVELOP).

The Higher Education Institutions Institutional Cooperation Instrument (HEI ICI) was used to support cooperation projects between higher education institutions (HEIs) in Finland and developing countries, with the aim of strengthening their subject-specific, methodological, educational and administrative capacities. The last HEI-ICI projects were implemented during the period 2020–2024. Since 2024, a similar instrument, the Higher Education Partnership (HEP), has replaced the HEI ICI, with the first HEP projects covering the period 2024–2026.

The Higher Education Partnership (HEP) Programme supports cooperation projects between higher education institutions in Finland and partner institutions in developing countries, with the aim of strengthening higher education systems and institutional capacities. The programme is focusing on three thematic priorities: teacher education; climate change and the circular economy; and food security. Examples of funded projects include initiatives to develop food security training in Nepal and to promote the use of biogas as an energy source in Zambia.

The Finnish Meteorological Institute (FMI) has coordinated several development cooperation projects funded by various development funding institutes such as the Ministry for Foreign Affairs of Finland (MFA), the World Bank, the Asian Development Bank, the World Meteorological Organization (WMO), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the European Union. Many of these projects are funded through the Institutional Cooperation Instrument (ICI) of the MFA, which enables close cooperation with partner institutions focusing

on human capacity building. The projects the FMI coordinates always include a strong training component, and the subjects of the training typically include adaptation to climate change. For example, capacity building has covered adapting to the changes in the intensity and frequency of extreme weather events that require the extensive development of early warning services. In addition to the partner institutes, the sectors that benefit from the training include traffic, agriculture, health, and energy production. The FMI also trains researchers from other countries, either on site in their own countries (for example, in Africa and Central Asia) or in Finland. More information about climate-change-related capacity building projects being carried out in developing countries is presented in Section 6.4.

The Finnish National Agency for Education (EDUFI) is also implementing several development cooperation projects, funded mainly by the European Commission as part of the Global Gateway Strategy and the Ministry for Foreign Affairs of Finland. The projects support systemic reforms in the education sector in developing contexts in several African countries and in Ukraine and Uzbekistan. One of the aims of the projects is to effectively transfer good practices in and tools for inclusive and green education policies and their implementation. This includes strengthening the capacities of teachers and education managers and training them in climate resilience. With three other EU member states, EDUFI is implementing a project on opportunity-driven vocational education and training (OP-VET) in Sub-Saharan Africa, supporting green and just transformation in line with the Paris Agreement on climate change and the Africa–Europe Green Energy Initiative. Climate and energy are focus sectors of the Global Gateway strategy of the European Commission, and the OP-VET project promotes the orientation of vocational education and training driven by tangible employment opportunities in the climate and energy sectors, including the training of teachers and the development of thematic collaboration projects. Between 2022 and 2024, EDUFI provided the European Commission[8] a Seconded National Expert who advanced the understanding within the EU of the role of education in the green transition and climate change adaptation and mitigation.

The University of Eastern Finland–UNEP Course on Multilateral Environmental Agreements (MEAs[9] is a high-profile two-week course on MEAs, international environmental lawmaking, and diplomacy. It is organised annually in cooperation between the University of Eastern Finland and UNEP, with a changing course venue and theme each year.

The aim of the course is to equip the present and future negotiators of multilateral environmental agreements with the information and experiences

[8] Department of the European Commission: Directorate-General for International Partnerships (DG INTPA, G.3)

[9] https://sites.uef.fi/cceel/uef-unep/

of others in the area of international environmental lawmaking to improve the impact and implementation of these key treaties.

The course is intended for experienced Government officials engaged in international environmental negotiations. Other stakeholders such as representatives of NGOs and the private sector, and researchers and academics in the field of international environmental law are also eligible. Since 2004, the course has had a total of 399 participants from 121 different countries.

Finland actively participates in the EU's Erasmus+ and European Solidarity Corps programmes (ESC). The programmes include early childhood education and school education, vocational education, higher education, adult education, and the sports and youth sectors. The programmes provide learners, staff, and organisations with opportunities to develop skills and exchange good practices in an international environment. The programmes fund the mobility of learners and staff, as well as cooperation projects. Funding is also provided for international Training and Cooperation Activities seminars, which aim to support the programme's thematic priorities, strengthen the competences of individual participants and their organisations, and facilitate networking.

Erasmus+ projects for staff and learners' mobilities from Finland to Europe included the mobility of 26,000 individuals from 1,300 Finnish organisations. In total, 86 Erasmus+ cooperation projects were engaging 248 Finnish organisations, including their staff and learners.

One of the ESC programmes' four priorities for 2021 to 2027 is the Environment and fight against climate change. The aim of the programmes is to increase participants' awareness of the priority, strengthen green competence, and encourage actors to take more sustainable actions, both during the project and after its completion. The aim is for environmental responsibility to be included in all projects, including those whose thematic focus is not environmental responsibility.

In 2024, 17 per cent of funded cooperation projects had their core objectives in the priority of the Environment and fight against climate change. A total of 57 projects were funded in European Solidarity Corps Programme for volunteering and solidarity projects, of which 19 were under the priority of the Environment and fight against climate change.

Finnish education actors have been involved in Erasmus+ projects, which have, among other things, strengthened the sustainability education practices of school education curricula, improved universities' environmentally responsible practices, strengthened teachers' and learners' environmental competences in vocational schools, and exchanged good practices between Nordic folk high

schools. Within the youth sector, restoration camps have been introduced as a new approach to youth work.

In addition to Erasmus+ projects funded through the Finnish National Agency for Education, Finnish VET and higher education actors have participated in centrally managed Erasmus+ projects funded directly by the European Commission. The projects aim to develop future-oriented curricula through transnational cooperation. These initiatives strengthen the skills required for the green transition and create ecosystems that connect education providers with industry partners in areas such as sustainable energy, hydrogen technologies, battery industries, energy-efficient construction, and circular economy practices.

Finland also actively participates in the Nordplus programme an educational grant programme from the Nordic Council of Ministers. The programme finances the mobility of learners and teachers at different levels of education and cooperation projects. Approximately 10,000 experts, teachers, and learners participate in the programmes' projects each year. The Nordic region's vision is to become the world's most sustainable and integrated region by 2030.

7.4 Public awareness

During the reporting period, public debate and engagement on climate issues in Finland evolved in parallel with broader societal developments. Climate and energy policy became increasingly intertwined with questions of security and resilience, especially as Finland accelerated efforts to phase out fossil fuel imports from Russia. Finland's electricity generation is now almost entirely emission-free, and the business community has taken a more active role in advocating ambitious climate regulation and long-term targets, recognising the green transition as a competitive advantage.

Climate Barometer

According to the Finnish Climate Barometer surveys, public awareness and concern remained high. After a slight dip in 2023 compared with 2019, levels strengthened again in 2025. In the 2025 Barometer, large majorities agreed that climate change impacts were already visible globally (86 per cent), that climate change was one of the greatest global threats (81 per cent), that mitigation was urgent (77 per cent), and that investing in mitigation could improve Finland's competitiveness through skills and new technologies (81 per cent). Three quarters of respondents viewed climate-compatible solutions such as low-emission industry as an essential foundation for a sustainable national economy (75 per cent). Agreement increased across comparable statements from 2023 to 2025; for example, the share agreeing that climate-compatible

solutions improved people's wellbeing rose from 68 to 75 per cent, and agreement with the urgency of mitigation from 72 to 77 per cent.

Self-reported exposure to climate-related phenomena in everyday life was widespread in 2025: 87 per cent had experienced at least one listed change, most commonly, milder winters (62 per cent), increased slipperiness in winter (54 per cent), a shorter snowy season (51 per cent), and more frequent heat and dry periods (43 per cent). Among those reporting such experiences, 62 per cent indicated some form of harm, most often worry about the future (37 per cent) and day-to-day inconvenience (35 per cent). Information preferences remained stable: respondents most wanted information from researchers, followed by state and municipal authorities, and news media and journalists; preferences for friends, close acquaintances, or social media influencers remained low. A comparison of the Climate Barometers from 2015 to 2025 shows persistently high overall concern across population groups, with systematic differences by gender, party affiliation, and residential context; after a dip in 2023, concern and perceived urgency returned to the previously higher levels in 2025.

Youth attitudes

The annually published Youth Barometer indicates that young people (15–29 years) report more uncertainty and insecurity than previously, and confidence in the future has declined. Nine out of ten consider human influence on global warming a fact. Just over half believe that sustainable global solutions will be found to environmental problems, while one in six disagree; notably, the share who do not believe in sustainable solutions has doubled in five years. Fifty-five per cent report concern about climate change and/or biodiversity loss, and a third report feelings of guilt for not doing enough for the environment.

Box 7.1
Media debate and information environment

Recent research[10] on Finnish media coverage provides a context for understanding the development of public awareness. A longitudinal analysis of climate-related reporting in major Finnish news outlets (1990–2023) shows that climate change has become a more visible and mainstream topic across different areas of journalism. Although the overall volume of reporting has increased, the framing has remained largely technocratic and solution-oriented, emphasising mitigation technologies, energy transitions, and individual behavioural choices. At the same time, media representations have tended to keep climate change separate from broader economic structures, focusing on practical impacts and policy processes rather than systemic or structural questions.

A detailed examination of long-term media patterns further shows that peaks in climate-related coverage have been driven primarily by major international

[10] Doctoral thesis University of Helsinki Decoupled Temporal Tensions : Evolving Articulations of Climate Change and Economic Growth in Finnish Media, Erkki Mervaala 23.01.2026

climate negotiations, the publication of influential scientific assessments such as IPCC reports, and notable weather or environmental events. Domestic policy cycles have also generated visible increases in attention, particularly during periods of legislative reform or public debate on climate-related issues. Within this broader landscape, forests and forest management have constituted a recurring topic, reflecting their central role in Finnish climate discussions and their connection with national climate policy.

An example of public awareness and information regarding climate policy actions is Finland's Ninth National Communication under the United Nations Framework Convention on Climate Change, which was released for open public opinion in 2026. A similar procedure was conducted with the previous national communication.

7.4.1 Climate change communication

New climate-related themes gained prominence in comparison with the previous reporting cycle. Climate litigation, the increasing activity of the corporate sector, and public debate on the financing of climate action all became more visible. Finnish research funding foundations also shifted their focus to sustainability-related research and emerged as influential communicators in the public sphere.

The corporate sector has become a notable advocate for ambitious climate-related regulation and long-term policy targets. Many companies view the green transition as a competitive asset, which has contributed to new business models that aim to reduce environmental impacts (such as OnePlanet) and strengthen climate- and nature-related legal advocacy (e.g. Maailma Legal).

This increasing role of companies has resulted in stronger Finnish business participation in the COP climate conferences. Finland's first national pavilion was introduced in Dubai, since when its significance has continued to grow. Cooperation between Finland's official negotiators and pavilion actors will be further strengthened at future COPs.

Climate Change Communication Coordination Group

Communications on climate change are handled by many organisations, making coordination essential. The Ministry of the Environment has held the formal coordination role since 2010. It established the coordination group for climate communication for 2025 to 2028 to coordinate state administration climate communication. The aim is to strengthen joint climate communication across government, while preserving each organisation's responsibilities. Reliable information about mitigation and adaptation, solution-oriented messages, and transparent reporting of actions and effectiveness are

emphasised. Joint tools include web communications, training and seminars, campaigns, and other targeted projects.

The coordination group is composed of all relevant ministries (the Ministry of the Environment, the Ministry of Economic Affairs and Employment, the Ministry of Transport and Communications, the Ministry of Agriculture and Forestry), research organisations (Finnish Environment Institute Syke, Natural Resources Institute Finland Luke, the Finnish Meteorological Institute, the Finnish Institute for Health and Welfare THL, VTT Technical Research Centre of Finland Ltd), regional organisations (the Centre for Economic Development, the Association of Finnish Cities and Municipalities), Metsähallitus, Motiva, Finnish Innovation Fund Sitra, the Research Council of Finland, the Energy Authority, Business Finland, and the Finnish Climate Change Panel.

In 2025, communications also highlighted climate–biodiversity linkages; the Climate and Nature Barometers were implemented and communicated jointly. Climate mis- and disinformation were addressed through training provided to members of the coordination group.

Finnish Climate Act

The current Finnish Climate Act entered into force in 2022. Beyond steering emissions reductions and strengthening carbon sinks, the Act and its planning, assessments, and the annual Climate Report maintain the prominence of climate policy in public discussion.

The annual Climate Report is prepared under the leadership of the Ministry of the Environment; its primary audience is Members of Parliament. In 2021, communication about the report was developed with an accessible visual summary featuring inputs from the Minister, researchers, and civil society representatives. Annually, the report attracts attention in the media and among stakeholders.

National climate plans under the Act's planning system have been prepared in cooperation with citizens and stakeholders, with each responsible ministry leading the communications on publication. Participants in the citizens' jury coordinated by the University of Turku produced a statement on Finland's energy system with recommendations for policy measures guiding household energy consumption. The outputs of the citizens' jury were used in ongoing policy preparation in 2025, including the drafting of the Energy and Climate Strategy and the Medium-term Climate Plan. In preparing the Medium-term Climate Plan, a nationwide KEITO public survey, youth consultations, consultations with the Sámi Parliament, and numerous stakeholder meetings were also organised. Feedback collected through these participatory processes indicated that measures based on voluntariness and incentives received the strongest support.

A Saami Climate Council – an independent science panel bringing both Saami traditional knowledge and scientific knowledge into climate-policy preparation – was also included in the new Climate Act. The Government appointed the first Council in 2023. The Council has organised events, engaged stakeholders, and actively communicated climate impacts on Saami culture, which is particularly vulnerable to climate change.

From 2025 to 2026, the Ministry of the Environment conducted an evaluation of the objectives of the Climate Act. The assessment examined both the objectives and means for achieving them, focusing on their impacts, cost-effectiveness, and acceptability. Finland's objectives were found to be aligned with international agreements and European Union obligations. Stakeholder and citizen workshops further indicated broad acceptance of the Act's goals and the measures proposed to achieve them.

Finland's carbon neutrality target for 2035, set under the Climate Act, has gained considerable international visibility and strengthened Finland's country brand. Finland's climate leadership has become a clear distinguishing factor internationally, and the business sector has been able to build on this groundwork to advance its own activities. The Ministry for Foreign Affairs has organised visits to Finland for international journalists, during which Finland's climate policies and the carbon neutrality target have been presented and discussed.



Participants at the public hearing on the annual Climate Report at the Parliament of Finland in 2024. © Laura Kotila / Ministry of the Environment

Research and science communication

The Finnish Climate Change Panel was appointed by the Finnish Ministry of the Environment for the first time at the end of 2011. The role and tasks of the Panel were defined for the first time in the 2015 Climate Act, and the reformed Climate Act entered into force in 2022. According to the Act, the Government appoints an independent scientific expert body – the Finnish Climate Change Panel – to support climate policymaking. The Panel is an interdisciplinary body of researchers and academicians that promotes dialogue between science and policy on issues related to climate change. The Panel compiles research data and issues recommendations to support decision making (see Section 3.2.2 for the role of the panel in policymaking). The Finnish Climate Change Panel has actively participated in public debate by releasing statements, organising discussions, and interacting with the media, decision makers, and other stakeholders. The Finnish Climate Change Panel strengthened its communication capacity with dedicated resources and now communicates independently, whereas coordination previously took place mainly via the Ministry of the Environment. This has improved the accessibility and timeliness of research-based messages in public debate and policymaking, including concise syntheses, tools for consumers and decision makers, and media briefings.

In 2022, following methodological updates, researchers at Natural Resources Institute Finland reported that the land-use sector had become a net source from a net sink a few years earlier, driven in particular by a change in the forest sink. This development negatively affected Finland's outlook for achieving national targets and EU obligations, triggering public debate about forest carbon sinks and possible responses.

The national IPCC working group coordinates and presents Finnish standpoints in the IPCC reports. It aims to raise awareness of the IPCC's work in Finland and the Finnish contribution to it. The communications department of the Finnish Meteorological Institute (FMI) is responsible for communications about the IPCC's activities and assessment results in close cooperation with the communications department of the Ministry of the Environment. The most important channels are press releases, and conferences and seminars for decision makers. These are organised in cooperation with the Finnish scientific community.

The various organisations in the Climate Change Communication Coordination Group have organised national events in connection with the publication of IPCC reports. These events have been open to all and streamed to enable remote participation across a wider geographical area in Finland. The group has communicated the content of IPCC reports through various channels, including press releases, blogs, infographics, and social media. During the latest reporting period, communication activities have covered the Sixth Assessment Report, including its Working Group reports and the Synthesis Report. The reports have been widely noted in both traditional media and on

social media. Infographics produced from IPCC reports can be freely used by anyone and have supported the wider dissemination and uptake of the reports' key messages. The events have also contributed to linking the reports' findings to national and international climate policy.

Many of the Government organisations provide training for various stakeholders, both independently and through Climate Change Communication Coordination Group. For example, the Finnish Meteorological Institute has organised annual training in climate change for journalists since 2006. In 2020 and 2021, the training was organised virtually, enabling wider participation of journalists from across Finland. In total, around 500 journalists have participated in the training. In recent years, engagement with journalists has continued through targeted briefings such as short information sessions on climate research and background briefings on topical climate-related issues. These activities have supported journalists covering a wide range of topics, including the environment, politics, economics, and technology.



Panellists on stage at the national IPCC launch event for the 6th Assessment Report in 2022.
© Laura Kotila / Ministry of the Environment

Children and young people

The voice and participation of young people have strengthened in Finland. The Youth Climate and Nature Group (NUOLI) was established in 2023 to support ministries in planning, implementing, and assessing youth participation in decision making.

Finland has signed the International Declaration on Children, Youth and Climate Action, committing to strengthening children's and young people's rights in the era of climate change, including the right to a healthy and safe environment, consideration of their rights in national climate action, and enhanced participation in climate decision making. The declaration is associated with YOUNGO and is under UNICEF's patronage.

In the autumn of 2025, a dialogue on climate and nature for children and young people was held and streamed online to highlight concerns and address questions with the Minister, two research professors and a NUOLI representative; it was organised jointly by the National Child Strategy, the Central Union for Child Welfare, UNICEF Finland, and the Ministry of the Environment.

New initiatives have been launched in Finland to promote the participation of children and young people. The National Programme to Promote Democracy and Participation (Democracy Programme), adopted in 2025, contains 15 policy goals, as well as key measures for promoting democracy and participation. In line with entries in the Government Programme, a particular objective of the Democracy Programme is to improve voter turnout and strengthen the participation of children and young people, and to develop good practices in education for democratic citizenship and human rights. Finland's first National Child Strategy was published in 2021, and the National Youth Work and Youth Policy programme was adopted in 2024. It includes an objective of improving young people's opportunities to participate in and influence social debate and decision making.





Children, researchers, and the Minister of the Environment and Climate took part in a large-scale climate and nature dialogue for children and young people in Helsinki in the autumn of 2025.
© Iina Ala-Kurikka / Ministry of the Environment

Further climate communication efforts

The Ministry of the Environment has convened quarterly "What's in the Air?" stakeholder events, bringing together an average of between 150 and 200 participants from companies, NGOs, other stakeholders, and the media to discuss current climate policy topics.

One result of the cooperation between various organisations is the national web portal on climate change, Climateguide.fi, which was launched in 2011. The portal's main language is Finnish, but much of the information is also available in Swedish and English. The website provides scientific background information about various aspects of climate change, as well as a tangible means for mitigation and adaptation. Climateguide.fi features web articles, checklists, observational and modelled data, mapping tools, interactive visualisations, videos, and learning assignments. The website raises awareness of climate change and its implications for Finland, supporting society and citizens in mitigating climate change and adapting to it. It also serves as a platform through which key Finnish research institutions and projects can disseminate their information in a user-friendly way. For example, the portal's new adaptation policy monitoring tool tracks how the implementation of the National Climate Change Adaptation Plan 2030 is advancing.

Climateguide.fi is especially targeted at the general public and decision makers and experts in various sectors, students and teachers, and the media. The Finnish Meteorological Institute, the Finnish Environment Institute, Natural Resources Institute Finland, and, since 2025, the National Climate Unit of the Economic Development Centres share responsibility for the content of the web portal, as well as for updating and further developing it.

The Finnish Innovation Fund Sitra led the EU Horizon-funded PSLifestyle project, which further developed and expanded the Lifestyle Test, a carbon footprint calculator originally developed by Sitra, to 10 European countries. The digital service was tailored for each country to provide culturally relevant guidance, accurate country-specific emissions calculations, and personalised practical recommendations that help users create positive and sustainable lifestyle plans, with benefits such as improved wellbeing, cost savings, and healthier everyday choices. The project also created an anonymised Lifestyle Data platform that gives policymakers, businesses, and researchers unique insights into citizens' lifestyle choices, barriers to change, and willingness to adopt more sustainable solutions, supporting both individual and systemic change. In Finland, the Lifestyle Test was completed 433,446 times between 2022 and 2026, and Finnish users created 43,477 personal sustainable lifestyle plans during the same period.

7.4.2 Raising awareness of energy efficiency

Communications on energy efficiency is mainly the responsibility of two ministries, the Ministry of Economic Affairs and Employment, and the Ministry of the Environment, and of other Government bodies, research institutes, and state-owned organisations – for example, Motiva. Motiva is a fully state-owned sustainable development company that encourages the efficient and sustainable use of energy and materials. Motiva provides information, solutions, and services to public administrations, businesses, municipalities, and consumers to enable them to make resource-efficient, effective, and sustainable choices. Motiva contributes to energy education through specific projects and campaigns in schools and enhances the energy competence development of professionals in various sectors through online training materials. Motiva also coordinates several communications and awareness-raising activities.

The Clean Energy System Transition (REPower-CEST)

Under the RePower-CEST project Finnish Environment Institute (Syke) has been preparing in co-operation with Geological Survey of Finland (GTK) and Technical Research Centre of Finland (VTT) a strategic roadmap for the clean energy transition for Finland. The project created a comprehensive view of the solutions, impacts, implementation challenges and opportunities of a clean energy system replacing fossil fuels. In May 2026, the project published a strategic roadmap for the clean energy transition in Finland. A large number of experts from different fields were involved in the work. The aim was to create a vision and a strategic overview of the feasibility of the clean energy transition, so that the requirements for climate, environmental sustainability, fairness and security are met. The roadmap is primarily aimed at decision makers in the national, regional and local governments as well as the EU.
Transition to a Sustainable Energy System Roadmap and Synthesis Report
http://hdl.handle.net/10138/635198

Energy Saving Week

Motiva has successfully run the National Energy Saving Week and the specific energy awareness week for primary schools since 1996. The theme week in October has become an established annual event during which companies, municipalities, schools, and other organisations and households concentrate on undertaking energy actions and promoting the sustainable use of energy voluntarily. The week offers a great opportunity to act on and to communicate about mitigating climate change, promote energy efficiency, and make sustainable choices.

Motiva provides Energy Saving Week participants with tools, tips, informative materials, and support for communications. Motiva communicates on the theme week and participants' actions through its communication channels, especially on social media. The campaign reaches hundreds of thousands of Finns every year. Energy SavingWeek is supported by the Finnish Energy Authority.

The rational use of energy and materials and understanding their meaning are an important civic skill that is good to teach children from an early age. Along with increased awareness and positive attitude changes, one of the main objectives of the Energy Saving Week for Schools is simply to encourage pupils to act on their knowledge. The theme week also aims to spread energy efficiency information and activities to homes. The Energy Agent Adventure is a competition for school children, where classes compete for two weeks to see who succeeds in doing the most tasks that save energy in school and at home. The top five classes win prizes. Local energy companies and municipalities support the schools by sponsoring the Hey, everything is working! material package and Children's Books for schools. Thousands of children learn about energy during the theme week every year.
https://www.energiansaastoviikko.fi

Down a Degree – public awareness campaign

Down a Degree was a campaign aimed at achieving significant electricity savings in response to disruptions in the energy market caused by the war in Ukraine. The campaign ran from September 2022 to June 2023. The Ministry of Economic Affairs and Employment of Finland held the main responsibility, with strong support from the Energy Authority. Motiva coordinated the campaign.

The short-term goal was to ensure sufficient energy supply for all and to encourage more than 95 per cent of Finnish households to save energy by reducing their consumption by five per cent during peak hours. The campaign involved 865 partners, including companies, organisations, and municipalities, and resulted in 1,637 reported measures. The campaign achieved very strong results: electricity consumption during peak hours decreased by eight per cent compared with 2021, and total energy savings reached 4 TWh during the winter of 2022 to 2023.

Advice and guidance to consumers on sustainable choices

The nationwide consumer energy advice service provides information about and ideas on how to save energy, the environment, and the climate at home. The target group of the advice is consumers, housing associations, municipalities, and small and medium-sized enterprises (SMEs). The core of the

activity is to provide high-quality and reliable information and tools to support their energy decisions. Regional energy advisers in all Finnish provinces provide unbiased and free information about how to increase energy efficiency and the use of renewable energy through the Energy Advice Phone Service, by email, and through online energy advice on Instagram and Facebook.

Motiva coordinates the consumer energy advice efforts by providing advisers with supportive services such as a website, Facebook and Instagram page, webinars, tools, marketing, and promotional and networking support. The network of regional advisers meets to exchange experiences and best practices and for training. The Finnish Energy Authority funds the activities.
https://www.motiva.fi/tietopankki/motivan-energianeuvonta/

Mobility management and European Mobility Week

The Finnish Transport and Communications Agency Traficom supports the development of smart mobility through annual state grants for mobility management, which are intended for municipalities, local authorities, and non-profit organisations. A variety of projects are eligible for grant applications that aim to influence people's travel choices and strengthen sustainable mobility habits, either through the provision of information or service experiments. Between 2021 and 2024, 118 projects were awarded grants.

Traficom also supports the European Mobility Week in Finland, which activates municipalities and other actors to spread information about sustainable mobility and involve citizens through various activities. Since 2010, Motiva has coordinated European Mobility Week in Finland on behalf of the Finnish Transport and Communications Agency Traficom
https://www.liikkujanviikko.fi

Home repair advice for the elderly over 65

The Finnish Association for the Welfare of Older People provides home repair advice for the elderly by helping veterans and older people assess and plan home renovation and apply for repair allowances, for example. A free phone service is available on weekdays.
https://vtkl.fi/en/liiton-toiminta/korjausneuvonta/

Photovoltaics for Homes and Energy Experts service

Photovoltaics for Homes (Aurinkosähköä kotiin) was an annual nationwide campaign running from March to September, which ended in 2025. The aim was to increase Finns' knowledge of photovoltaics and its suitability for houses and housing associations, and to provide information about procurement costs and service providers through an online comparison service. The campaign website provided reliable and unbiased information about photovoltaics and its

procurement. The national service has been operated by Motiva and supported by the Energy Authority since 2018.

From the beginning of 2026, the information was moved to Motiva's website, and consumers can have advice and guidance from energy advisory services. In addition, the Energy Experts service (Energiaosaajat) was established in 2026.

The Energy Experts is a service where users can find solutions and partners for energy projects such as solar panel and heat pump installations, as well as energy audits for housing associations. The Energy Expert service is intended for consumers, housing associations, municipalities, businesses, and other organisations. Users can explore companies operating in their area and send a contact request to get more detailed information. The service is maintained by Motiva and commissioned by the Energy Authority.
https://www.motiva.fi/en/solar-power/
https://www.motiva.fi/energiaosaajat/

Farewell to Oil Heating Campaign

The Farewell to Oil Heating Campaign was active from 2020 to 2025. The campaign aimed to support households in phasing out oil and natural gas heating by providing information, technical advice, and financial assistance. Financial incentives were used to accelerate the transition to low-carbon heating solutions.

The technical guidance and communication provided by Motiva supported consumers in making informed decisions and in utilising available financial support schemes. In addition, Motiva provided training to grant handlers at the Centres for Economic Development, Transport, and the Environment (ELY Centres) in the technical aspects related to heating system conversions.

Motiva developed website content and social media materials targeted at consumers and energy advisors, and offered advisory services to households planning to change their heating systems. The campaign was implemented with support from the Ministry of the Environment and the Pirkanmaa Centre for Economic Development, Transport, and the Environment (ELY Centre).

7.4.3 Local activities

Many municipalities in Finland have a climate strategy or are in the process of preparing one. These municipalities have incorporated climate change mitigation into their practices (see Section 4.2.5).

According to the Ministry of the Environment's estimate, by early 2025, 197 of the 292 municipalities in mainland Finland had set themselves a climate target. Approximately five million citizens, 90 per cent of Finland's residents, live in

municipalities that have set climate targets. More than 60 per cent of Finns live in municipalities that are aiming for carbon neutrality or an 80 per cent reduction in emissions by 2030.

Fifty-two per cent of municipalities in mainland Finland have made a concrete climate plan. According to the Ministry of the Environment's estimate, in early 2025, 143 municipalities in mainland Finland had their own climate plan, and nine municipalities were involved in a regional climate plan. In addition, 45 municipalities are now preparing or updating a climate plan.

Municipalities play a decisive role as mediators of information regarding attitudes towards climate issues and enabling changes in people's lifestyles. Many municipalities are committed to reducing their greenhouse gas emissions and encouraging citizens to contribute to combating climate change.

Carbon Neutral Municipalities Network

The Towards Carbon Neutral Municipalities (Hinku) Network brings together municipalities, businesses, citizens, and experts to create and carry out solutions to reduce greenhouse gas emissions. The municipalities involved are committed to reducing greenhouse gas emissions more extensively and rapidly than EU targets require. The network aims to create solutions that have economic and social benefits, as well as environmental advantages.

There are 99 Hinku municipalities and five Hinku regions in the network (as of March 2026). The Hinku municipalities are home to 2.4 million inhabitants, accounting for more than 40 per cent of the Finnish population. The municipalities in the network are committed to an 80 per cent reduction in greenhouse gas emissions from 2007 levels by 2030. The tools and data offered to the partners are based on research and aim to deliver scientific knowledge and expertise to practise and excel in creating a climate-smart Finland. The data include municipalities' and regions' usage-based and consumption-based emissions. The tools include carbon footprint calculators and the sharing of best practices. The results are encouraging: climate emissions in Hinku municipalities decreased between 2007 and 2022 by 40 per cent. The Hinku network is coordinated by the Finnish Environment Institute. https://hiilineutraalisuomi.syke.fi/en/hinku/

EU Mission for Climate-neutral and Smart cities – Finnish network

In 2022, the European Commission announced the 112 cities selected to participate in the EU Mission for 100 Climate-neutral and Smart Cities by 2030, also known as the Cities Mission. Six Finnish cities – Tampere, Turku, Lahti, Lappeenranta, Espoo, and Helsinki – were selected as European pioneers

aiming to achieve carbon neutrality as early as 2030. In 2024, the cities were awarded the prestigious EU Mission Label in recognition of their systematic work and the implementation of the Climate City Contract.

In Finland, this work has fostered a mutually supportive network in which Finnish mission cities, several Finnish follower cities, and state ministries collaborate closely. Within this network, participants share best practices and inspire one another in pursuing common climate goals.
https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en

Visibility for tangible emissions reduction actions

Between 2021 and 2025, the Finnish Environment Institute intensified its communication cooperation with municipalities, parishes, and non-governmental organisations. The aim was to gain visibility for tangible emissions reduction actions, encourage actors to reduce emissions, and create a network where different parties could learn from each other's experiences. Municipal emissions developments were reported twice a year. The Finnish Environment Institute was responsible for national communications to enable municipalities and counties to report on their own results and the reasons for emissions developments based on the material. The topic thus received a lot of publicity, both locally and nationally. The average number of media hits between 2020 and 2024 was about 285 per year.

There have also been targeted climate mitigation issues launched in the media – for example, cooperation with the Housing Fair in 2021 in the city of Lohja. The aim was to spread good climate solutions in housing implemented in the area to a wider audience and to construction sector professionals. The cooperation with the housing fair made it possible to reach very large audiences interested in building and housing issues.

The theme of climate work and its connection with the economy in municipalities were regarded as an important topic in Finland, especially before the municipal election in Finland in May 2021. A Twitter campaign was undertaken to raise awareness and discussion of the positive connection between the economy of municipalities and their climate action. Several municipalities, organisations, research institutes, companies, and NGOs participated in the campaign. Stakeholders were asked to join the campaign and tweet together on 24 May 2021 about their climate work that had positive economic effects. An analysis of the impacts showed that the campaign raised awareness of the "Economy and Climate" theme among target audience, but it did not spark a political confrontation.

The Finnish Environment Institute continued its advocacy on social media and created a concept with social media influencers between 2022 and 2023. The strategy for cooperation between the Finnish Environment Institute and social media influencers was created after an initial workshop. The strategy was tested. and proved successful: the great majority of influencers wanted to cooperate with a researcher in future.

The Finnish Environment Institute has supported national actors such as the Finnish Scout Movement and the Evangelical Lutheran Church to set their own climate targets and define the means to achieve them. In 2019, the Evangelical Lutheran Church of Finland published a climate strategy, "Carbon-neutral church 2030", to guide parishes' climate work. The Finnish Environment Institute helped the Church Board define the means to achieve the target, and the roadmap was published in 2024. The roadmap lists the three most important ways for parishes to reduce the environmental impacts of their operations: switching to fossil-free energy; giving up unnecessary properties; and making purchases for only essential needs. The National Church Council, the Finnish Environment Institute, and the Martha Association NGO have also implemented the Eco-Fasting campaign annually.

Canemure accelerated regional climate work

At the heart of the six-year (2018–2024) "Towards Carbon Neutral Municipalities and Regions" (Canemure) project was collaboration and networking, strong expertise, and tangible climate actions that yield emissions reductions. The project received funding from the EU LIFE IP programme. Ambitious goals cannot be achieved solely through legislation; in Finland, a country of long distances, regional climate work that arises from local needs and enhances wellbeing is essential. Throughout the project and across seven regions, there was extensive stakeholder collaboration, climate mitigation roadmaps were developed, new research and development projects were accelerated, and businesses and decision makers were provided with useful information. The Canemure project promoted smart and low-carbon mobility, increased decentralised renewable energy production, improved buildings' energy efficiency, and supported processes that create sustainable urban structures and conditions for low-carbon production and consumption. In agriculture and forestry, the project also advanced the transition to low-emission soil management practices, particularly on peatlands.

Canemure's expert network connected research organisations, regional cooperation groups, pioneering municipalities, and grassroots actors in the fight against climate change. Up-to-date information about greenhouse gas emissions, best practices, and the impacts of climate actions is available for municipalities, businesses, and citizens, including insights into public procurement, sustainable mobility, funding channels for climate work, and consumer opportunities to mitigate climate change.

During the running of the project, numerous news articles were published on Hiilineutraalisuomi.fi (Carbonneutralfinland.fi). In addition, blog posts and newsletters were produced, and the project received wide media coverage in both traditional and social media. Furthermore, the project organised webinars, which attracted wide audience. Altogether, 130 Sustainability Leap (sustainabilityleap.fi) cases were published as part of the project

Towards Carbon Neutral Municipalities and Regions – Main results of the LIFE IP Canemure-Finland (layman's report):
https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE17-IPC-FI-000002/towards-carbon-neutral-municipalities-and-regions-in-finland

Finnish Sustainable Communities Network

Another indication of the determination at the local level is the Fisu network – Finnish Sustainable Communities. Fisu municipalities form a group of pioneer communities committed to becoming carbon neutral and waste-free, as well as curbing overconsumption by 2050. The municipality, with businesses and other local operators, builds a common vision and roadmap to achieving these goals. The municipalities identify new ways of working and cooperation, often through joint development projects in specified themes set out in the network's long-term action plan. The idea is to strengthen the municipal and regional economy, create jobs, and promote sustainable wellbeing. The network is coordinated by the Finnish Environment Institute Syke and Motiva, which together form a service centre in support of the Fisu municipalities. The service centre conveys topical information, monitoring data, and competence to the municipalities and other interest groups, promoting the Fisu network in the national media and in events related to its core themes. It also provides reliable information about new opportunities and develops best practices in facilitating peer-to-peer network collaboration. https://fisunetwork.fi/en/

Climate Information Advisory Service

The Helsinki Region Environmental Services Authority's (HSY) Climate Information Advisory Service (Ilmastoinfo), advises residents and housing associations in the Helsinki metropolitan area. The advisory service helps in a wide range of energy issues: matters related to the use of equipment and properties; energy renovations of buildings; or the transition to renewable energy. Climate Information runs housing company energy expert training courses focusing on the basics of a housing company's energy consumption and energy efficiency, including as online training at https://koutsi.hsy.fi/.
The advisory services are free of charge.
https://www.hsy.fi/ilmastoinfo/

Industrial Symbiosis in Finland

FISS (the Finnish Industrial Symbiosis System) is a tool for promoting the circular economy. FISS is a collaborative approach that helps companies and other actors make better use of resources and generate new business. The FISS model is based on the active promotion of symbiosis, or facilitation and co-development. The goal is also to increase the value added of materials and create competitive new products and services. FISS aims to promote new business opportunities, the reuse of waste, and reducing the use of natural resources. The goal is also to advance the implementation of a waste hierarchy. FISS activities promote the resource efficiency of various actors in the regions and can be seen as an important tool in regional development and the economy. Motiva coordinates FISS at a national level, and the identification and promotion of symbioses is done at a regional level, where regional organisers work with companies and help them.
https://teollisetsymbioosit.fi/

Active and Sustainable Journey to School

Active Journey to School (Fiksusti kouluun) is a programme to promote more sustainable and active school journeys to reduce traffic-related emissions and promote physical activity on the way to school. The programme aims for better traffic safety, an enhanced and sustainable physical activity culture in schools and teaching, support for strategies, and operating models for active and sustainable journeys to school. The programme offers information and advice for the planning and implementation of smarter journeys to school. The programme has been running since 2018. Fiksusti kouluun is a joint programme of the LIKES Research Centre for Physical Activity and Health, the Network of Finnish Cycling Municipalities (Pyöräilykuntien verkosto), and Motiva (until 2021) to promote sustainability and physical activity in school journeys. It works in cooperation with the Schools on the Move programme. The programme is funded by the Ministry of Education and Culture, and the Finnish Transport and Communications Agency Traficom.
https://fiksustikouluun.fi/english/

Sustainable Commuting to Work

The Sustainable Commuting to Work (Fiksusti töihin) website provided facts and tips for more sustainable commuting to work, as well as for transitions during the workday. The campaign ended in 2022.

Road transport creates a significant proportion of greenhouse gas emissions and other environmentally harmful emissions such as small particles and hydrocarbons. Sustainable mobility and commuting cover several options: walking and cycling whenever possible; the use of public transport for longer commutes; choosing electric and gas cars when driving is essential;

and diverse mobility, wellbeing, and climate-friendly choices. The website provided information about sustainable commuting and mobility, tips for employers on how to encourage employees to commute sustainably, and tips for employees for better wellbeing through smart commuting, examples, and best practices. The project also provided webinars and events, materials, and publications and newsletters. The project was funded by the Finnish Transport and Communications Agency Traficom and the Moving Adult programme. The project was coordinated by Motiva.

7.4.4 National Policy Implementation Activities

Energy Efficiency Agreements

In Finland, energy efficiency has been promoted through voluntary Energy Efficiency Agreements between the Government and different sectors since 1997. The scheme has been implemented continuously since 1997 through successive agreement periods, providing long-term cooperation, continuity, and cumulative results across sectors. At the end of the 2017 to 2025 agreement period, nearly 800 companies with more than 7,500 sites, as well as 164 municipalities and joint municipal authorities, were participating in the scheme. The fourth agreement period started in 2026, ensuring the continuation of the scheme and its activities.

The agreement scheme is considered a flexible and cost-effective policy instrument for achieving national and EU energy efficiency targets. Participants commit to setting targets, implementing energy efficiency measures, and annually reporting their energy use and achieved savings. The long-established monitoring and verification system provides reliable data on energy savings and supports the implementation of the energy savings obligation the energy savings obligation of the Article 8 of the EU's Energy Efficiency Directive (EED).

The scheme also includes extensive operational support for participants, such as expert advice, guidance, webinars, training, joint projects, and communication activities, which foster peer learning and the exchange of best practices. In 2024, more than 220 participating companies and municipalities received tailored advisory support, and more than 40 events and webinars were organised for around 2,800 energy efficiency professionals. https://energiatehokkuussopimukset.fi/en/energy-efficiency-agreement-scheme-in-finland/

Energy Performance Certificate Advisory Service

The Energy Performance Certificate (EPC) is a tool for comparing and improving the energy efficiency of buildings in sales and rental situations. For

new buildings, an EPC must be submitted when applying for a building permit. EPCs were introduced in Finland in 2008, with the latest updates in 2018. The EPC is mainly required for buildings subject to energy efficiency requirements. The Act on the Energy Certification of Buildings implements the EU's Energy Performance of Buildings Directive (EPBD).

Motiva provides information about and examples of EPCs, organises webinars for qualified energy certificate issuers, and offers an advisory service on EPCs to homeowners, housing companies, and other stakeholders. The advisory service covers a weekly phone service, an email service, and a FAQ section. The service is commissioned by the Ministry of the Environment. The Housing Finance and Development Centre (ARA, since 2025 the Centre for State-Subsidised Housing Construction, VARKE) maintains the EPC register, which includes qualified energy certificate issuers, as well as statistics on EPCs.
https://www.motiva.fi/energiatodistus
https://energiatodistusrekisteri.fi/

Land-use, Housing, and Transport Agreements

Land-use (M), Housing (A), and Transport (L) Agreements, known as MAL agreements, are concluded between the State of Finland and the seven largest urban regions: Helsinki, Turku, Tampere, Oulu, Jyväskylä, Kuopio and Lahti. Their purpose is to support cooperation among municipalities and between municipalities and the state in guiding urban structure and coordinating land use, housing, and transport.

The agreements are concluded with broad participation from relevant state authorities and have become an established framework for cooperation between municipalities and central government, also strengthening interregional collaboration.

The objective of the MAL agreements is to promote a sustainable urban structure and transport system while improving the functionality and competitiveness of urban regions and ensuring balanced municipal development. The agreements define key objectives for land use, housing production, and transport network development. They have a 12-year term and are updated every four years to agree on tangible measures, with each government committing to their financial contribution.

Wood Construction Advisory Service

The Public Wood Construction Advisory service provided municipalities with free expert advice on wood construction issues from 2021 to 2023. The aim of the advice service was to increase the use of wood in public-sector construction by increasing the knowledge of and interest in wood construction in municipalities and strengthening cooperation between different actors.

The carbon footprint of wood construction is significantly smaller than other building materials when a building's entire lifecycle, from the manufacture of building materials to construction, use, and recycling, is considered. Motiva ran the Public Wood Advisory Service, which covered a hands-on advisory service, free Wood Academy online training, regional events, and working groups focusing on the joint development of public wood construction. The project was funded by the Ministry of the Environment as part of the Wood Construction Programme (2016–2023).
https://www.motiva.fi/julkiselle-sektorille/julkinen-puurakentaminen/

Sitoumus2050.fi platform

Sitoumus2050 is a unique concept that communicates Agenda 2030 goals and gives cities and companies a tangible way to act on achieving targets. The idea of the Sitoumus2050.fi platform is to encourage organisations to set measurable sustainability targets, make public commitments, and report regularly on their progress. The service is maintained by the Finnish National Commission on Sustainable Development. Organisations themselves can decide which sustainability goals are meaningful for them, and which actions are relevant when trying to achieve their targets. Commitments typically have targets for reducing greenhouse gas emissions, achieving carbon neutrality, or other environmental goals. Social sustainability goals are also popular.

All information on the site is public, so anyone can check what kind of goals a certain company has set and read about their progress in their reports. More than 3,000 organisations have published their sustainable development commitments on the site so far.
https://sitoumus2050.fi/en/web/sitoumus2050/home#/

Green Deal Agreements

Green Deal is a voluntary agreement between the state and the business community. Agreements can also be concluded with the public sector. Green Deal Agreements are used to find solutions to climate challenges, reduce the loss of biodiversity and the over-consumption of natural resources, and promote a circular economy in Finland. Green Deal Agreements bring together those who play a key role in bringing about the desired change.

The agreements may contribute to better implementation of the legislation or complement the law. For example, the objectives set in the agreements may be stricter than in the law, or certain objectives may be achieved without further regulation. Green Deals and the commitments made under them are part of Society's Commitment to Sustainable Development, introduced by the Finnish National Commission on Sustainable Development. The Parties undertake to set ambitious and achievable targets for environmental and social impacts. Green Deal Agreements seek results that can be achieved relatively quickly, the

follow-up of which is agreed in the agreement. The agreements aim to bring added value compared with the current situation by jointly seeking new solutions and approaches to addressing the selected challenges. The agreements specify the measures to be taken by the parties to the agreement and the undertakings to which they are committed to achieve the agreed objectives.

Examples of Green Deals: Plastic Bag Green Deal (2016 to 2025), Green Deal in the Construction Equipment Industry (2019 to 2025); Green Deal on Sustainable Dismantling (2020 to 2025); Emission-free Construction Sites – Green Deal on Sustainable Procurement (2020 to 2030); Construction plastics Green Deal (2020 to 2027).
https://sitoumus2050.fi/en/tietoa-green-dealista#/

Construction Plastics Online Training Package

The circular economy in construction is advancing on many fronts, but there is still room for improvement in plastics recycling. The construction sector is one of the industries that uses the most plastics, but separate collection of the plastic fraction in the construction value chain is not yet commonplace. A major reason is the lack of expertise on construction sites and throughout the supply chain.

The Construction Plastics Online Training Package focuses on the film plastic used for packaging and protection, which accumulates most in terms of volume. The online training is aimed at the entire construction industry supply chain. The free, self-study, and open-to-all training package is suitable for clients and implementers of construction projects and contracts, the product industry, the trade sector, and construction equipment rental companies. The training provides supervisors and management with additional information and skills for guidance.

The training package is related to the implementation of the voluntary Construction Plastics Green Deal (2020 to 2027). The Construction Plastics Green Deal aims to increase the separate collection, reuse, and recycling of film plastics. Motiva has produced the training package and maintains the online training commissioned by the Ministry of the Environment.
https://www.motiva.fi/tietopankki/rakentamisen-muovit-verkkokoulutus/ (about the training course)
http://www.motiva-verkkokurssit.fi (online course)

Low-Emission Work Machines Online Training Package

Many of the machines used on construction sites are still powered by internal combustion engines and emit a significant amount of CO_2 and local emissions. Switching to low-emission machines and using them properly can help reduce the carbon footprint of construction and traffic emissions. To support

this change, Motiva has produced a “Low-Emission Work Machines” training package. In addition to reducing greenhouse gas emissions, the goal of the online training is to reduce local emissions that are harmful to health, such as particulate matter, carbon monoxide and nitrogen dioxide, and noise.

The training is free of charge, and the material, which is adapted for short-term studies, is suitable for both self-study and teaching material. The Low-Emission Work Machines Training Package is open to everyone, focusing on ways to reduce emissions from machinery from the perspective of the machine user, contractor, and builder. Motiva maintains the online training, and the training package is commissioned by the Ministry of the Environment.

The online training is part of the implementation of both the Green Deal in the Construction Equipment Industry and the Low Emissions Construction Sites Green Deal. These agreements aim to reduce emissions through voluntary action.
https://www.motiva.fi/tietopankki/vahapaastoiset-tyokoneet-koulutuskokonaisuus/
http://www.motiva-verkkokurssit.fi (online course)

Materials Marketplace

This national marketplace for materials is for the professional exchange of waste and production by-products of companies and organisations. The Materials Marketplace can also be used to seek and provide related services such as waste management and expert services. The key objective of the Materials Marketplace is to promote the recovery of waste and by-products and the circular economy by providing a meeting place for operators and users of recycled materials. The aim of the Materials Marketplace is to make the material flows generated in Finland more visible in one place so that new ways of utilisation emerge around them, and the materials end up being increasingly utilised. Such a recycling market is the key to increasing the value of recycled materials. The Marketplace originates from the renewal of the Finnish Waste Act (2020), according to which a possessor of waste must first search for a market-based waste management service on the platform before it is possible to ask for municipal waste management in accordance with the secondary liability of a municipality. The use of the Materials Marketplace is free of charge and open to industry players. Motiva operates the Marketplace, which is commissioned by the Ministry of the Environment.
http://www.materiaalitori.fi

KEINO Competence Centre

KEINO was a network-based Competence Centre for Sustainable and Innovative Public Procurement in Finland and KEINO. It ended in 2024. The main objectives of the operation were: to increase the number of innovative and sustainable

procurements in Finland; to make public procurement recognised and actively used as a management tool; and to ensure contract entities openly disseminated information about their own experiences and learned from one another. The KEINO Competence Centre aimed to provide opportunities for collaboration and networking between procurement professionals and public actors involved in procurement, as well as businesses. The members responsible for the operation and co-development were Motiva, the Association of Finnish Local and Regional Authorities, the VTT Technical Research Centre of Finland Ltd, Business Finland, the Finnish Environment Institute Syke, and Hansel Ltd. The KEINO Competence Centre was part of the implementation of the Finnish Government Programme, and its operations were steered and funded by the Finnish Ministry of Economic Affairs and Employment. KEINO supported and helped Finnish public contracting authorities with the development of sustainable and innovative procurement. Motiva was the coordinator of KEINO and was responsible for the centre's services.

Circular Economy Finland (KiSu)

Circular Economy Finland (KiSu) is a hub of skills and knowledge which unites those who seek solutions with those who offer them. The network supports different actors in finding their own circular economy paths. Circular Economy Finland's goal is to support the work of municipalities, companies, and other organisations in developing a carbon-neutral circular economy and society. Circular Economy Finland facilitates access to information, networking, and collaboration.

Circular Economy Finland has been developed with various actors since the spring of 2022. Circular Economy Finland is one of the key measures in the national Strategic Programme to Promote a Circular Economy. The activities of Circular Economy Finland are guided by the Ministry of the Environment and the Ministry of Economic Affairs and Employment. The Finnish Environment Institute Syke and the sustainable development company Motiva coordinate and implement the activities of Circular Economy Finland. It is funded by the Ministry of the Environment.
https://kiertotaloussuomi.fi/en/

The Accelerating Climate Efforts and Investments (ACE LIFE)

The Accelerating Climate Efforts and Investments (ACE LIFE) project is a large-scale national initiative supporting Finland in meeting its ambitious climate targets, including a 50 per cent reduction in greenhouse gas emissions in the effort-sharing sector by 2030 (compared with 2005 levels) and achieving carbon neutrality by 2035. Funded primarily by the EU LIFE Programme and implemented between 2024 and 2030, the project brings together more than

50 partners from public administration, research, business, and civil society to accelerate climate action and investment across key sectors.

The project focuses on reducing emissions in sectors where progress has been particularly challenging – namely, agriculture, heavy transport, mobile machinery, and small and medium-sized industrial processes. ACE LIFE supports the implementation of Finland's Medium-term Climate Plan (KAISU) by developing tangible solutions, piloting new technologies, and promoting scalable investments and policy measures. Key actions include advancing plant-based protein and paludiculture value chains in agriculture, electrifying heavy transport and industrial processes, and increasing the use of alternative fuels such as biomethane.

In addition to direct emissions reduction measures, ACE LIFE strengthens the effectiveness of climate policy and financing. The project improves access to climate funding, supports investment planning, and develops tools and recommendations to overcome barriers to low-carbon transitions. Through extensive piloting, stakeholder collaboration, communication, and capacity building, the project aims to scale up successful solutions and mainstream climate action across Finnish society.

The communication activities of the Accelerating Climate Efforts and Investments (ACE LIFE) project are designed to support the uptake of climate solutions and strengthen their societal impact in Finland. Communication is coordinated through a dedicated work package that ensures consistent messaging and collaboration across the consortium. The main communication tasks include disseminating project results, engaging stakeholders, and building capacity among key target groups such as businesses, policymakers, and the public. There is a special emphasis on increasing acceptance of climate actions, supporting the use of project results in practice, and strengthening understanding of effective climate policy and funding.

Key communication measures include maintaining a central project website, active use of social media, organising webinars and events, and close cooperation with media and stakeholder networks. In addition, the project produces tangible case examples based on pilot activities to demonstrate practical solutions and encourage their wider adoption. Training activities, demonstrations, and stakeholder engagement further support the dissemination and scaling of results.

Overall, ACE communication focuses on making climate solutions visible, understandable, and actionable, thereby facilitating their replication and contributing to the achievement of national climate targets.
https://hiilineutraalisuomi.syke.fi/en/projects/accelerating-climate-efforts-and-investments-ace-life/

7.4.5 Activities and campaigns of the NGOs

A growing number of NGOs have climate-related activities. For example, the World Wide Fund for Nature (WWF Finland), the Finnish Association for Nature Conservation (Suomen Luonnonsuojeluliitto), Finn Church Aid (Kirkon ulkomaanapu), the Finnish Red Cross, Youth Academy, Fingo, the Martha Association, and the Guides and Scouts of Finland (Suomen Partiolaiset) keep the issue constantly on the agenda and offer people opportunities to participate.

The Nature League (Luonto-Liitto in Finnish), established in 1943, is a nationwide non-governmental nature and environmental protection organisation for children and young people. The Nature League arranges environmental education for children and young people in the form of afternoon clubs and nature camps. It also provides opportunities to participate in thematic action groups. One of the action groups deals with the theme of climate.

WWF Finland has participated in the worldwide Earth Hour movement since 2007. The event is held annually, encouraging individuals, communities, households, and businesses to turn off their non-essential electric lights for one hour from 8:30 to 9:30 p.m. towards the end of March as a symbol of their commitment to the planet. Schools are also invited to participate, and some material and ideas are provided especially for them. WWF Finland also runs the Green Office, which is an environment management system for offices. For young people, WWF Finland provides an opportunity to participate in climate work in WWF Youth groups (WWF Nuoret) in the three biggest cities in Finland. WWF Youth groups organise campaigns and events, and encourage other young people to act. They focus especially on sustainable food.

EKOenergy is a non-profit ecolabel and promotes sustainable energy choices globally. The label is developed and managed by the Finnish Association for Nature Conservation, and EKOenergy-labelled energy is currently being used in 60+ countries. The EKOenergy label helps consumers find out and communicate about using climate-friendly and environmentally sustainable energy. The label also works as a fundraising tool for renewable energy projects in developing countries. By using the label, renewable energy consumers make an additional positive impact. More than 40 projects were financed between 2018 and 2021. In 2020, UN DESA (UN Department of Economic and Social Affairs) included EKOenergy as one of the 16 good practices for SDG (Sustainable Development Goals) implementation, and in 2021, EKOenergy's commitment to promoting renewable energy was accepted under the UN Energy Compacts programme.

The Association for Rural Culture and Education organises training courses and workshops that help local communities build skills for solving environmental and climate issues in their own sphere. It collaborates especially with village actors in campaigning on local climate action. An example of village-level

awareness raising and action support is that in 2024, a Leader-funded project by Leader Varsin Hyvä in Southwest Finland published a workbook for community-based climate action. The workbook presents more than 40 means of climate mitigation and preparedness and adaptation to climate change. https://www.motiva.fi/tietopankki/rakentamisen-muovit-verkkokoulutus/

As part of the national KERÄ network, the Association for Rural Culture organises open environment dialogues that address issues such as a just green transition in rural contexts. The dialogues present and create ideas for tangible solutions to support sustainable and locally sensitive decision making. https://msl.fi/en/environment/, https://msl.fi/ymparisto/ymparistodialogit/

In partnership with the European Sustainable Development Week (ESDW), Finnish Sustainability Week is arranged annually as a forum to raise various climate and sustainability initiatives and encourage societal discussion on the theme. It brings together local sustainability events in different parts of Finland. Started in 2019 by Finland's Swedish-speaking 4-H NGO in Ostrobothnia, the Sustainability Week has grown into a central forum to support sustainability dialogue in and about rural Finland. The KERÄ network[11] (2024–2027), develops the Week as a continuous and evolving forum. The KERÄ network operates under the auspices of the Rural Policy Council, and its activities are implemented by two NGOs[12] with NOVIA University of Applied Sciences.
https://kestavankehityksenviikko.fi/english/
https://www.maaseutupolitiikka.fi/paatoksenteontueksi/verkostot/kera

Some new groups and movements

Alongside the well-established NGOs, new NGOs, movements, and loosely organised groups have emerged to require climate action and find solutions. For example, many of these groups bring together certain age groups or occupations and the use of the arts (concerts, music videos, exhibitions) or strongly highlight some consequences of climate change. More intense non-violent forms of action have also been introduced: the civil disobedience practised by Extinction Rebellion Finland (Elokapina) has stimulated discussion about climate change, climate policy, and acceptable forms of climate action.

Ilmastotoiminta.fi gathers information about the different possibilities of climate and environmental activities today at one address, so more and more people can find the most suitable form of climate action. The site provides information about various organisations and movements that carry out climate

[11] KERÄ - För hållbara landsbygder och en rättvis omställning (in Swedish). Oikeudenmukaisen siirtymän ja kestävien maaseutujen puolesta (in Finnish). For a just transition and sustainable rural areas (in English).

[12] Central organisation of the Swedish speaking rural advisory centres in Finland and the Association for Rural Culture and Education

and environmental activities, as well as tools for planning and implementing climate activities. The site was launched and is maintained by two private individuals with experience of climate communication, environmental action, and research.

Fridays for Future is a worldwide youth-led movement in which many young people in Finland have been involved since 2018. It has succeeded in raising young people's views and concerns. Climate strikes by Fridays for Future have been organised in many towns, and the society has been forced to consider whether it is acceptable to miss school lessons while participating in social activities like climate action. In turn, adults have set up Climate Parents (Ilmastovanhemmat ry), which is active in insisting that decision makers consider the coming generation when deciding on climate issues. Climate Parents has been followed by Climate Grandparents (Ilmastoisovanhemmat ry) and a group called Activist Grannies (Aktivistimummot).

Protect Our Winters Finland Ry (POW) was established in 2014, and it especially attracts those who like or work with winter sports. In turn, Save Pond Hockey is uniting the global hockey community against climate change. It co-organises Save Pond Hockey Tournaments around the world and donates profits to projects tackling the climate crisis. Like POW, Save Pond Hockey has utilised ambassadors: among the more than 3,500 players who have joined the tournaments so far are the Stanley Cup champions, Olympic medallists, celebrities, and the President of Finland.

Joint campaigns

NGOs and movements have also joined in conducting climate change or energy-related campaigns, some of which have received broad publicity. Coal-free Finland (Hiilivapaa Suomi) is a longer-term campaign at a municipality and city level to shut down coal plants in municipalities across Finland, in which citizens have decided to take action against the use of coal. The campaign is working in collaboration with the Finnish Friends of the Earth, the Finnish Nature League, Changemaker, Climate Parents, 350 Finland, Fingo, UN Youth of Finland, Europe Beyond Coal, and Save Pond Hockey. It is run by volunteers from a variety of backgrounds. The campaign's methods include lobbying and advocacy, participating in public debate, and awareness raising among citizens and stakeholders.

NGOs supporting climate education

Many NGOs also play an important role in supporting teachers and youth workers in climate education. FEE Finland (the Finnish Foundation for Environmental Education) enhances a sustainable way of life through environmental education. FEE Finland is part of an international FEE (Foundation for Environmental Education) network, which consists of 73

member countries. FEE Finland coordinates the Green Key programme in Finland and enhances environmental education collaboration.

A non-profit organisation, Development Centre Opinkirjo, established in 1947, produces and offers training and teaching materials for teachers. Climate has been one of its themes for several years. Ilmastokirjo – Climate Spectrum provides material for teachers and students but also connects schoolchildren and other actors in society by facilitating a QA service and organising meetings on climate issues.
https://ilmastokirjo.fi/

7.5 Short descriptions and internet links of some projects, networks, and campaigns

Hiilineutraalisuomi.fi (Carbon Neutral Finland)

Hiilineutraalisuomi.fi (Carbon Neutral Finland) provides research-based information, tools, and solutions for mitigating climate change. The website is maintained by the Finnish Environment Institute (Syke). It supports tangible climate action and serves as a communication platform for projects related to climate change mitigation. Hiilineutraalisuomi.fi offers fact-based and up-to-date information and tools for climate change mitigation, with a special focus on regions, municipalities, and companies. The site features news, blog posts, event announcements, tools, datasets, and publications related to climate change mitigation. The service is aimed at professionals working on climate action in regions, municipalities, companies, government administration, and the third sector. In addition to the website, Hiilineutraalisuomi channels also include a newsletter, a webinar series, and a Linkedin profile.
https://hiilineutraalisuomi.syke.fi/en/

Climateguide.fi

The Climateguide.fi website provides information about climate change, its impacts, adaptation, and mitigation. The website's aim is to be a publicly available national digital service addressing climate change and to provide up-to-date, independent, and reliable information about climate change based on research and other verified data. It also aims to support decision making, risk management, climate communication, and learning. The website is also available in Finnish (Ilmasto-opas.fi) and in Swedish (Klimatguiden.fi). The website and its main content are maintained by the Finnish Meteorological Institute (FMI), the Finnish Environment Institute (Syke), Natural Resources Institute Finland (Luke), and the National Climate Unit of the Economic Development Centres.
https://www.climateguide.fi

Ilmastokatsaus

The Finnish Meteorological Institute (FMI) publishes a monthly climate bulletin in Finnish (Ilmastokatsaus) and an annual climate bulletin (Ilmastovuosikatsaus). Both online digital magazines are in Finnish and cover weather and climate issues, with articles about weather conditions in Finland and weather events worldwide, weather and greenhouse gas statistics, and changes in Arctic sea ice. The monthly bulletin also has English summaries of weather events. The magazine's target audience are from the fields of research and education, as well as members of the general public who are interested in the current climate, weather, and climate change.
https://ilmastokatsaus.fi

Climate Diet

The Climate Diet is a calculator, developed by the Finnish Environment Institute, which helps consumers calculate their carbon footprint. It also gives advice on how to reduce it and presents the results compared with the carbon footprint of average Finns. The calculator considers different fields of life, from housing to travel, food consumption, shopping habits, and household waste management. The latest update of the calculator was in 2024. Between 2019 and March 2026, the calculator was used almost 220,000 times to calculate carbon footprints, meaning approximately 31,000 calculations per year.
https://ilmastodieetti.ymparisto.fi

Lifestyle Test

The Finnish Innovation Fund Sitra developed a Lifestyle Test to support citizens in better understanding how their lifestyle affects the climate. The test has been available since 2017 and had provided more than 1.4 million responses by 2023. In 2023, a new version of the test was developed in an EU-funded PSLifestyle project with the help of citizens across Europe in eight European countries: Finland, Estonia, Germany, Italy, Portugal, Greece, Slovenia, and Turkey.
https://www.sitra.fi/en/lifestyle-test/

Climate.now

Climate.now is a multidisciplinary study and teaching module on the basics of climate change. It contains written material, video lectures and interviews, assignments, tests, and a guide for teachers that will help anyone familiarise themselves with the basics of climate change. The study module can be completed independently or as part of higher education studies. In addition to teachers and students, the material can be used by companies, other organisations, and the media.
https://courses.mooc.fi/org/uh-inar/courses/climatenow-2025

Teacher's Climate Guide

The Teacher's Climate Guide is a free and open climate education package for subject teachers working in secondary schools and high schools. It explains climate change in the context of each school subject and provides exercises and visual material. It also contains tips for multidisciplinary climate education, tips for integrating climate change in education and activities at the primary level, and basic information about climate change and climate education. The Guide was updated during between 2024 and 2025.
https://openilmasto-opas.fi/
https://sites.uef.fi/cceel/uef-unep/

Teachers' Climate Change Forum

University of Helsinki Science Education (part of the national LUMA Centre Finland) and the Institute for Atmospheric and Earth System Research (INAR) have organised the international Teachers' Climate Change Forum 2022 (TCCF) for continuous professional development program of teachers in all levels of education. The conference deals with climate science, climate education, and the connection between these two domains. Online material is also provided for teachers; the material provides teachers at different levels of education with the latest research related to climate change and supports teachers in building their own expertise and self-efficacy to teach climate change.

The Teachers' Climate Change Forum is a virtual forum organised by LUMA Centre Finland. At the forum, teachers interested in climate change education can share their practical experience and learn from each other. The Director of the LUMA Centre Finland chairs the forum.
https://www.helsinki.fi/en/science-education-and-academic-outreach/teachers/teachers-climate-change-forum

Citizens Climate Pledge

Citizens Climate Pledge is an NGO-led initiative that encourages individual citizens to announce their personal commitment to halving their carbon footprint within ten years. Launched in 2015 in Finland, Citizens Climate Pledge aims to bring citizens into the centre of the societal transition to low-carbon development. Today, the initiative has more than 8,300 signatories, including the present and two former Presidents of Finland, the leaders of Finland's largest corporations, musicians, artists, and top athletes. Citizens Climate Pledge became global in 2016, when the Finnish initiators launched the international version with UNFCCC. It is now possible for any global citizen to commit to join a global movement of action on climate change.
https://climatepledge.global/

MAPPA.fi

The MAPPA service is an environmental education search engine which includes materials for learning outside and teaching sustainable lifestyles. It serves as an open and common place for more than 300 organisations that produce material for teachers and other educators. Educators themselves can also add their materials to the service so that they can also be used by others. For example, the user can search for materials by age group, subject, or the type of situation in which the material is required. There are also "thematic backpacks" in which materials have been collected that together form a useful set like "Food Materials" or "A Perspective of Hope in Climate Education".

MAPPA was first published in 2013 and has since grown to be a significant service that helps teachers find ideas and materials, and producers to gain more visibility for their work. MAPPA has been developed further, and it now includes a common calendar of events in the field and presents supporting services that are available for teachers around the country. MAPPA was established and is maintained by the Finnish Association of Nature and Environment Schools. It was initially funded by the Ministry of the Environment and later the Ministry of Education, Partioaitta, and the Otto A. Malm Foundation.
https://mappa.fi/en/home/

Educators' Climate Front

Climate Front in a community that helps professionals in various fields act together to mitigate climate change. The idea is to help people use their expertise in climate work while helping the professions cooperate. The Climate Front can be joined as an individual or as an organisation. Teachers and Educators are currently one of the six professions in the Front. The others are psychologists, doctors, engineers, IT workers, and artists.
https://ilmastorintama.fi/

CLIMentines Climate Action Guide for Youth Workers

The Climate Action Guide for Youth Workers developed in the CLIMentines project was published in 2025. The guide provides practical tools and methods for youth workers, organisations, and professionals in the youth and education sectors for participatory climate advocacy and decision making to engage young people.

The guide was created by the seven partner organisations of the project and is one of the key outputs of the CLIMentines – Empowered Youth for Climate Action project. The guide is intended to serve as a tool for promoting youth participation, increasing environmental competence, and utilising participatory democracy methods as part of climate decision making.
https://nuortenakatemia.fi/climentines-ilmastovaikuttamisopas-nuorisotyontekijoille/

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Sustainable development policy of the Ministry of Education and Culture and its administrative branch – Valto (valtioneuvosto.fi)

8 Improvements in reporting over time

Annex 1
Units and abbreviations

Annex 2
Methodologies and assumptions for projections and estimating effects of policy measures

This annex describes the approach, models and assumptions used for obtaining the projections and estimating the GHG emissions reductions and removals due to policy measures. The aim is to provide a more detailed account of the process than in the sector-specific sections of 3.4 and 3.6, which briefly list the most essential assumptions.

1 Approach and responsibilities

The approach and responsibilities in preparing the projections have not changed since the preparation of the BTR1.

The reported "with measures" (WM) projections are integrated energy and climate projections based on comprehensive modelling and assessments conducted by experts from various research fields. The projections are slightly updated versions of projections modelled in an extensive project "New measures and scenarios of national energy and climate policy" (KEITO)[1]. Although the KEITO project included a great deal of updated information, some inputs and assumptions were also derived from a previous project "Baseline scenarios for energy and climate policy package towards zero emissions" (PEIKKO)[2]. The Government funded both projects. The modelling covers the energy system and all GHG sources and sinks that are included in the GHG inventory. The updated projections and the impact assessment of policy measures were used as the scientific basis for the preparation of the Government's energy and climate strategy.

Finland uses a sectoral approach with detailed sector-specific modelling that is coordinated and manually interlinked across sectors. The Ministry of Economic Affairs and Employment coordinated the preparation of the reported WM projections and was responsible for the projections regarding the amount of energy used by industry, households and services and for calculations of fuel and carbon dioxide emissions in the energy production sectors as a whole.

1 https://publications.vtt.fi/pdf/technology/2025/T442.pdf

2 Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO), http://urn.fi/URN:ISBN:978-952-383-219-0

The Ministry of the Environment was responsible for the projection regarding space heating, the analysis of the regional and urban structure, and emissions projections and calculations for F-gases, waste and machinery. The duty of the Ministry of Transport and Communications included projections for fuel and electricity use, as well as emissions of the transport sector and international bunkers. The Ministry of Agriculture and Forestry oversaw the calculation of emissions and removals in agriculture and land use, land-use change, and forestry sectors (LULUCF). The Ministry of Finance was responsible for forecasting short-term economic development and taxation.

The ministries selected the expert organisations, research institutes, and consultants, which prepared the sectoral projections, assessments of policies and measures, and other calculations, modelling, and analyses. The following organisations contributed to the reporting: the Finnish Environment Institute; VTT Technical Research Centre of Finland Ltd; Motiva Oy; Natural Resources Institute Finland; Merit Economics; the Finnish Transport and Communications Agency; Sitowise Group Oyj and Statistics Finland.

The main assumptions and methods used in the work are described below.

2 Assumptions underlying calculations

A summary of key variables and assumptions is presented in Table Annex 2-1. Methodology to prepare projections and to estimate effects of policy measures is in general the same as used when preparing the BTR1. Some variables and assumptions have changed compared to those used in the BTR1, others such as predicted population growth are the same as in BTR1.

The population growth in the projections is based on the population forecast drawn up by Statistics Finland in 2021. The population will increase only slightly from 5.56 million (end of 2022) to 5.60 million in 2030. In 2033, the population will start to decrease. The population's age structure will change significantly over the next couple of decades as the proportion of older age groups will increase.

The Covid-19 pandemic and its assumed effects on the economy were considered in the modelling of the WM projection whose starting point is the year 2024. The energy crisis and changed energy scene following Russia's unprovoked and unjustified invasion of Ukraine are also included in the projections. This is especially reflected in cutting off all energy imports from Russia throughout the modelling period. For the LULUCF sector, the most recent results on a decline in tree growth from the national forest inventory form the basis for the projection work.

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 a macro-economic study for the ministries by Merit Economics. The current economic growth is modest, but it is expected to improve toward the end of the decade. In the WM projection, the annual average increase in the national economic output is 1.5 per cent from 2025 to 2040.

The following paragraphs describe the assumptions that underlie the same sectors as presented in the report, starting from energy.

The fuel taxation structure takes into account energy content and lifetime carbon dioxide emissions. They are applied to two categories shown in the table below and described in more detail in Section 3.4.4. The electricity tax is divided into two categories, of which the lower (category II) is applied to industry and heat pumps in district heat production, and the higher mostly to consumers, for example. As the table illustrates, the ongoing trend is that electricity for industry is taxed less and combustion fuels more. After 2025, the taxation structure and levels will remain constant in real terms in the projections.

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 recommended harmonised values provided by the EU Commission for greenhouse gas emission projections in 2024.

Table Annex 2-1

Key variables and assumptions used in the projections analysis for 1990 to 2040

		Historical								Projected			
	Unit	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
Population	Million inhabitants	5.0	5.1	5.2	5.3	5.4	5.5	5.5	5.6	5.6	5.6	5.6	5.6
Gross Domestic Product	Million EUR, 2025 prices	171,147	167,651	215,172	244,823	256,370	257,350	271,210	279,430	281,670	301,000	327,240	355,140
Coal international price	EUR/GJ LHV, 2023 prices	2	1	1	2	3	2	3	3	4	4	4	4
Crude oil international price	EUR/GJ LHV, 2023 prices	5	4	4	9	12	9	6	11	12	14	15	16
Natural gas international price	EUR/GJ LHV, 2023 prices	NA*	3	3	5	7	6	2	10	9	9	8	10
Emission allowance price (EU ETS)	EUR/t, 2023 prices	NO	NO	NO	25	15	8	25	65	95	95	100	100
Tax components: **													
Electricity, tax category I (includes supply security fee)	cent/kWh, 2024 prices	NA*	NA*	NA*	NA*	1.18	2.76	2.66	2.25	2.25	2.16	2.16	2.16
Electricity, tax category II (includes supply security fee)	cent/kWh, 2024 prices	NA*	NA*	NA*	NA*	0.35	0.86	0.83	0.06	0.06	0.06	0.06	0.06
Calculation basis of excise duty rates for heating, power plant and machinery fuels (coal, natural gas)													
Energy content component	EUR/MWh LHV, 2024 prices	NA*	NA*	NA*	NA*	NA*	8.14	9.01	10.33	10.30	9.90	9.90	9.90
Carbon dioxide component***	EUR/t CO_2, 2024 prices	NA*	NA*	NA*	NA*	NA*	54	62.6	53.0	52.8	50.8	50.8	50.8
Calculation basis of excise duty rates for liquid transport fuels													
Energy content component	EUR/MWh LHV, 2024 prices	NA*	NA*	NA*	NA*	NA*	70.46	69.34	60.52	60.34	58.00	58.00	58.00
Carbon dioxide component****	EUR/t CO_2, 2024 prices	NA*	NA*	NA*	NA*	NA*	71.0	73.2	62.0	62.0	49.2	49.2	49.2

* No data available or regarding taxes, the taxation structure was significantly different from the present and thus not comparable

** The values in the table represent base case rates. Several reductions and exemptions exist

*** Life-time CO_2 emissions (except for the year 2015 combustion only). Life-time emissions of fuels are approximately 20 % higher than emissions from combustion.

**** Life-time CO_2 emissions. Life-time emissions of fuels are approximately 20 % higher than emissions from combustion.

Sources: Euracoal, FRED, World Bank, Energy Instrat, Statistics Finland

The primary energy by source, energy sources for district heat and combined heat and power production, electricity supply, and energy sources in the transport sector are presented in Tables Annex 2-2 to Annex 2-7.

Both gross final and primary energy consumption will be levelled off in the projections despite economic growth because of increased energy efficiency in all sectors. The decreasing energy sector emissions are the result of policy measures that replace fossil fuels with renewables and electricity. The development of the primary energy supply and gross final energy consumption in the WM projection are shown in Figure Annex 2-1 and Table Annex 2-2.

Figure Annex 2-1
Historical development (1990 to 2024) and WM projection (until 2040) of the primary energy supply by energy source and gross final energy consumption (solid line), TWh.

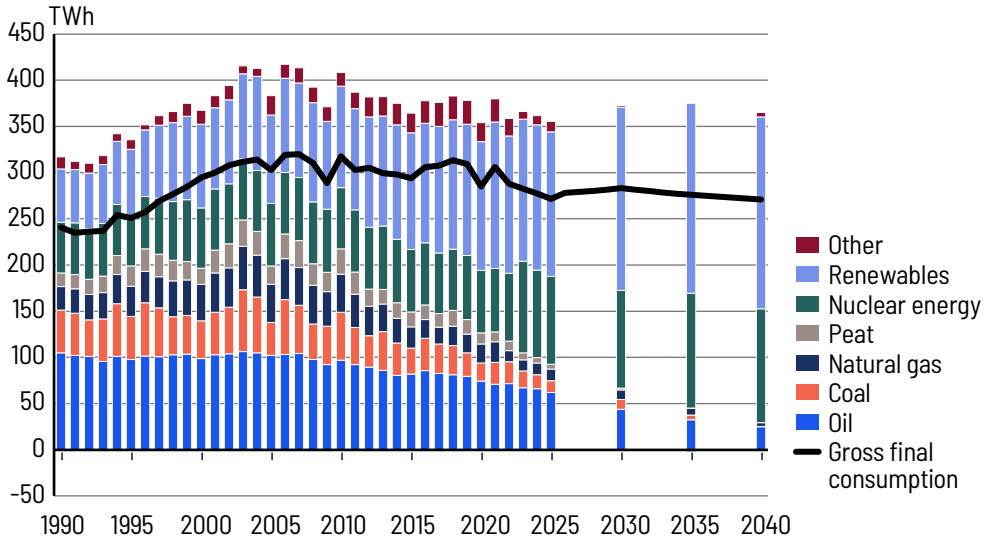


Table Annex 2-2
Primary energy by energy source and gross final energy in 2010, 2015, 2020, 2024 and in the WM projection for 2025, 2030, 2035 and 2040 in TWh

	Historical				WM projection			
	2010	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
	TWh							
Oil	97.2	81.8	74.4	24.9	62.0	44.0	32.5	24.9
Coal	51.8	28.3	19.5	0.3	12.8	10.4	5.3	0.3
Natural gas	41.3	22.9	20.6	4.2	12.5	10.4	7.0	4.2
Peat	27.2	16.1	11.9	0.1	5.3	2.2	0.5	0.1
Nuclear energy	66.3	67.7	67.7	123.3	94.9	105.5	124.3	123.3
Renewables	109.9	126.3	139.2	207.5	156.6	198.3	205.7	207.5
Other	14.6	21.4	20.9	4.8	11.2	1.6	-2.2	4.8
Gross final consumption	317.7	293.9	285.0	271.0	271.6	283.2	276.0	271.0

The trend of replacing fossil fuels and peat with renewables and electricity is also clear in the district heating sector, as the Table Annex 2-3 illustrates. Especially the share of waste heat recovery as well as electric boilers are expected to grow rapidly in the coming years. Most of the increase is attributed to heat pumps and electric boilers, as almost all the waste heat streams that can be directly utilised are already harnessed. The table also presents the fact that the total district heat consumption, and therefore the energy sources, is in decline due to buildings' improving energy efficiency.

Table Annex 2-3
Energy sources of separate and CHP district heating plants in 2010, 2015, 2020, 2024 and in the WM projection for 2025, 2030, 2035 and 2040, in TWh

	Historical				WM projection			
	2010	2015	2020	2024	2025	2030	2035	2040
	TWh							
Fuel oils	3.2	1.4	0.7	1.4	0.3	0.2	0.2	0.0
Coal	14.0	11.6	6.8	3.0	0.9	0.0	0.0	0.0
Natural gas	22.7	10.8	8.0	3.6	3.3	2.3	1.0	0.0
Peat	12.3	8.6	7.3	3.3	3.4	1.4	0.3	0.1
Wood-based fuels	11.7	16.3	19.7	25.0	24.7	23.1	19.2	19.4
Other renewables [1)]	0.8	2.1	2.8	3.3	2.8	2.8	2.6	2.1
Other fossil fuels [2)]	0.8	1.8	2.4	3.0	2.6	2.5	2.3	1.8
Other sources [3)]	0.4	1.1	4.5	7.8	8.7	12.8	11.5	10.5

1) biogas, renewable part of waste
2) non-renewable part of waste
3) waste heat, electric boilers, includes both electricity and heat of heat pumps

As for electricity supply, especially the share of wind power is expected to grow even more rapidly than in the past (Table Annex 2-4). At the same time, the share of wood-based fuels will grow to some extent before starting to decrease after 2030. The need for electricity imports depends on many factors, but the annual net import should generally remain substantially lower than in the past, despite the continuously growing electricity demand that results from decarbonisation and electrification.

Table Annex 2-4
Electricity supply in 2010, 2015, 2020, 2024, and in the WM projection for 2025, 2030, 2035, and 2040, in TWh

	Historical				WM projection			
	2010	2015	2020	2024	2025	2030	2035	2040
	TWh							
Hydro	12.7	16.6	15.7	14.1	12.3	14.7	14.8	14.9
Wind and solar	0.3	2.3	8.2	21.2	23.1	41.7	55.2	62.3
Wood-based biomass	10.0	10.1	10.3	9.3	11.5	15.9	15.1	14.9
Other renewables [1)]	0.4	0.6	0.6	0.5	0.5	0.6	0.6	0.5
Nuclear	21.9	22.3	22.4	31.1	31.3	34.8	40.1	39.7
Oil	0.4	0.2	0.2	0.2	0.0	0.0	0.0	0.0
Coal	13.6	4.8	2.3	0.8	0.9	0.7	0.3	0.0
Natural gas	11.0	5.1	3.9	0.7	1.3	0.9	0.3	0.0
Peat	5.9	2.9	2.0	0.7	0.8	0.2	0.0	0.0
Others [2)]	0.7	0.9	0.9	1.0	0.5	0.6	0.5	0.4
Imports	10.5	16.3	15.0	3.2	5.6	0.0	0.0	0.0

1) mainly renewable part of waste
2) mainly fossil part of waste

Regarding the forest industry, the basis for the WM projection is the same as in the BTR1 but the latest market development, including some production capacity closures, has been taken into account. The total growth is modest as the production volumes of pulp, cardboard and sawn goods increase slowly and the volumes of other products, especially paper, continue to decline.

Nevertheless, the forest industry is both a significant energy consumer and an electricity and heat producer. Especially pulp mills produce large amounts of electricity and heat from black liquor, which is the main by-product from the kraft process, which digests pulpwood into pulp. In addition, biomass by-products from the forest industry, such as bark and sawdust from the mechanical forest industry, are utilised as fuels both in the forest industry and the energy sector. For example, these by-products amounted to approximately 18 TWh and black liquor to 39 TWh in 2024. At the same time, the total use of wood-based fuels in Finland was approximately 99 TWh.

Table Annex 2-5 shows historical and projected electricity consumption in the forest industry. The production volumes are included in the table listing LULUCF parameters (Table Annex 2-11a).

Table Annex 2-5
Electricity consumption of the forest industry in 2010, 2015, 2020, and 2024 (historical), and 2025, 2030, 2035, and 2040 (WM projection)

	Historical				WM projection			
	2010	2015	2020	2024	2025	2030	2035	2040
Electricity consumption, TWh								
Pulp and paper	20.2	17.5	15.2	13.1	13.6	16.0	16.1	15.5
Mechanical forest industry	1.6	1.4	1.4	1.4	1.5	1.7	1.6	1.6

The main volume of carbon capture is expected to occur in the forest industry in the form of BECCS (bioenergy with carbon capture and storage). The main source is the flue gases from wood combustion. In addition, the WM projection (see Table Annex 2-6) includes moderate amounts of waste-energy CCS (carbon capture and storage) from waste incineration and other CCS mainly from the process emissions from the cement industry.

Table Annex 2-6
Carbon capture and storage volumes and electricity consumption in 2025, 2030, 2035, and 2040 (WM projection)

	WM projection			
	2025	2030	2035	2040
Fossil CCS, Mt CO_2	0.0	0.4	0.6	0.9
Bio CCS, Mt CO_2	0.0	0.0	1.5	3.4
Waste CCS, Mt CO_2	0.0	0.2	0.6	0.6
Electricity consumption of all CCS, TWh	0.0	0.1	0.4	0.7

In the transport sector, greenhouse gas emissions are influenced by a decline in specific energy consumption and especially by replacing fossil fuels with alternative transport fuels. The WM projection's annual distribution obligation percentages, i.e. the minimum share of renewable fuels required in road transport fuel sales, for the share of biofuel for 2024 to 2030 are 13.5, 16.5, 19.5, 22.5, 31, 32, and 34 per cent (from 2030 onwards). Biogas and electric fuels are included in the distribution obligation from 2022 onwards and renewable electricity from public charging stations from 2025 onwards. In the WM projection, the bio-share of transport gas will remain at the current 99 per cent. The bio-share of gasoline will stay around the current 9 per cent. The bio-share of diesel will vary: it will rise at its highest to 38 per cent in 2030. The variation in the bio-share of diesel is due to the fact that the bio-share of gasoline is not expected to significantly grow from the current level due to engine standards, and biogas is already sold at the largest possible amount. Main assumptions for the transport sector are presented in Table Annex 2-8.

Table Annex 2-7
Energy sources in transport in 2010, 2015, 2020, and 2024 and in the WM projection for 2025, 2030, 2035, and 2040, in TWh

	Historical				WM projection			
	2010	2015	2020	2024	2025	2030	2035	2040
	TWh							
Gasoline, fossil	17.8	15.8	13.6	13.3	10.5	7.9	3.8	2.6
Diesel, fossil	27.1	23.4	24.5	21.6	23.0	14.4	10.7	7.2
Biofuels	1.5	5.8	4.7	5.9	5.6	9.0	6.1	4.1
Aviation fuels, fossil	1.6	1.2	1.0	1.1	1.3	1.5	1.5	1.5
Light fuel oil	1.7	1.6	1.3	1.1	1.5	1.3	1.3	1.2
Heavy fuel oil, gas, hydrogen	0.5	0.1	0.2	0.1	0.8	1.2	2.7	3.7
Electricity	0.7	0.7	0.8	1.5	2.2	4.7	8.0	10.6

In Finland, many rural municipalities have a declining population and urban populations have increased. The national transport forecasts, which the transport emission calculation system LIPASTO uses as one of the sources for data, takes into account the population projection by Statistics Finland (at municipality level), but not the shift in car ownership resulting from population shifts to urban centres. However, kilometres driven per vehicle is affected by urbanization in the forecast used in LIPASTO. LIPASTO itself is unable to take into account population changes for the time being.

Table Annex 2-8
Main assumptions for the transport sector

		Historical				WM Projection			
	Unit	**2010**	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
Number of vehicles – in total	**pieces**	**3,340,794**	**3,461,862**	**3,461,451**	**3,558,070**	**3,575,804**	**3,671,104**	**3,725,651**	**3,798,987**
Passenger cars	pieces	2,486,283	2,612,922	2,748,448	2,762,471	2,783,943	2,891,362	2,951,029	3,028,006
Vans	pieces	289,824	307,706	338,389	334,297	330,568	320,391	320,128	321,646
Buses	pieces	11,610	12,455	9,955	10,971	11,065	12,059	13,084	13,913
Trucks	pieces	94,334	95,250	94,691	94,081	94,256	94,914	96,660	97,123
Motorcycles, mopeds, 4-wheels	pieces	458,743	433,529	269,968	356,250	355,972	352,378	344,750	338,299
Passenger cars by operating forces									
Petrol and Diesel	%	100	100	97	89	86	67	44	25
Battery Electric and Plug-in Hybrid	%	0	0	2	10	13	32	56	75
CNG Gas and Flexible Fuel Vehicles	%	0	0	1	1	1	1	0	0
Hydrogen	%	0	0	0	0	0	0	0	0
Vehicle kilometres – in total	**Million kilometres**	**54,860**	**56,365**	**49,668**	**50,745**	**51,303**	**54,998**	**60,127**	**64,421**
Passenger cars	Million kilometres	46,245	47,355	39,092	39,609	40,127	43,641	48,548	52,696
Others	Million kilometres	8,615	9,010	10,576	11,136	11,176	11,357	11,579	11,725

The main assumptions for the F-gases are listed in Table Annex 2-9. More than 90 per cent of the emissions of F-gases originate from refrigeration and air-conditioning equipment. The single most significant emission source is commercial refrigeration. The sector comprises of refrigeration in food retail stores and professional kitchens. The most significant factor affecting the emissions of F-gases is the replacement of HFC refrigerants with natural refrigerants (carbon dioxide and hydrocarbons). By 2035, it is assumed that all the remaining HFC refrigerants will have been replaced by natural refrigerants in existing commercial refrigeration equipment. The replacement is assumed to be slightly faster with the additional measures.

Table Annex 2-9
Main assumptions for F-gases

	Historical				Projection			
	2010	2015	2020	2024	2025	2030	2035	2040
	%							
WM projection								
Share of centralized refrigeration systems with CO_2 or hydrocarbons annually in use								
in food retail stores	3	8	24	63	73	90	100	100
in professional kitchens	NO	NO	10	22	25	65	100	100

Source: Finnish Environment Institute

For agriculture, the development of livestock numbers has been estimated using the Dremfia agricultural sector model, which considers expected trends in domestic demand, the prices of agricultural inputs and outputs and agricultural policy. Slowly decreasing domestic demand for beef, pork and dairy products (observed 2018–2023) is expected to continue. This will result in a modest reduction in beef, pork and dairy products consumption per capita over 2020–2040, while poultry meat consumption is expected to increase slightly in the period 2020–2040. Consumption of cereals and grain legumes for food are expected to increase slightly over 2020–2040. These trends in food consumption have been discussed with stakeholders in earlier research projects[3]. Population will remain close to the 2020 level until 2040 despite a slight decrease after 2033.

Farm sizes and productivity are increasing in dairy cattle farming, which will see a large-scale shift from single dairy robot units to units of two or more robots between the 2020s and 2030s. Total milk production will slightly fall from the 2020 level by 2040, but the number of dairy cows will be reduced by approximately 14 per cent. Fewer cows will be needed to produce the same amount of milk because the average milk yield of dairy cows will increase in the future.

The development in the dairy sector will be reflected in the lower numbers of calves and heifers. Instead, the number of suckler cows will increase by about

[3] Lehtonen et al. (2020), for example

5,000 cows by 2035. Despite declining domestic beef production, relatively low beef prices compared with production costs and agricultural subsidies that are expected to remain unchanged will limit the potential for further growth in suckler cow production.

Production of pork and poultry meat, and hence also animal numbers, follow the trends of domestic food demand. Pork consumption is decreasing, but the annual consumption of poultry meat is expected to reach 150 million kilograms and remain at this level. It has been assumed that the number of sheep will remain the same.

In the Dremfia model, total fertilization, including synthetic nitrogen fertilization are determined according to nitrogen yield response and nitrogen and plant product prices. The amount of manure decreases as the numbers of farmed animals decrease. Hence, the amount of nitrogen input from the application of manure will decrease by 13 per cent between 2020 and 2040. Rising synthetic nitrogen fertilizer prices caused by rising fossil energy prices will reduce synthetic fertilizer application. Additionally, precision farming techniques will allow crops to meet their nitrogen requirements with lower amounts of nitrogen.

The total area of agricultural land will not change significantly by 2040.

Table Annex 2-10
Main assumptions for agriculture

		Historical				WM Projection			
	Unit	**2010**	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
Livestock									
Dairy cattle	1,000 heads	289	285	260	234	231	225	221	223
Non-dairy cattle	1,000 heads	636	630	587	560	565	548	547	540
Sheep	1,000 heads	126	155	140	115	134	134	134	134
Pig	1,000 heads	1,340	1,239	1,104	974	935	888	894	899
Poultry	1,000 heads	9,587	12,927	13,577	15,279	14,876	14,914	14,912	15,007
Nitrogen input from application of synthetic fertilizers	kt nitrogen	157	143	139	161	130	120	109	110
Nitrogen input from application of manure	kt nitrogen	72	76	73	66	60	60	61	63
Nitrogen in crop residues returned to soils	kt nitrogen	83	99	90	101	86	92	95	88
Area of cultivated organic soils	1,000 hectares	329	340	349	355	342	330	331	332

Source: Natural Resources Institute Finland

The main assumptions for the LULUCF sector are presented in Table Annex 2-11a, with additional information in Table Annex 2-11b. The assumptions are based on the KEITO scenario and subsequent updates to it.

Table Annex 2-11a
Main assumptions for LULUCF

	Unit	Historical				WM Projection			
		2010	2015	2020	2024	2025	2030	2035	2040
4.A Forest land									
Roundwood removals for energy use	1,000 cubic meters	7,734	9,186	10,308	12,134	10,125	10,125	9,478	9,478
Roundwood removals for non-energy use	1,000 cubic meters	51,957	58,849	58,546	62,564	64,136	64,136	63,890	63,890
Forest increment	1,000 cubic meters	106,400	106,220	103,200	103,200	105,089	105,089	102,136	102,136
Forest land remaining forest land	1,000 hectares	21,781	21,753	21,737	21,718	21,711	21,676	21,663	21,657
Land converted to forest land	1,000 hectares	163	134	117	115	122	162	177	183
4.B Cropland									
Cropland	1,000 hectares	2,358	2,351	2,358	2,382	2,384	2,380	2,393	2,405
4.C Grassland									
Grassland	1,000 hectares	172	169	170	175	176	178	174	173
4.D Wetlands									
Peat extraction sites	1,000 hectares	91	99	100	89	83	44	19	11
Other wetlands (managed)	1,000 hectares	2,879	2,864	2,856	2,856	2,854	2,849	2,845	2,842
4.E Settlements									
Lands converted to settlements	1,000 hectares	231	252	239	216	211	188	170	160
4.G Harvested wood products									
Production of sawn wood	1,000 cubic meters	9,257	10,474	10,807	10,963	11,720	11,969	11,969	11,969
Production of wood panels	1,000 cubic meters	1,264	1,246	1,137	1,267	1,064	1,071	1,073	1,074
Production of paper and paperboard	1,000 tonnes	8,640	8,556	8,182	8,519	9,480	9,426	9,426	9,426

Source: Natural Resources Institute Finland

Table Annex 2-11b
Main assumptions for LULUCF: Additional information

	Assumption
Forest	
Roundwood demand	Based on production volumes of different branches of the forest industry and roundwood imports
Energy wood demand	Based on the development of the energy sector and energy wood imports
Wood imports	Imports from Russia are mainly substituted by domestic harvest
Wood prices	Average of 2014 to 2023
Costs of silviculture	Average of 2014 to 2023
Climate	The increase in temperature and CO_2 concentration has increased the increment of trees
Extended rotation periods	Extension of the recommended rotation periods by 10 years or of the target diameter by 2–3 cm, excluding forests prone to damage.
Maintaining higher stand density	Maintaining higher stand densities in Scots pine- and Norway spruce-dominated forests on mineral soils, with specified exceptions. Based on thinning regimes for extended rotation periods.
Climate actions in state owned forests	30,000 hectares of state-owned forest fertilised annually
Avoidance of remedial drainage	1,000 hectares less annually on drained most fertile and poorest peatland forests
Comprehensive peatland forest management, thinning from above	3,000 hectares annually on most fertile drained peatland forests
Ash fertilisation on peatland forests	11,000 hectares annually (an increase of 8,000 hectares)
Forest fertilisation on mineral soils	41,000 hectares annually (an increase of 18,000 hectares)
Increased volume of dead wood in commercially utilised forests	Increase of the number of retention trees left standing in connection with regeneration felling from 5 to 6.3 cubic metres per hectare
Rapid and efficient forest renewal	Immediate regeneration after regeneration felling
Agricultural lands	*For years 2025, 2030, 2035, 2040*
Raising the groundwater level in peaty agricultural land (grasslands) –30 cm	18 hectares annually
Paludiculture, groundwater level –30 cm	13 hectares annually
Paludiculture, groundwater level –5 to –10 cm	0.5 hectares annually
Perennial grasslands without tilling	2,000 hectares annually

Table Annex 11b Continued

	Assumption
Land-use change	
Afforestation of idle lands 2027–2029	3,000 hectares annually
Afforestation of low-yield arable land 2024 to 2028	1,800 hectares annually
Deforestation, from forest to arable land	Decrease of 900 hectares annually on organic soils and 800 hectares annually on mineral soils
Managed wetlands, peaty arable land to wetland (no longer in agricultural use)	633 hectares by 2025

The main assumptions for waste sector are listed in Table Annex 2-12. 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 (2,444 TJ). Several new waste incineration plants have been constructed in recent years, and in 2024 the incinerated amount outside the emissions trading sector was already approximately 18,200 TJ. The WM projection estimates the incinerated amount outside the emissions trading sector to remain approximately at the same level. Since 2017, there has been a comprehensive landfill ban on biodegradable waste and biodegradable waste can only go to landfills in waste batches (e.g. rejects) with a very low biodegradable fraction. In the WM projection it is assumed that 12 thousand tonnes of biodegradable municipal waste will go to landfills per year from 2025. The share of methane recovery from landfills in the WM projection is assumed to be around 20 per cent of the total methane generation for years 2025, 2030, 2035 and 2040. No new recovery plants are assumed, and no changes are assumed to the technical level of the plants' operation.

Table Annex 2-12
Main assumptions for the waste sector

		Historical				WM Projection			
	Unit	**2010**	**2015**	**2020**	**2024**	**2025**	**2030**	**2035**	**2040**
Municipal solid waste (MSW) going to landfills	t	1,092,684	316,346	14,988	7,746	12,000	12,000	12,000	12,000
Share of CH_4 recovery in total CH generation from landfills	%	28	28	20	16	20	20	19	19

For the projections, the division of emissions into those included in the EU Emissions Trading System (EU ETS) and those outside the EU ETS is based on a data set of greenhouse gas emissions covering 2005 to 2024 provided by Statistics Finland. The relative shares of EU ETS and non-ETS emissions to be used in the projections are set for the individual branches or categories and greenhouse gases and are listed in Table Annex 2-13. The individual shares are assumed to remain constant for each branch over time in the projections.

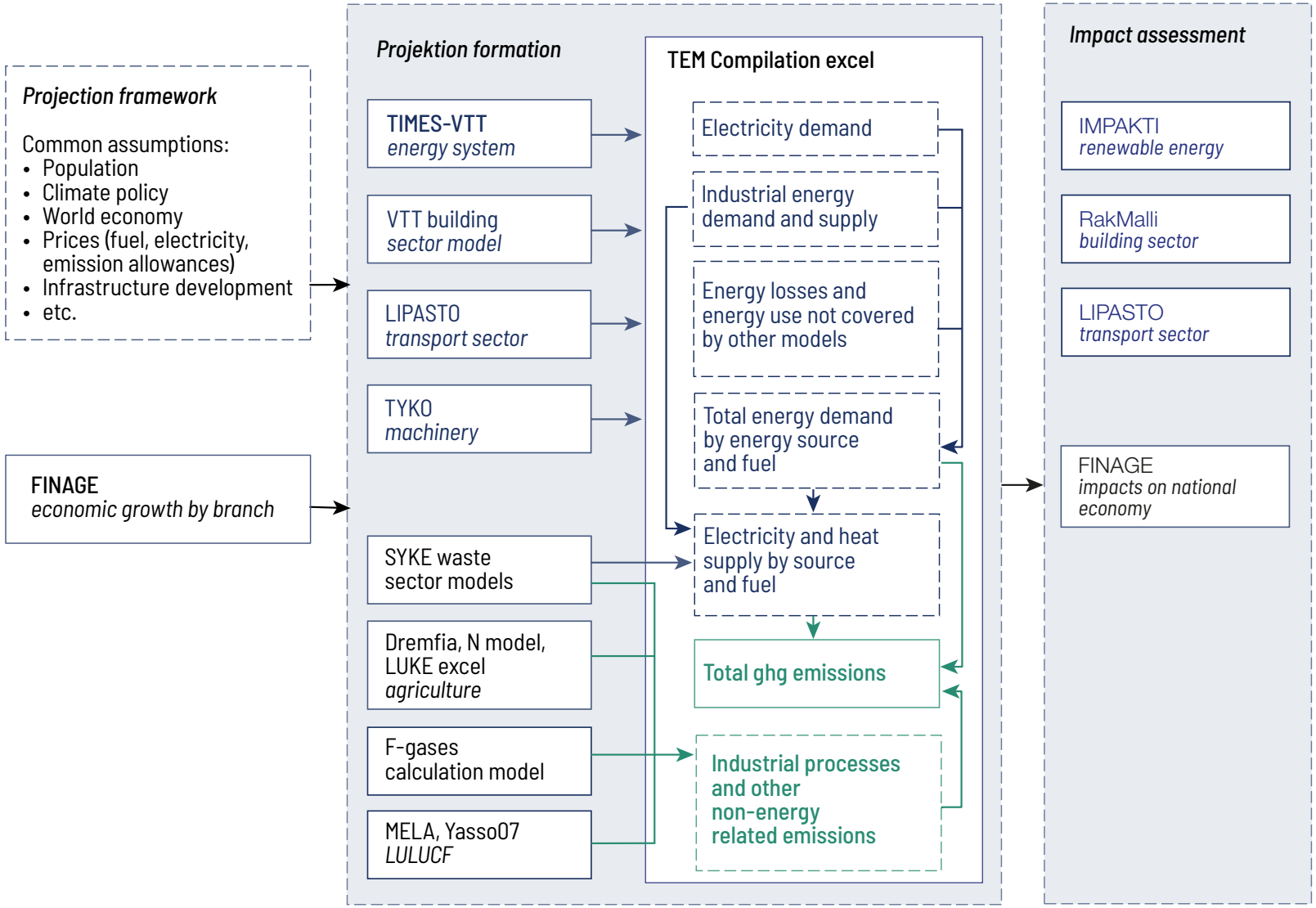
Table Annex 2-13
Projected EU ETS and non-ETS shares of GHG emissions.

CO_2 emissions	EU ETS	Non-ETS
	%	
Energy sector		
Energy industries excl. small plants	100	0
Energy industries, small plants	0	100
Waste incineration plants	0	100
Food industries and manufacture of beverages	51	49
Manufacture of wood and of products of wood	12	88
Manufacture of paper and paper products	93	7
Petroleum refining	98	2
Chemical industry excl. petroleum refining	81	19
Manufacture of non-metallic mineral products	78	22
Manufacture of basic metals, iron and steel production	100	0
Manufacture of basic metals, non-ferrous metal production	0	100
Other manufacturing industry	0	100
Civil aviation	99	1
Transport sector excl. civil aviation	0	100
Machinery	0	100
Building specific heating	0	100
Agriculture	0	100
Fishing	0	100
Other energy sector emissions	0	100
Fugitive emissions	90	10
Industrial processes		
Mineral industry	89	11
Chemical industry, hydrogen production	83	17
Chemical industry, production of phosphoric acid and other chemicals	0	100
Metal industry, iron and steel production	100	0
Other		
CO_2 captured	100	0
Liming	0	100
Other product and solvent use	0	100
Indirect CO_2 emissions	0	100
N_2O emissions		
Fuel combustion incl. transport and machinery	0	100
Nitric acid production	100	0
Manure management	0	100
Agricultural soils	0	100
Waste disposal and treatment	0	100
Other emissions	0	100
CH_4 emissions		
Fuel combustion incl. transport and machinery	0	100
Fugitive emissions	0	100
Enteric fermentation	0	100
Manure management	0	100
Waste disposal and treatment	0	100
F gas emissions		
F gas use	0	100

3 Description of models and methods

A fairly large number of models are applied for the preparation of the greenhouse gas emission projections and impact assessment of policy measures. The individual models that are essential to energy and greenhouse gas emission projections are described in the sections below. The relationship and data flow between the different models is shown in Figure Annex 2-2. Data from sector-specific models and studies are compiled by the Ministry of Economic Affairs and Employment in the module named "TEM Compilation excel". The same Excel spreadsheet is used to calculate the projected energy balances and greenhouse gas emissions of the industry and the electricity and district heat production. The methodology for this is presented below under the title "Energy demand and production".

Figure Annex 2-2
Schematic diagram of the relationship and data flow between the different models applied in the projections and impact assessment of policy measures.



Buildings

The development of the energy consumption of the building stock has been modelled in accordance with the Long-term Renovation Strategy (LTRS)[4], which follows the Energy Performance of Buildings Directive 2018 revision[5] and covers the 2020 existing building stock. The calculation of the goals of the LTRS and the data were created by VTT and Syke experts. To implement the strategy in Finland, three key actions were identified: 1) removal of buildings and improving spatial efficiency; 2) improvements in energy efficiency in connection with maintenance and repairs; and 3) ceasing the use of fossil fuels in heat production. The guidance of the Energy Efficiency of Buildings Directive (EPBD) applies to residential and non-residential buildings in permanent use. Leisure, agricultural, industrial and storage buildings are therefore excluded. With the recast EPBD (2024)[6], the LTRS has been updated through a draft of National Building Renovation Plan (NBRP)[7].

The energy consumption scenario for buildings considers climate change, the removal of buildings, development of heating methods, repair measures and maintenance to phase out the use of heating oil. The primary sources for the scenario are the data describing the building stock of Statistics Finland and energy certificates (defined by Ministry of the Environment Regulation[8]) of the register maintained by the Centre for State-Subsidised Housing Construction (Varke), which assumed the statutory duties of the former Housing Finance and Development Centre of Finland (ARA).

The removal of buildings has been modelled by examining the life cycle of the building stock based on building register data. Based on this information, the expected service life has been calculated for buildings of different ages. The development of the strategy's heating methods was modelled as part of the modelling project PITKO[9] based on the 2018 data by the Statistics Finland. The development of heating sources is based on the results of the TIMES-VTT optimisation model. The effect of global warming was considered in the strategy so that it reduced the heating energy demand of buildings and increased the cooling energy demand. The impact of repairs on the energy consumption of old buildings is based on energy efficiency improving measures in exterior envelope repairs and technical system repairs. The

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4 Finland's Long Term Renovation Strategy 2020–2050. https://ym.fi/korjausrakentamisen-strategia

5 revised Energy Performance of Buildings Directive (EPBD) (EPBD 2018/844/EU)

6 2024/1275/EU

7 Finland's National Building Renovation Plan (Draft) 2026. https://circabc.europa.eu/ui/group/8f5f9424-a7ef-4dbf-b914-1af1d12ff5d2/library/8e3241d4-748b-439d-a0c2-2b2a3dc5f358/details?open=true

8 1048/2017

9 https://urn.fi/URN:ISBN:978-952-287-656-0

calculation assumes that terraced houses and apartment buildings will phase out property-specific oil heating by 2030, and detached houses and non-residential buildings by 2050. It is assumed that fossil fuels and the electricity they consume will be replaced by heat pumps. An exception is the assumption of a small part of non-residential buildings to be heated by oil. It is assumed that this oil heating will be completely covered by bio-oil in non-residential buildings in 2050. The Government Regulation on energy subsidies for residential buildings from 2020 to 2022 has also been considered – it is assumed that a third of the energy savings will be realised as an improvement in structural energy efficiency, and two thirds through an increase in the use of heat pumps.

The methodology and modelling of the building sector projections described above have been used since the Fifth Biennial Report, including the BTR1. Earlier, the building sector projections were based on modelling by the Finnish Environment Institute.

The impacts of policies and measures in the WM projection were estimated using the RakMalli model. RakMalli is a renewed tool developed to replace the previously used EKOREM and POLIREM models. The model compiles official Finnish statistics from Statistics Finland as its primary data source and harmonizes them to represent the Finnish building stock, its energy consumption, greenhouse gas emissions, and their development over time.

The emission impacts of building-related policy measures have been evaluated using the RakMalli calculation model and information on the emission coefficients for district heating and electricity. The model calculates 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 or specific consumptions of energy, or the distribution of heating systems. Energy savings are converted into emissions reductions using a three-year rolling average emission coefficient in the case of district heating. When electricity savings are converted into emissions reductions, marginal emission coefficients are applied according to the year of commissioning.

One of the main purposes of the model has been to produce assessments for the climate and energy policy reporting that show how developments in Finnish climate policies have affected the energy consumption and the greenhouse gas emissions of the Finnish building stock. As the model utilizes official Finnish energy and building stock statistics, it is well suited for analysing the impacts of policy measures on emissions, the use of renewable energy resources and the division of impacts between the ETS and non-ETS sectors. In terms of calculation methodology, the renewed model RakMalli follows the principles of

the two modelling tools previously used in national communications, EKOREM and POLIREM, and it has been introduced in a phased manner.

The building stock is divided into building-type categories in accordance with the Building Classification 2018 used by Statistics Finland. Building stock data can further be divided into different age classes to better describe the methods of construction in different eras and to allocate the effects of building removal to the old, energy-inefficient building stock. Energy modelling of the building stock is implemented as a combination of a statistical overview and energy modelling. The background of the energy modelling is largely based on Finnish building regulations corresponding to different construction eras. The model includes a great deal of descriptive data such as U-values for structures for assessing insulation, technical specifications for ventilation, and information about electricity consumption. The model also includes heating system distributions for the different building types. These distributions and emission coefficients are used to determine greenhouse gas emissions for the studied building stock. In addition to analyzing energy consumption and greenhouse gas emissions, the model can be used to assess the energy saving and emission reduction potentials resulting from different policy scenarios. These scenarios may include building-related structural measures as well as changes in the structure of energy production.

Energy demand and production

The Ministry of Economic Affairs and Employment compiles the projections for energy production using demand projections for each sector as a basis. Except for the energy used by industry, households, and services, as well as the energy used for other smaller consumption purposes, the demand projections are produced by other organisations using the models described in this section. The energy demand projections for industry and services are determined by industrial production per product group (pulp and paper, basic metals), branch-specific economic growth (other industry, public, and commercial services), specific energy use trends, and expected energy efficiency improvements. The household projection is based on population and household forecasts. The demand projection assumptions are based on statistics, expert judgements, and surveys by consultants, research organisations, and branch organisations.

The global TIMES-VTT energy system model is the main tool for the energy system modelling. The energy needed from power and heat generation plants (main activity producer plants) is based on modelling the total electricity and heat demand, the calculated electricity and heat generated by the industry itself (auto-producer plants), as well as assumptions about electricity net imports. The model also uses information on existing and planned power plants and their possible dismantling and construction schedule, respectively.

The TIMES-VTT model has been developed by VTT Technical Research Centre of Finland Ltd, which also runs the model and produces projections and analyses for the ministry. 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. The model is based on the global ETSAP TIAM model, which was developed through international cooperation, building on the IEA ETSAP TIMES modelling system[10]. Methodologically, it is a so-called partial equilibrium model, which maximises the total economic surplus of consumers and producers.

The model includes detailed descriptions of both the current system of energy production and consumption and future technologies in terms of several different investment options. The TIMES-VTT model's extensive database contains a detailed description of the current energy system, including the energy production and distribution system, building stock, energy uses in housing and services, the stock of cars and other vehicles, processes and plants for manufacturing energy-intensive industrial products, other industrial energy end uses, as well as energy use in agriculture and forestry. The model database also covers estimates for energy system removals such as removals from energy production plants, buildings and vehicles. However, the largest part of the database naturally consists of technological descriptions of investment options and assumptions in future energy systems, including estimated trends in their costs and technical performance such as energy production efficiencies, service life, and usability. The model also depicts regional technical potential of energy commodities, the global fuel trade, and emissions trading, including trade in CO_2 transport and storage services. The TIMES-VTT model and its databases have been discussed in several scientific articles. Finally, energy sector CO_2 emissions projections are obtained by multiplying the fuel consumption of different fuels by the corresponding emission factors. Historical emissions and amounts of fuels are used to calculate CH_4 and N_2O emissions.

As for policy measures, the IMPAKTI calculation tool is used to calculate the emissions mitigation impact of measures that promote the use of different renewable energy sources. IMPAKTI calculates the emissions reduction for each energy source separately. The result covers the impact of all the policy instruments promoting the energy source in question. The tool does not separate the impact of single instruments, e.g. investment subsidy and information campaigns. The total impact of policies and measures promoting the use of individual energy sources is estimated based on energy production (wind power and biogas plants) or fuel use (forest chips) and the assumptions concerning the energy source that is being replaced by the renewable energy source. It is assumed that forest chips mainly replace peat in power and heat production and other fuels to a small extent. For agricultural farms, it is assumed that the use of forest chips replaces light fuel oil. For changes in

[10] https://iea-etsap.org/index.php/applications/global

district heating the average emission factor 85 t CO_2/GWh for all district heat in the last three years (2023–2025) is used.

It is assumed that the electricity produced by renewable energy sources (wind, photo voltaic, biogas) mainly replaces marginal electricity of the electricity market. The electricity supply has undergone a significant transition during the last 15 years and therefore the assumptions on marginal production used in previous reportings have been revised. The impact assessment is now based on a study by Sitowise Oy published in 2025[11]. Renewable energy installations taken into use 2016 or earlier are assumed to mainly replace electricity produced by condensing power plants using fossil fuels or peat and to a smaller extent other electricity generation sources and electricity imports. Installations taken into use in the years 2017–2023 are assumed to replace also CHP[12] to an increasing amount. From 2024 the emissions of electricity generation have been very low, and new installations are assumed to replace average generation. The emission factors used in the impact assessments are 600 t CO_2/GWh until 2016, 325 t CO_2/GWh for 2017–2019, 275 t CO_2/GWh for 2020–2023 and 31 t CO_2/GWh from 2024. In BTR1 and NC8 an emission factor of 600 t CO_2/GWh was used for all years.

Strengths of the IMPAKTI model include the strong methodological basis, consisting both of scientific knowledge and up-to-date understanding of the developments in the policy area, transparency owing to the relatively simple methodology and suitability to the national circumstances. A minor weakness of the model is the lack of a disaggregated impact by policy instrument. Due to strong interlinkages and overlapping effects of policies and measures promoting renewable energy, the approach used in IMPAKTI would not produce meaningful results for disaggregated policy instruments. The emission factors listed above are also used for assessing the mitigation impact of energy efficiency and energy savings measures.

Transport

The transport sector projections are compiled using the LIPASTO calculation system, which has also been used to estimate emissions for the greenhouse gas inventory. The LIPASTO calculation system includes five sub-models: LIISA for the road transport inventory; ELIISA for road transport projections; RAILI for the railway inventory; MEERI for the waterborne transport inventory; and TYKO for the non-road mobile machinery inventory. LIPASTO models are updated and compiled by VTT Technical Research Centre of Finland. Since 2022, the road transport projections have been calculated using a new stand-

[11] Sitowise Oy 2025. https://www.motiva.fi/wp-content/uploads/sites/2/2025/07/Vaikuttavuusarvioinnin-paastokerrointarkastelu-06-2025.pdf

[12] CHP=combined heat and power production

alone model called ELIISA, which is an upgraded version of its predecessor ALIISA. ELIISA computes the development of the vehicle fleet, kilometrage, consumption, and GHG emissions (includes CO_2, CH_4, and N_2O) until 2050. ELIISA considers all possible powertrain options for vehicles in Finland. The changes in the vehicle fleet are based on the estimated annual sales of new vehicles and imported vehicles and the vehicle scrappage rate. Fuel and energy consumption estimates are based on actual fuel sales.

The kilometrage projections for transport are based on the national projections modelled by Finnish Transport and Communications Agency. Since the national projection is produced only every four years, and road transport scenarios produced typically once a year, the national kilometrage projection is implemented through vehicles' average annual kilometrage (estimated per vehicle type, for passenger vehicles, also per powertrain, as in the national kilometrage projection). As vehicle fleet estimates change, road transport kilometrage estimates therefore also change and may not fully match the national projection.

The forecast for rail transport is based on the expert estimation of the development of diesel train transport volume (gross tonne kilometres). This development follows the national transport forecasts on transported tonnes by the Finnish Transport and Communications Agency Traficom. The developments in emission coefficients are based on expert estimates.

The projections for national waterborne transport have focused on experts' estimation of the development of port calls. These estimates have been updated based on Traficom's (Finnish Transport and Communications Agency) national transport forecasts. The future development of the emissions coefficients for waterborne transport is based on estimates and research results from other countries.

When impact assessments of individual policy measures are needed, the modellers usually first determine the effect of the policy measure on the input data for the previously mentioned models, such as the vehicle fleet, kilometrage or consumption. This can be based on separate studies, for example. Finally, the model is run with and without the changes to the input data to obtain the impact assessment.

Machinery

Emissions for machinery are estimated with the TYKO model which is part of LIPASTO (see under Transport above). TYKO is a deterministic model that gives results of emissions and the amounts of fuels used. The emissions for the following gases are calculated: carbon monoxide (CO); hydrocarbons (HC); nitrogen oxides (NOx); particles (PM); methane (CH_4); nitrous oxide (N_2O);

sulphur oxide (SO_2); carbon dioxide (CO_2). The period of the calculations is 1980 to 2040, and the model includes 50 types of machinery.

The calculation is based on the following key elements: performance and related emission factors (g/kWh); and fuel usage (g/kWh). For example, the method is widely used in the Nonroad model used by the US EPA (Environmental Protection Agency) and the CORINAIR Off-Road vehicle and Machines model. It has been adjusted for Finnish circumstances, e.g. the age and attrition of the machinery. The method is compliant with the "2006 IPCC Guidelines for National Greenhouse Gas Inventories" and the EMEP/EEA's "Emission Inventory Guidebook". Additional estimations are produced for policies when necessary to adjust for cross-sectoral effects.

The TYKO model has been the only machinery model of its kind in Finland and needs a renewal. The typical usage of machinery in different sectors is estimated based on secondary data; more research is needed to improve model assumptions, as usage of machinery is a key factor affecting the model's output. The model also needs technical improvements: the extension of the time series until 2060 and inclusion of CNG[13]-powered, hybrid, and electric machinery. As a result, Statistics Finland launched the emission calculation system reform project LIIKE, funded by the Ministry of Transport and Communications, the Ministry of the Environment and the Ministry of Finance. The LIIKE calculation system with its models is being updated and additional development in the Finnish Environment Institute is ongoing to include air pollutant assessments.

F-gases

The F-gas emission projections (including HFCs, PFCs, and SF_6) are prepared by the Finnish Environment Institute.

The total F-gas emission projections are sums of the subcategory emission projections. The F-gas emission categories are: refrigeration and air-conditioning equipment; foam blowing and the use of foam products; aerosols; electrical equipment; and grouped emission sources such as fixed firefighting systems and semiconductor manufacturing. The calculation model for F-gas emissions and emission projections in the refrigeration and air conditioning equipment category CRT 2.F.1 are part of the official Finnish GHG emission inventory reporting system. The model has 15 different subcategories (equipment types), and the total F-gas emissions of category 2.F.1 are sums of the subcategory emissions. Each of the 15 subcategories is linked to one of the six 2.F.1.a–f reporting categories in the GHG inventory reporting under the UNFCCC and Paris Agreement. The model covers the years 1990 to 2055. The

[13] compressed natural gas

emissions estimation methodology in the model is the Tier 2 emission factor approach of the 2006 IPCC Guidelines (Volume 3, Section 7.5, see also Finland's National Inventory Document, Section 4.7.2.2).

Emission projections of F-gas categories other than refrigeration and air-conditioning equipment (CRT 2.F.1) are calculated in separate simplified Excel spreadsheet calculation modes and are based on the calculation spreadsheets used in GHG emission inventory reporting.

The modelling builds on aggregating information for the F-gas categories, and there are therefore only limited opportunities to project the detailed effects of individual policy measures in terms of emissions reductions.

Agriculture

An economic model and several greenhouse gas calculation models were used to compile the projections for the agricultural sector (CH_4, N_2O), which the Natural Resources Institute Finland has prepared.

Future agricultural production volume and intensity was estimated using the Dremfia agricultural sector model, which considers the prices of agricultural inputs and outputs and agricultural policy. The model has frequently been used to evaluate the impacts of agricultural and agri-environmental policies. The model has therefore also been continuously updated and revalidated based on the available statistical information about input and output prices, food consumption, use of inputs, production, land use, and productivity in agriculture[14]. The parameters and principles of agricultural policy have been updated annually, as well when necessary. The results from Dremfia were fed into the calculation models, which are used for the greenhouse gas emission inventory (see the Finland's National Inventory Document for details). Dremfia produced most of the input data for the greenhouse gas modelling: the area of cultivated farmland; the use of mineral fertilisers; and the numbers for the most important animal species in agriculture. In addition, the development of some variables (not included as such in the Dremfia model) in the future was estimated using expert judgements, including the area of organic soils, the allocation of manure to different manure management systems, cattle weights and nitrogen excretion of animals. It was assumed that the number of horses, sheep, fur animals, reindeer, and turkeys would remain stable.

[14] Lehtonen et al. 2018, Koljonen et al. 2024

Strengths and weaknesses of the Dremfia model can be summarised as follows:

Strengths: Regional disaggregation of the model is well suited for analyzing effects of agricultural policy; The data of the model is carefully selected from official statistics and research data so that the model includes relevant country specific bio-physical and economic relationships. The model produces development paths at annual time steps up to 2055. The model allows simultaneous imports and exports of the same commodity[15]. The food consumption per capita and the total consumption in the model follows the observed reality well. The model includes endogenous technological and structural change of dairy sector which accounts approximately 50 per cent of the value of production. This means that the model considers economic factors such as input and output prices, on structural change of dairy farms. Flows of nitrogen and phosphorous represent the production practices and intensity observed and thus they are very close to published studies on nutrient balances.

Weaknesses: Annual weather anomalies, which may significantly affect farmers' crop cultivation decisions and regional crop areas, are not explicitly taken into account in the model validation. In addition, crop area allocation is somewhat sensitive to exogenous EU prices due to the profit-maximisation assumption. Therefore, the modelled areas of individual crops do not necessarily match the observed areas in each year, while the total areas of cereals, other crops and grasslands are close to the observed levels over five-year periods. Almost entirely exogenous food demand per capita, due to exogenous demand trends while only deviations of only few percents are allowed from the given trend value, rules out any large changes in the consumption of agricultural products (through consumer behaviour) because of price shocks. Such shocks, however, have been observed to cause relatively small effects on food consumption. Fully exogenous farmland area per region do not consider any long-term changes in land use, e.g. lost farmland due to urban expansion, or clearing forest land for agriculture. Adding new products to the model requires a lot of data and validation work. The model excludes horticulture, reindeers, fur animals, horses, lambs and goats which however have a marginal impact on agricultural GHG emissions in Finland.

The method and assumptions were the same as in BTR1. The method makes it possible to consider all measures that are related to agricultural policies, and it produces time series that are consistent with the reported emissions.

[15] Armington assumption

Waste

The Finnish Environment Institute calculates the projections for the waste sector. The waste scenarios are based on statistics and modelling following IPCC guidelines. The projection tool is thus primarily an emissions calculation model, which is complemented by expert judgements on how rapidly the measures will affect the waste sector. The same basic modelling tool has been used for previous national communications and the BTR1.

The projection calculations are based on assumptions concerning developments in the amount of waste related to population projection and the rate at which different waste treatment facilities are introduced. The modelling deals separately with solid municipal waste, municipal sludge, industrial sludge, industrial solid waste, and construction waste. Different treatments are considered separately (landfilling, biological treatment, incineration, recycling). Emissions from wastewater treatment, composting, and anaerobic digestion are dealt with separately, and me-thane collection from landfills is also considered. CH_4 and N_2O emissions are treated separately. After the waste amounts have been defined, the greenhouse gas emissions are calculated according to the IPCC guidelines and the methods used in the Finnish inventories.

The modelling builds on aggregated information for the waste sector, and there are therefore only limited opportunities to project the detailed effects of individual policy measures in terms of emissions reductions. There has thus far been only limited information about the costs and benefits of the measures included in the analyses. There are no direct overlaps with projections from other sectors, as the projections of the waste sector do not include emissions from waste incineration, which are reported in the energy sector.

LULUCF

The LULUCF projection is a compilation of the projections for different land-use categories and harvested wood products (HWP). Projections are prepared for forest land, cropland, grassland, wetlands, and settlements. The emissions (CO_2, CH_4, N_2O) and removals (CO_2) are estimated and calculated using several models and GHG inventory calculation procedures modified for projections. Natural Resources Institute Finland has prepared the projection.

To produce the emission projections, areas for each land use and land-use change category were estimated applying trends and averages in land-use changes based on historical GHG inventory data complemented by the policy targets – for example, the increase in afforestation. The land-use input from the agricultural and energy sectors was considered. The area required for

peat extraction was based on peat consumption for energy derived from the TIMES-VTT modelling for an earlier KEITO-WEM scenario. The land-use change categories of former peat extraction areas were mainly based on the previous scenario work as well. Similarly, the land areas required for the construction of wind power and solar-power plants were retained from the earlier scenario. The applied method is developed for the LULUCF projection work.

The development of forest resources was estimated using MELA2016[16]. The modelled results on tree biomass stocks, harvest volumes of commercial timber and energy wood, and natural mortality were used to estimate carbon stock changes in living tree biomass. Roundwood demand was determined from the wood consumption and production volumes of the forest industry. The demand for and consumption of household wood energy were derived from previous results of the TIMES-VTT energy system model (the KEITO-WEM scenario), whereas the demand for and consumption of forest chips in heat and power plants were based on expert assessments informed by scenarios developed by Finnish Energy. The MELA model also provided the input data for the Yasso07 soil model[17] (modelling carbon stock changes in mineral forest soils) and CO_2 emission calculation for drained peat forest soils. These methods are the same as used in the GHG inventory. N_2O and CH_4 emissions from soils were also calculated using the GHG inventory methods.

MELA has a long development history, starting with being an analysis tool for wood production potential. It is currently a tool for forest resource modelling, used for policy support and decision making at national and regional levels. The MELA programme has two parts: 1) an automated stand simulator based on individual tree growth and development models; and 2) an optimisation package based on linear programming. National forest inventory data are used to establish the initial state for the modelling. It is possible to incorporate climate scenarios into the programme. For these projections, the effects of changes in historical long-term temperature and CO_2 concentration on the increment of trees are included. MELA is developed for Finnish conditions and uses several country-specific models applying Finnish forest management recommendations. Compatibility with the historical GHG inventory data has improved through the KEITO project. However, because MELA is based on optimisation, predicted carbon sinks may exceed those achieved in practice.

The projections for cropland and grassland were produced with the GHG inventory methods, including the use of the Yasso07 soil carbon model for mineral croplands. The Dremfia agricultural sector model provided input data for the modelling. For some new policy measures which are not yet included in the GHG inventory, either national research-based or IPCC emission factors were used. This applies mainly to new measures for agricultural land. Yasso07

[16] Hirvelä et al. (2017)

[17] See Finland's National Inventory Document 2026 for Yasso model description

is a dynamic model for cycling the organic carbon in mineral soils. The model was applied for forest land, cropland, and land-use transition areas in the same way as in the GHG inventory.

The HWP projection was estimated with a model modified from the production-approach-based GHG inventory HWP model (see National Inventory Document, Section 6.11). The assumed production of the forest industry was an input to the model.

Many policy measures in the LULUCF sector affect each other and span across multiple land use categories, but it is not feasible to model an entire LULUCF sector projection for each individual measure. Therefore, methods for assessing impacts of individual measures have been developed in separate studies, using partially different models than in the scenarios. For example, for the impact assessment of afforestation and increased fertilization, the growth of the tree stand was modelled with MOTTI, which is an alternative to MELA. Other climate actions, such as new measures on peatland fields, were assessed in the same way as in the scenarios, using country-specific or IPCC emission factors.

Economic effects

FINAGE is a dynamic applied general equilibrium (AGE) model of the Finnish economy. FINAGE is based on the MONASH model[18] developed at the Centre of Policy Studies of the Victoria University in Australia. MONASH-style models are used in countries ranging from China and South Africa to the United States and Australia. In Europe, models based on MONASH have been developed for Denmark, Finland, and the Netherlands. VATTAGE, a precursor of FINAGE, is described in detail in Honkatukia (2009)[19].

Several factors explain the popularity of MONASH. The main ones are the advanced and user-friendly software packages that facilitate data handling and the setup of complicated policy simulations, which also allow a very detailed post-simulation analysis of simulation results. MONASH-type models are also very adaptable to analyses of different types of policies and different timeframes. In a forward-looking policy analysis, MONASH-type models offer a disciplined way to forecast the baseline development of the economy. Last, but not least, they also allow the user to replicate and explain the historical development of an economy in greater detail, which is not true of most AGE models.

In FINAGE, there are normally three types of inter-temporal links connecting the consecutive periods in the model: (1) the accumulation of fixed capital; (2)

[18] Dixon & Rimmer (2002)

[19] Honkatukia 2009

the accumulation of financial claims; and (3) lagged adjustment mechanisms, notably in the labour markets and for balancing the public sector budgets. Together, these mechanisms result in gradual adjustments to policy shocks to the economy. In the model, capital is sector-specific, which means it takes time for an industry to adjust to the changes in energy costs caused by emissions trading and energy taxes. In energy-intensive industries, a rise in energy costs lowers the return on capital, which slows down investments until a new equilibrium is reached. In other industries, similar effects are caused by a rise in domestic energy taxes. However, some industries gain from the subsidies granted to renewable energy, and even in energy-intensive industries, subsidies can dampen the rise in costs if they can substitute renewable energy for fossil fuels. The model assumes sluggish real-wage responses to policy shocks. Real wages will adjust sluggishly to deviations from the expected equilibrium wage growth, with the result that in the short run, adjustments will occur partly through increased unemployment levels. In the long run, wages will adjust fully to one-off shocks, and full employment will be restored. However, in the case of gradually tightening emissions targets, the shocks are not one-off, implying sustained above-equilibrium unemployment rates.

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Annex 3
Reasons for not reporting expected emissions reductions for certain policies and measures

Policy measure	Explanation
Implementation of the EU Emissions Trading System in Finland	Complexity. Long-term measure impacting investments and energy use throughout the energy sector and industrial processes. Overlapping with and complementing other PaMs.
Energy taxation	Estimating the emissions reduction potential of energy taxation reliably is extremely difficult. There are numerous overlapping factors into demand for different fuels of which taxation is one. Therefore, its individual impact is difficult to estimate separately.
Promoting offshore wind power	Emission reductions not reported due to high uncertainties.
Incentive for biogenic carbon capture and storage or utilisation	Emissions reductions not reported due to missing data and complexity.
Nearly zero-energy regulation	By 2040, most of the new buildings are already expected to comply with the standard, meaning the regulation's additional impact would be minimal and difficult to separate from other overlapping measures.
Act on energy certificates for buildings	It is impossible to separate the impacts of the Act on energy performance certificates for buildings from other policy measures. The impacts of the minimum requirements are allocated to the effectiveness of building regulations and some part of the impacts have been assessed as part of the fiscal policy measurements.
Revision of the Land Use and Building Act regarding renovation of buildings	No methods or data to assess the impacts.
Increased tax credit for household expenses to replace oil heating	The emission reduction impact of tax credit is difficult to estimate due to overlapping policies independently from other policies.
Land-use planning	The long-term impacts of land-use planning are subject to significant uncertainties, including evolving urban development patterns, policy changes, and economic factors, which challenge reliable projection beyond the near-term horizon.
Information dissemination and campaigns targeted to residents and other users of buildings	No methods or data to assess the impacts.

Policy measure	Explanation
Long term planned real estate maintenance	No methods or data to assess the impacts.
Car tax and vehicle tax	Not estimated due to interplay between many factors.
Changes to taxable values of employer-provided commuter tickets and bicycles	The impact is difficult to estimate as there has been no studies of the impact of these changes. However, the impact on GHG emissions is probably very small.
Conversion subsidy for passenger cars	Conversion subsidy was in use 2018–2022 and 2024, and total emission reductions have not been estimated.
Support for charging stations and biogas and hydrogen filling stations in road traffic (auction)	The measure complements other PaMs, individual impact not possible to specify.
Extension of temporary reduction of taxable values of company-car benefit for battery electric vehicles	The PaMs impact has not been estimated. However, the impact of the measure is probably extremely small in absolute terms, but the exact quantitative impact is hard to quantify due to overlapping policies and uncertainty of measure.
Energy Efficiency Design Index (EEDI) for new ships	The PaM concerns mainly international transport, therefore a national assessment is not available.
Energy Efficiency Existing Ship Index (EEXI)	The PaM concerns mainly international transport, therefore a national assessment is not available.
IMO data collection system (DCS)	The PaM concerns mainly international transport, therefore a national assessment is not available..
Implementation of Alternative fuels and Sustainable Aviation Fuels (SAF) in air transport	The PaM concerns mainly international transport, therefore a national assessment is not available.
Implementation of Aviation Emissions Trading	The PaM concerns mainly international transport, therefore a national assessment is not available.
Implementation of Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)	The PaM concerns mainly international transport, therefore a national assessment is not available.
Implementation of Maritime Emissions Trading	The PaM concerns mainly international transport, therefore a national assessment is not available.
Improved regulation of the development of major retail centres	The PaM concerns near-term effects, where available data and assumptions are more reliable.
Maritime Transport MRV Regulation	The PaM concerns mainly international transport, therefore a national assessment is not available.
Uptake of alternative fuels in maritime shipping	The PaM concerns mainly international transport, therefore a national assessment is not available.
Operational carbon intensity (CII)	The PaM concerns mainly international transport, therefore a national assessment is not available.

Policy measure	Explanation
Promoting regional public transport and demand-responsive transport	The measure has evolved during the preparation process to the extent that the original impact assessments no longer reflect the measure in its current form, and therefore an updated impact assessment is not available.
Tax deductions for clean investments	Estimating the emission reductions are difficult as the impact of the deduction on investments is highly uncertain. In addition, there are also overlapping policies.
Food loss and food waste	Assessment not available due to limited resources.
Programme for Organic Production 2030	Assessment not available due to limited resources.
Action plan to Reduce Ammonia Emissions from Agriculture in Finland 2021-2027	The action plan concerns the reduction of ammonia emissions from agriculture. The plan is valid until 2027, so the reduction in ammonia emissions has been estimated for this year. More detailed information on emission reductions can be found on page 31 of the action plan https://julkaisut.valtioneuvosto.fi/handle/10024/163564
Implementation of the Nitrates Directive (1991/676/EEC)	The impact of the Nitrates Directive on greenhouse gas emissions has not been assessed. The greenhouse gas emission impact comes through the restrictions/maximum amounts on fertilization.
Real estate composition of fields	Climate impact of this PaM has not been estimated.
Reducing methane emissions from dairy cows through feeding	When we prepared the BRT1, we did not have this information available.
Gender-selected semen	Assessment not available due to limited resources.
Age structure of cattle	Assessment not available due to limited resources.
Nutrition recommendations	Assessment not available due to limited resources.
Promoting agroforestry	Assessment not available due to limited resources.
Public food procurement	The measure complements other PaMs, an individual impact not possible to estimate.
National Food Strategy 2040	The measure complements other PaMs, and an individual impact not possible to estimate.
Voluntary carbon markets	Assessment not available due to limited resources.
Fixed-term act on the financing of sustainable forestry 71/2023	Climate impact of this PaM has not been estimated due to multiple measures related to this PaM. Financing aims for multiple benefits and purposes including climate.
National Forest Strategy 2035	The measure complements other PaMs, and an individual impact not possible to estimate.
Other non-quantifiable measures to improve carbon sequestration in the land use sector	Not estimated due to complexity. Consist of multiple non-quantifiable measures.

Policy measure	Explanation
Prevention of forest damage and adaptation to climate change	Assessment not available due to limited resources.
Accelerating reforestation, maintaining higher stand densities, and extending rotation periods	Assessment not available due to limited resources.
Voluntary carbon markets / EU CRCF regulation	Assessment not available due to limited resources.
Aid scheme for afforestation	Assessment not available due to limited resources.
Roots in Data Programme	Assessment not available due to limited resources.
Promoting the use of wood in construction	Assessment not available due to limited resources.
Voluntary nature credit markets	Assessment not available due to limited resources.
Waste tax act amendment	Estimating the emission reductions is difficult as the impact of the deduction on waste emissions is uncertain. In addition, there are also overlapping policies.
Waste Act amendment Decree on waste, amendment	Details of the planned amendments are not yet available.

Annex 4
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