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INTEGRATED REPORTING ON GREENHOUSE GAS POLICIES AND MEASURES AND ON PROJECTIONS

under article 18 of Regulation (EU) No 2018/1999 of the European parliament and of the Council Decision on the Governance of the Energy Union and Climate Action

FINLAND

CONTENTS

1 INTRODUCTION

As a member of the European Union, Finland has reporting obligations regarding integrated reporting on greenhouse gas policies and measures and on projections under Article 18 of the Regulation (EU) 2018/1999 and articles 36, 37 and 38 of Commission implementing Regulation (EU) 2020/1208. By 15 March 2021, and every two years thereafter, Member States shall report to the Commission information on their national policies and measures or group of measures and their national projections of anthropogenic greenhouse gas emissions by sources and removals by sinks.

Finland's 2025 reporting on the policies and measures and projections comprises of following data and information submitted through the Commission´s online tool in the Reportnet 3 portal:

- this textual report (pdf file)
- information on implemented, adopted and planned policies and measures (PAM web form)
- national projections of greenhouse gas emissions (excel file)
- description of National Systems for Policies and Measures and Projections (web form)
- Model Factsheet (excel file)
- other tables specified in Annex XXV in the Implementing Regulation (EU) 2020/1208.

From 2023, the Member States have also reported the progress of the other four dimensions of the Energy Union in accordance with the Governance Regulation. That part of the integrated national energy and climate progress reporting is submitted through the ReportENER portal.

Information provided on greenhouse gas emissions and trends in this report is consistent with the information in Finland's greenhouse gas inventory submission to the EU on 15 January 2025[1]. Statistics Finland is responsible for greenhouse gas emissions inventory reporting. 2022 is used as reference year for the projections. The warming potential of different greenhouse gases is translated into carbon dioxide equivalents using global warming potential (GWP) factors according to the IPCC's Fifth Assessment Report (AR5).

End of June 2024 is the cut-off date between existing measures and additional measures. Climate and energy policies and measures that have been implemented or adopted by June 2024 are included in the "With Existing Measures" (WEM) projection provided that necessary information on the impact of the measure is available. No "With Additional Measures" (WAM) and "Without Measures" (WOM) projections are presented.

In Finland, the policies and measures to reduce greenhouse gas emissions as well as mitigation and adaptation objectives and actions are largely defined in national, governmental, regional and/or sectoral strategies, programmes and plans. The concrete climate and energy policy measures that are presented in the integrated reporting on greenhouse gas policies and measures and on projections, and discussed

[1] Finland's preliminary greenhouse gas inventory submission to the EU 15.1.2025 (preliminary data), https://stat.fi/tilasto/khki

in more detail in this report, are largely based on Finland's latest National Climate and Energy Strategy, the second Medium-term Climate Change Policy Plan and the Climate Plan for the Land Use Sector, all of which were finalized in 2022. In addition, the reporting includes new policies and measures adopted by the EU and by the current Government, in office since June 2023.

Chapter 2 provides information on implemented, adopted and planned policies and measures. Projected greenhouse gas emissions as well as sensitivity analysis of the projections are presented in Chapter 3. The methodology for preparing the projections is presented in Chapter 4. Information on updates of the Long-term strategy is presented in Chapter 5.

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2 POLICIES AND MEASURES

2.1 Background for the information provided

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. These agreements and targets drive the process of preparing the actual mitigation policies and measures and laying them out in different strategies.

The EU has set Finland a 2030 national target for reducing greenhouse gas emissions in the non-emissions trading sector by 50 per cent compared to 2005. At the same time, emissions from the land-use sector should be kept lower than the computational reduction in emissions from sinks.

Finland has also ambitious national climate targets. According to the national Climate Act, Finland aims to be climate neutral by 2035. A target to strengthen carbon sinks is also included in the Act. The Climate Act specifies three emission reduction targets: the aim is to achieve greenhouse gas emission reductions of 60 per cent by 2030, 80 per cent by 2040 and 90 per cent but aiming for 95 per cent by 2050 compared to the levels in 1990.

The mitigation actions presented in this Reporting are largely based on the latest National Climate and Energy Strategy, the second Medium-term Climate Change Policy Plan and the Climate Plan for the Land Use Sector, all of which were finalized in 2022. In addition, the Reporting includes new policies and measures adopted by the EU and by the current Government, which has been in office since June 2023.

The National Climate and Energy Strategy is an overarching energy and climate policy planning document that in addition to emissions reduction and increasing of carbon sinks includes other energy policy themes as well: renewable energy, energy efficiency, energy market, energy security and research, innovation and competitiveness. The Medium-Term Climate Change Policy Plan specifies the key measures for achieving the binding emissions reduction targets in the effort sharing sector by 2030. The purpose of the Climate Plan for the Land Use Sector 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.

End of June 2024 is used as the cut-off date between existing measures and additional measures. Climate and energy policies and measures that have been implemented or adopted by June 2024 are included in the "With Existing Measures" (WEM) projection provided that necessary information on the impact of the measure is available (see Section 3.1). At the time of writing, the Government is planning new policy measures compared to the measures in the WEM projection. These measures will be assessed and, whenever feasible, included in a new "With Additional Measures" (WAM) projection. The modelling process has already commenced but is not yet complete. Therefore, no WAM projection is available for this report.

Finland reports a total of 126 individual or groups of policies and measures in the PAM web form in the Reportnet 3 portal. Beginning from the 2023 Reporting, the PAM web form includes also measures that concern other dimensions of the Energy Union than decarbonisation. 115 of the reported measures have a direct climate mitigation impact. 95 of these are fully or mainly implemented, nine adopted, four have

expired but has still an emissions reduction impact, and seven are planned. The number of measures with decarbonisation impact in this reporting is roughly the same as in the 2023 reporting when there were 121 measures reported. Some regrouping of measures has been done for this reporting. In some cases, measures that have been implemented since the last reporting have now been merged with previous existing measures of the same type, and some measures have been removed since the last reporting. The number of measures itself gives no indication of the climate policy ambition level.

2.2 Mitigation actions and their effects

Finnish regulations, policies, and measures are strongly affected by the increasing number of directives, policies, and measures of the EU. This chapter provides information on the most important policies and measures related to the reduction of greenhouse gas emissions. Both existing and some planned measures are described although no WAM projection is presented. The mitigation actions, or policies and measures, and their effects are described by sector in the sections below and a summary of them is presented in the Reportnet 3 portal.

Finland is continuously seeking to improve 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. There are various reasons why it has not been possible to obtain estimates, such as complexity and the overlaps with other measures (for example, the EU ETS), the measure is still in a phase in which the details of implementation are unknown (for example, recently decided agricultural measures such as new types of animal feed), 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).

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 presumably somewhat on the low side.

The energy sector policies and measures are split under four headings. Section 2.2.1 presents all energy sector policies and measures except those targeted for the transport sector or related to taxes. Policies and measures in the transport sector are presented in Sections 2.2.2 and 2.2.3. Energy taxation and tax-related subsidies are described in Section 2.2.9.

2.2.1 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, over 40 per cent of which (including energy for transport) are domestic. The major trend is a steady increase in the use of renewable energy both in absolute and in relative terms. Direct governmental 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 and is still undergoing a significant turning point in the investment climate. It is illustrated by the ongoing boom in 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 recent 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, the greenhouse gas emissions are in practice reduced in two ways: 1) the primary energy consumption is reduced by cutting the end use or increasing the conversion efficiency in power plants; 2) fuels and energy use are shifted to alternatives with less emissions.

The main policies and measures in the energy sector include the EU Emissions Trading System (ETS), 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 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 WEM projection for the energy sector are described in more detail in the following sections. A list summarising the policies and measures can be found in the PAM web form in the Reportnet 3 portal.

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 take place 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 emissions from voyages within the EEA and 50 per cent of emissions from voyages between the EEA and third countries. The covered GHG gases are CO_2 and N_2O and PFC emissions from certain industries. For maritime, also CH_4 emissions will be covered as of 2026.

EU-wide, some 11,000 installations are included in the EU ETS of which over 500 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), 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 to their demand. Starting from 2026, free allocation will be gradually phased out for the less exposed sectors, with the exception of district heating. For the aviation sector, free allocation will be removed as of 2026.

In 2027, a new emissions trading system for buildings, road transport and additional sectors (ETS2) will start in the EU. The new ETS2 will be an upstream system where the entity who 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 yearly. For the final consumer of fossil fuel, the system will mean higher fuel prices beginning from 2027. The ETS2 is a complementary measure to reduce GHG-emissions in the ESR (Effort Sharing Regulation i.e. outside the current EU ETS) sectors. It is estimated that in Finland the new ETS2 would cover about 50 per cent of the total emissions from the ESR. 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 have an emissions reduction target and a cap for emissions as well. The cap will be first set for 2027 in the beginning of the year 2025, and it will be adjusted yearly by a Linear Reduction Factor of 5.1 per cent for the years 2024–2027 and then by 5.38 per cent for the years 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 that are 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 yearly reductions in later years when the prices for allowances are estimated to be higher.

Unlike the current EU ETS, the new ETS2 will not include free allocation and therefore all the emissions allowances are released to the market by auctioning from the beginning of 2027. The Commission and the Member States will jointly organize a tender for the organisation of the auctions.

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

Table 1. Greenhouse gas emissions in the emissions trading (ETS) sector and non-emissions trading sector in Finland in 2005, 2010, 2015, and 2020–2022, 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 not consistent 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	2021	2022
	million tonnes CO_2 eq.						
ETS	NA	35.3	41.9	25.3	19.6	20.3	19.0
of which energy	NA	30.5	37.7	21.5	16.0	16.4	15.4
industrial processes	NA	4.9	4.2	3.9	3.5	3.9	3.7
Non-ETS	NA	34.3	33.6	29.6	28.0	27.2	26.5
CO_2 emissions from domestic civil aviation	NA	0.3	0.2	0.2	0.1	0.1	0.1
Total	71.8	69.9	75.7	55.1	47.7	47.6	45.7

Due to a statistical difference between the greenhouse gas inventory and ETS data, sums may not add up.
Scope of the EU ETS in trading period from 2013 to 2020 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, an act prohibiting the use of coal in energy production from 1 May 2029 was enforced. The prohibition was estimated to reduce the use of coal by 3 TWh compared to market-based development without the prohibition. The avoided greenhouse gas emissions equal 0.65 million tonnes of CO_2 eq.

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 already by 2025.

Therefore, the Ministry of Economic Affairs and Employment opened a call for investment subsidies for projects accelerating the replacement of coal in energy production. In 2021, almost EUR 23 million was granted 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. Priority was given to projects based on technologies other than combustion. After these projects, the priority was given to combined heat and power production before separate heat production. Novelty and demonstration potential of the projects were also considered. After these projects are completed by 2025 at the latest, coal will be almost completely removed from the fuel mix in the energy sector.

Low-carbon roadmaps

In 2020, 14 Finnish sectors produced their own sectoral roadmaps, or pathways for the sector's decarbonisation. This work was updated in 2024, according to the statement of Government Programme of Prime Minister Orpo, which outlined that the sector specific low carbon roadmaps will be updated. 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 prepared the updated 2024 roadmaps on a voluntary basis and were responsible for funding the work themselves. Typically, sectors used consultants as support in the scenario work. The roadmaps include a comprehensive description of the current situation, an evaluation of emissions reducing 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 road maps 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 have been fast and surprising and underline the central role of clean energy in all roadmaps. In addition, they showcase that Finland's electricity demand will rise significantly compared to 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 educated workforce to go ahead with the green transition. The results of the roadmap project will be used as direct input for the government's climate and energy strategy, which is currently being prepared under the Ministry of Economic Affairs and Employment as well as the preparation of the industrial policy strategy equally being prepared by the ministry.

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 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 low emission pathways of sectors.

Roadmaps increase the commitment of sectors to emission reduction efforts and offer to 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[2]. More information on the roadmaps can be found in the webpages of the Ministry of Economic Affairs and Employment[3].

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 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, long history of building codes and regulations, the broad coverage of energy efficiency agreements (the first agreement period started as early as 1997; the third period, 2017 to 2025, is currently 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 efficient EU-wide measures.

Energy Efficiency Directive

The EU's Energy Efficiency Directive[4] (EED) has been implemented mainly with the Energy Efficiency Law, which entered into force at the beginning of 2015. 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 needed 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.

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[2] Summary of Sectoral Low-Carbon Roadmaps 2024, 30.10.2024. Publications of the Ministry of Economic Affairs and Employment 2024:46. http://urn.fi/URN:ISBN:978-952-327-845-5

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

[4] (EU) 2018/2002

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 1990's, the realised annual CO_2 emissions reductions have been declining and are estimated to be 0.15 million tonnes in 2025, and 0.09 million tonnes in 2040. Correspondingly the realised annual CO_2 emissions reductions related to mandatory energy audits are estimated to be 0.13 million tonnes in 2025 and 0.2 million tonnes in 2040. The great majority of the emissions reductions, around 95 per cent, is estimated to occur in the emissions trading sector due to the large share of electricity and district heat in energy savings. Buildings' energy use is discussed below in a separate section of this chapter.

The Energy Efficiency Directive (EED) Recast[5] (2023) has entered into force and national efforts are being carefully assessed to define and specify the policies and measures needed for the period 2021–2030. This work is being carried out by the Energy Efficiency Working Group 2023, appointed by the Ministry of Economic Affairs and Employment in May 2023. The group consists of representatives from different ministries with the support of a large group of sectoral experts. While the need for new measures is being assessed, the systematic work and effort to promote energy efficiency continues in Finland. Finland's next energy and climate strategy will be completed in spring 2025.

Voluntary energy efficiency agreements

Voluntary Energy Efficiency Agreements have played a central role since 1997 in increasing energy efficiency in Finnish energy policy. They cover industries, private services, and municipalities, as well as oil-heated buildings, well over 60 per cent of the total energy consumption in Finland. 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 have 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 is 8.1 million tonnes in 2025, and 9.6 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 are calculated based on assumptions that the current agreement period from 2017 to 2025 will continue.

Negotiations on a new agreement period of 2026–2035 have already started, aiming to seamlessly continue a new agreement period at the beginning of 2026.

[5] (EU) 2023/1791

Ecodesign and energy labelling

The EU Ecodesign Regulation[6] 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[7] 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, the consumption of energy and of other resources, thereby enabling consumers to choose appliances on the basis of their energy efficiency.

The ecodesign requirements for energy efficiency of energy using products are estimated to lead to 22.7 TWh annual saving of energy in 2030 corresponding to CO_2 emission reductions of 9.2 million tonnes of CO_2 eq. The estimation is based on the results from the Nordcrawl calculation tool[8] that has been developed for calculation of energy savings of ecodesign and energy labelling policies in the Nordic countries. Energy labelling has not been evaluated.

Renewable energy

Finland is one of the world's leading users of renewable energy sources. The recent development in the renewable energy sector has been very good and the trend is expected to continue. Finland has been able to increase its renewable energy target for 2030 significantly recently. 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 2022, the share of renewable energy sources increased to 48 per cent of final energy consumption. The growth of the share of renewable energy in recent years is mainly due to growth of onshore wind capacity. The capacity of onshore wind power has grown rapidly, from 2600 MW in 2020 to 8400 MW in 2024. The number of wind power (both onshore and offshore) and solar PV[9] projects at different planning stages is high.

The most significant part of the renewable energy supply comes from biomass, especially from the side-products of the forest industry (Figure 1). The remainder of the renewable energy supply comes mainly from hydro and wind power. The new capacity of onshore wind power is built market based. Solar PV is rapidly becoming market based. Offshore wind power is still facing some challenges with economic feasibility of the projects, but project developers show high interest towards offshore wind in Finnish sea areas. Finland has set a target of 62 per cent for the share of renewable energy (gross final consumption) in 2030, in compliance with the Renewable Energy Directive.

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

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

[8] 2024 Nordcrawl report (to be published) https://www.norden.org/en

[9] photovoltaic system

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 (e.g. wind power, wood chips, 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 the new electricity capacity is wind power, which is being built in Finland without state aid. Therefore, Finland has been able to phase out operating aid schemes and is not planning for new state aid auctions or other operating aid schemes.

Renewable energy is promoted through the Energy Aid Scheme which is an investment subsidy[10]. 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 will be EUR 14.1 million for small-scale projects. Finland is currently phasing out a separate funding for large-scale demonstration projects. However, decisions concerning the state budget are made annually.

Finland also allocated EUR 537.17 million of European Union Recovery and Resilience Funds to renewable energy, energy infrastructure and electrification projects. The sliding feed-in tariff system for the production of electricity from renewable energy sources came into force in Finland on 25 March 2011. The aid scheme concerns government support for electricity production based on wind power, biogas and small-scale 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 the aid for up to 12 years from the start of production.

In May 2018, Parliament approved the Act on the Amendment of the Act on Production Aid for Electricity from Renewable Energy Sources[11], 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 on the basis of 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 total of 1.4 TWh worth of annual electricity production.

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 compared to 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 emissions allowance and has thus been in decline since the beginning of 2018. When the price of the allowance is above EUR 23.7/CO_2 tonne, 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.

[10] Government Decree 262/2023

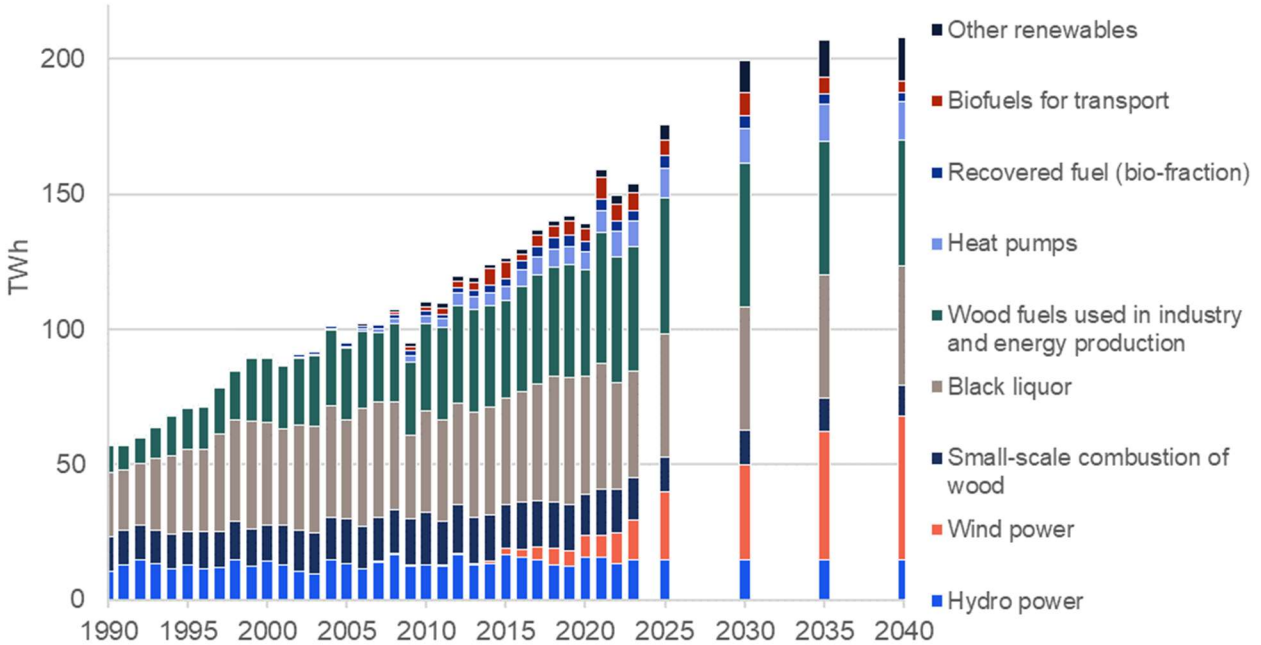
[11] Government Decree 441/2018

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. The production of renewable energy is generally promoted by streamlining the permit granting processes and speeding up the appeal proceedings. The most recently adopted policy measure is the Act on Offshore Wind Power in the Exclusive Economic Zone[12] which was approved in December 2024. The Act will help promote offshore wind power in the exclusive economic zone, clarify the regulation of offshore wind power projects within the zone and ensure that the rights to the exploitation of offshore wind power are granted in a fair, transparent and predictable manner. The new legislation will promote a predictable and encouraging operating environment as well as smooth project development and construction.

The effect of promoting wind power and solar PV on emissions has been estimated based on the assumption that wind power and solar PV reduce the need to produce electricity mainly in condensing power plants using fossil fuels and peat (for more information on the IMPAKTI calculation tool used to estimate the emissions reduction impacts of renewables, see Annex 3). Using a marginal emission coefficient of 600 t CO_2/GWh, the promotion of wind power and solar PV will reduce the emissions in 2030 by 19.7 million tonnes CO_2 and 3.3 million tonnes CO_2, respectively. The reduction will occur entirely in the ETS sector. The estimate includes the impact of all policies and measures promoting wind power and solar PV (including the impact of the feed-in tariff).

The historic use of and WEM projection for renewable energy in Finland is shown in Figure 1 and Table 2.

Figure 1. Historic development and WEM projection for renewable energy, TWh



[12] 937/2024

Table 2. Historic development and WEM projection for renewable energy, TWh

	Historical				WEM Projection			
	2010	2015	2020	2022	2025	2030	2035	2040
	TWh				TWh			
Black liquor	37.7	39.5	43.9	39.6	46	46	45	44
Wood fuels used in industry and energy production	32.3	36.2	39.1	46.5	50	53	50	46
Small-scale combustion of wood	19.2	16.2	15.3	15.9	13	13	12	11
Hydro power	12.7	16.6	15.7	13.3	15	15	15	15
Heat pumps	2.9	4.8	6.6	9.2	11	13	14	14
Wind power	0.3	2.3	7.9	11.6	25	35	48	53
Biofuels for transport	1.6	5.8	4.7	6.4	6	9	6	4
Recovered fuel (bio-fraction)	1.7	3.2	3.8	4.0	5	5	4	3
Other renewables	1.5	1.6	2.2	3.2	6	12	14	16
Total	109.9	126.3	139.2	149.6	175	199	207	208

Renewable energy policies and measures for the transport sector are described in Section 2.2.2.

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 use and maintenance of the building stock. In addition to policy measures in the building sector, energy use is affected by the EU emissions trading system ETS via changes in the prices of heat and electricity.

CO_2 emissions from the use of energy in buildings are mainly covered by the EU ETS. District heating is the source of almost half of all space heating in Finland. Most district heating production falls within the sphere of the EU ETS. The total space heating energy used in residential, commercial and public buildings was 75 TWh in 2022 (27 per cent of the total end use of energy in Finland). Approximately 28 TWh of the space heating belonged to the non-ETS sector in 2022.

Finland has some specific conditions in the heating and cooling of buildings. The most common heating source in Finland in 2022 was district heating (40 per cent of heat energy use). The second most common heating source in Finland in 2022 was electricity (22 per cent). The share of small-scale combustion of wood in heating energy consumption was 19 per cent. The number of heat pumps is increasing rapidly, especially in detached housing, and their share of heat energy use was 12 per cent in 2022. The use of natural gas in building-level heating systems is practically non-existent in Finland, but oil boilers were still quite common in 2022 (7 per cent). Demand for cooling remains low in Finland, but it is expected to increase due to climate change.

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 the energy efficiency of buildings. The directive was implemented in Finland by a regulation that came into force at the beginning of 2008. This legislation on the energy efficiency of buildings includes the following:

- Act on Energy Certification of Buildings
- The Ministry of the Environment Decree on Energy Certification of Buildings
- 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 to earlier requirements (2003) in December 2008 due to the implementation of the EPBD. The requirements were further tightened (by 20 per cent) in March 2011 due to the implementation of the Directive on the Energy Performance of Buildings Recast. 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 favors the utilisation of district heating and renewable energy in defining the overall energy performance of a building. 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 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, the energy performance certificates are needed when the building (or part of it, for example, an apartment) is sold or rented. The Housing Finance and Development Centre of Finland (ARA) is the administrative authority ensuring the quality of certificates and the qualified experts, and the appropriate preparation and use of the certificates.

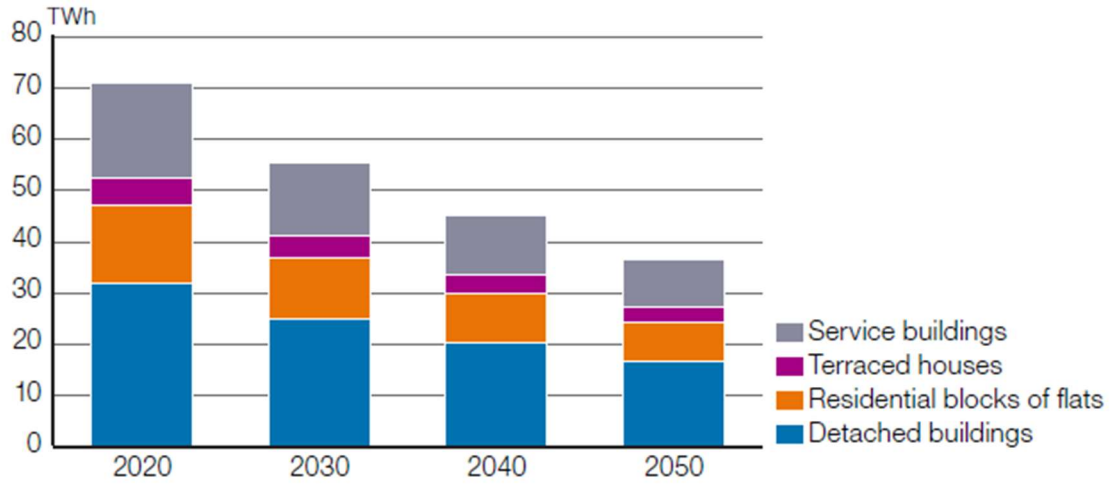
The regulation for the energy performance of new buildings entails about 6.3 million tonnes of annual emissions reductions of CO_2 eq. by 2030. Almost all the emissions reduction will take place in the EU ETS sector through the reduced use of electricity and district heat.

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 on 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, e.g. in repair, energy efficiency, and building maintenance issues.

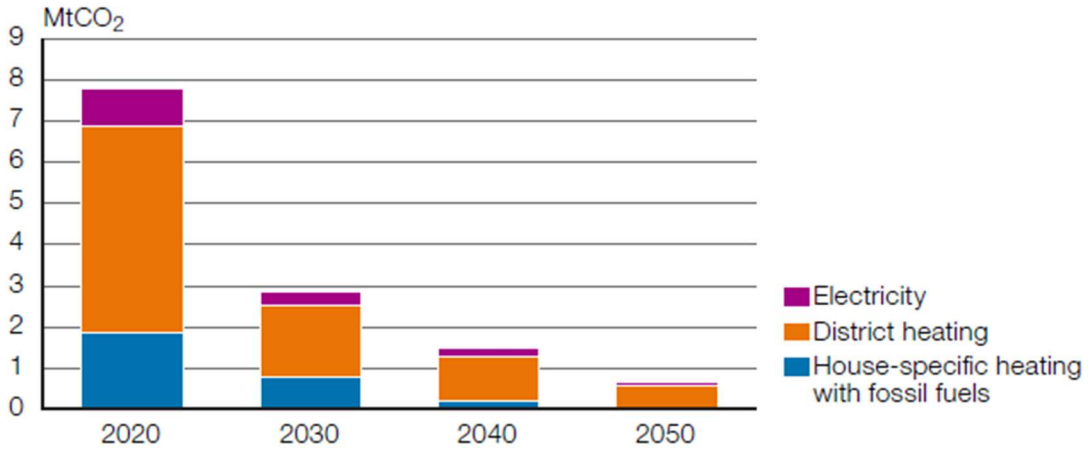
Finland submitted its Long-Term Renovation Strategy (LTRS) to the EU in 2020. It follows the EPBD 2018/844/EU revision and covers the 2020 existing building stock. The main goals of the strategy are to decrease the energy use of the existing building stock by 51 per cent by 2050 and the related CO_2 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 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, the phase-out of oil use in heating and related policies, as well as retrofitting subsidies are policy measures supporting the Finnish LTRS.

Figure 2. Heating and cooling use of buildings by building type, TWh



Source: Finland's renovation building strategy 2020–2050

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



Source: Finland's renovation building strategy 2020–2050

Due to the implementation of the Directive on the Energy Performance of Buildings Recast, the regulation for the energy efficiency of the existing building stock was put into effect on 27 February 2013. It is estimated that the emissions reductions due to improvements in energy performance in renovations and alterations will be 1.1 million tonnes of CO_2 annually in 2030. Most of the emissions reductions will take

place in the EU ETS sector. However, there are expected non-ETS emissions reductions from oil fuel boiler replacements, especially in detached houses.

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 2022, emissions from separate heating amounted to 1.9 million tonnes of CO_2 eq. In 2022, residential buildings accounted for 36 per cent of emissions from building-specific heating, commercial and service buildings for 42 per cent and agricultural buildings for 22 per cent. Emissions from building-specific heating have decreased by 55 per cent from the 2005 level.

Emissions are expected to decrease further as a result of 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. In 2027, a new Emissions Trading System for distributors (ETS2) will start in the EU (see Section 2.2.1 EU Emissions Trading System). ETS2 will significantly impact 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 summer 2022, the subsidy system for detached houses was extended to apply to phasing out natural gas heating, although its role is almost insignificant.

The subsidy for phasing out oil heating has significantly activated the replacement of heating systems. By August 2024, a total of 33,770 owners of detached houses had applied for aid for switching away from oil heating, of which more than 28,350 had received a favourable decision. A total of 1182 owners of detached houses had applied for grants for phasing out gas heating, of which 1083 had received a favourable decision. So far, when those who have received a favourable decision implement a heating method change, the estimated impact on annual emissions is approximately 0.19 million tonnes of CO_2 eq.

An alternative form of support for owners of detached houses to renew their heating system is income tax credit for household expenses, including 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 are owned by municipalities and municipal enterprises in Finland, of which around 4,300 are in use and around 5,000 are 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 5 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 articles 14 and 15 of the EPBD. The coordinating advice programme (advice forum) covers almost all buildings and gather actors in energy efficiency agreements in the building sector. The annual impact is estimated to be 0.015 million tonnes of CO_2. This measure is however not included in the WEM projection, as there is no detailed information on the impact of the measure on

the energy balance. The latest EPBD recast has entered into force, so the previously mentioned decrees will soon be reviewed.

The emission impacts of building-related policy measures have been evaluated using EKOREM and POLIREM calculation models (see the Model Factsheets) and information on the emission coefficients for district heating and electricity. These models calculate heat and energy consumption and the resulting greenhouse gas emissions of the building stock. The impacts of policy measures are evaluated by modifying the energy efficiency of the building elements (EKOREM) or specific consumptions of energy (POLIREM), or the distribution of heating systems. The energy savings are converted into emissions reductions with an average emission coefficient in the case of district heating (190 kg CO_2/MWh) and a mean marginal emission coefficient in the case of electricity (600 kg CO_2/MWh).

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[13]. The act sets an obligation to supply light fuel oil with bioliquids so that the share of biofuels will increase from 3 per cent in 2021 towards 10 per cent in 2028. In 2027, a new Emissions Trading System for distributors (ETS2) will start in the EU (see Section 2.2.1 EU Emissions Trading System) and it covers also CO_2 emissions from fossil fuels used in machinery.

The Ministry of the Environment and the Association of Finnish Technical Traders have a Green Deal for 2019–2025 on non-road mobile machinery to increase the share of fully electric and low-emission machinery. Through voluntary commitments made under this agreement, those operating in the sector will aim to increase the supply of fully electric and other low-emission non-road mobile machinery and encourage its wider use. The Ministry of the Environment, Senate Properties and the Cities of Espoo, Helsinki, Turku, and Vantaa have a voluntary Green Deal for 2020–2030 to reduce emissions at construction sites. As part of the implementation of the voluntary Green Deals in 2021, Motiva Oy, a hundred per cent state-owned sustainable development company in Finland, created a training package for non-road mobile machinery with funding and coordination from the Ministry of the Environment. The training package is freely available for operators in the non-road mobile machinery sector and it was further developed and updated in 2022–2023 and further updated and maintained in 2024-2025.

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.

There are also continuous efforts to improve the knowledge base of emissions calculations from non-road mobile machinery. With funding from the Ministry of Transport and Communications, the Ministry of the

[13] Government Decree 418/2019

Environment and the Ministry of Finance, Statistics Finland is developing a new transport and construction machinery emission calculation system LIIKE. The purpose of the accounting system is to respond to growing reporting needs and to support decision-making related to climate action. The LIIKE calculation system with its models is planned to be completed by the end of 2024.

Customer energy advice

One 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 customer energy use. Energy advice actions have been running since the first agreement period starting in 1997. Customer energy advice is also one of the policy measures notified for Energy Efficiency Directive (EED, (EU) 2018/2002) article 7 implementation in Finland. When calculating energy savings for these behavioural measures based on advice services, only conservative one-year energy savings lifetime has been considered. Annual estimated energy savings are constantly around one terawatt hour per year, and the CO_2 emissions reduction is about 0.35 million tonnes per year.

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

The advising activities are versatile, including e.g., web services, active information and knowledge sharing, webinars, workplace activities, newsletters, online courses, information campaigns, announcements, media cooperation, podcasts, videos, and social media utilisation.

Active sharing of best practices and updated information on 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) of improving energy efficiency is given to small and medium size companies that have signed the energy efficiency agreement.

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

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

- Energy Advice for Consumers – Motiva https://www.motiva.fi/en/home_and_household/energy_advice_for_consumers
- Regional energy councelling | Energy Authority https://energiavirasto.fi/en/regional-energy-councelling
- Energy Advice for Consumers – Motiva https://www.motiva.fi/en/home_and_household/energy_advice_for_consumers
- Online courses about energy efficiency and renewable energy - Motiva https://motiva-verkkokurssit.fi/
- Promoting household consumption flexibility by Motiva: https://ajoitaajoissa.fi
- Other online services by Motiva https://www.motiva.fi/motiva/motivan_muut_verkkopalvelut

Planned policies and measures

The government has submitted to the parliament a proposal on a tax credit for certain large investments aiming at a climate neutral economy. A company that would carry out a large investment aiming at a climate neutral economy in Finland with eligible investment costs of at least EUR 50 million would be entitled to the investment tax credit. The amount of the credit would be 20 percent of the eligible investment costs with a maximum of EUR 150 million per company. The credit could be deducted from corporate income tax in 2028 and in the following 19 years. The annual deduction could be no more than ten per cent of the total amount of the credit. The investment credit could cover investments in energy production from renewable sources, excluding electricity generation, as well as energy storage, investments in reducing greenhouse gas emissions and energy consumption in industrial processes, and investments in certain sectors that are strategically important for the transition to a climate neutral economy.

The government has reserved EUR 140 million for an incentive for biogenic carbon capture and storage or utilisation. The decree on the investment aid is under preparation and the aim is to be able to receive applications in late 2025. The investment aid could be granted to biogenic carbon capture and storage (BECCS) or biogenic carbon capture and utilisation (BECCU).

Summary of policies and measures

A summary of the policies and measures in the energy sector is presented in the PAM web form.

2.2.2 Transport

Adopted and implemented policies and measures

This chapter focuses on measures related to road transport, although the biofuels distribution obligation also slightly reduces emissions from recreational boats. Measures related to shipping and air transport are described in Section 2.2.3, as they mainly concern international transport and bunker fuel emissions. In the projections, the maritime and aviation emissions are, nonetheless, reported in accordance with the CRF-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 Change Policy Plan (2022) and National Climate and Energy

Strategy (2022). The Medium-term Climate Change Policy Plan and the Roadmap to Fossil-Free Transport set a target to reduce transport emissions by at least half by 2030 compared to 2005 levels. The Roadmap to Fossil-Free Transport is also one of the reforms included in the Finnish Recovery and Resilience Plan (the original plan and the revised plan). Milestones and targets have been set for this reform in the plan and their achievement is linked to the payments from the RRF[14] instrument.

The emissions reduction measures fall into three categories:

1) Replacing fossil fuels with alternative transport fuels

The main measure in this category is the biofuel 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. However, Finland has revised the gradually rising distribution obligation several times. For 2024, the target was 13.5 per cent instead of 28 per cent as stipulated by the legislation previously in force. In 2025 the distribution obligation shares for 2025-2027 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 years 2026 and 2027. After that the distribution obligation shares bounce back to the previously approved levels. As of 2025 renewable electricity delivered at public charging stations can be used to fulfill the distribution obligation. A new minimum share for renewable fuels of non-biological origin was established for years 2028-2030 and beyond, requiring a 1.5 percentage-point share in 2028 and 2029, and 4 percentage-point share in 2030 and beyond. In addition to reducing fossil fuel consumption and emissions in transport, the distribution obligation can also increase fuel prices and thus further reduce transport emissions. When the distribution obligation is reduced during this government term, this emission reduction effect will temporarily decrease.

Other measures included in this category are the promotion of the infrastructure for electricity and biogas used in transport. In February 2024, the Ministry of Transport and Communications launched work to prepare a national programme for alternative transport fuels distribution infrastructure. 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[15] and be the basis for monitoring required by the Regulation. The programme[16] was published in November 2024.

Regarding the support mechanisms in place, there is a state-funded infrastructure support programme for alternative fuels infrastructure (electricity, biomethane, hydrogen). A total of approximately EUR 35 million

[14] Recovery and Resilience Facility

[15] 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

[16] 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

was allocated to subsidies for 2022–2023. A total of EUR 10 million has been reserved for 2024. Decisions on further continuation of the programme have not yet been made.

In Finland, the construction of electric car charging points in housing associations has also been supported since 2018. From the beginning of 2022, subsidies began to be granted not only to housing associations, but also for electric car charging devices installed at workplaces. A total of EUR 32.5 million was allocated to charging subsidies for housing associations and workplaces for 2022–2023. There is no allocation for 2024 for this purpose. VTT Technical Research Centre of Finland (2020) estimates that in 2030, public charging infrastructure subsidies could reduce emissions by approximately 0.01–0.02 million tonnes of CO_2 eq. and recharging grants for housing companies and workplaces by approximately 0.02–0.1 million tonnes of CO_2 eq.

2) Renewal of the car fleet

According to the latest WEM projection, there will be a total of approximately 925,000 electric cars (BEV[17] + PHEV[18]) and 2,400 electric trucks in Finland in 2030 and their number will continue to strongly increase 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 updated regulation on CO_2 emission performance standards for cars and vans will reduce the 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 to the previous WEM projection. The updated 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 to the previous WEM projection.

In 2018, Finland introduced a purchase subsidy for battery electric vehicles and a conversion subsidy for converting an old car into an ethanol- or gas-powered car. The purchase subsidy for a battery electric car was EUR 2,000. The conversion subsidy for a gas-powered car was EUR 1,000 and the subsidy for an ethanol-powered car was EUR 200. These subsidies expired at the end of 2022. During the period 2018–2022, a total of EUR 37 million was directed to purchase (around EUR 35 million) and conversion (around EUR 2 million) subsidies in Finland. In 2024, the Ministry of Transport and Communications prepared a bill according to which it is still possible to apply for conversion subsidies during 2024.

A subsidy for purchasing gas-powered trucks was introduced in December 2020, and one for purchasing electric trucks and electric and gas-powered vans from the beginning of 2022. The purchase subsidy for a gas-powered truck is EUR 2,000–14,000 per vehicle and a subsidy for an electric truck is EUR 6,000-50,000 per vehicle. The subsidy for electric van is EUR 2,000–6,000 per vehicle and the subsidy for a gas-powered van is EUR 2,000 per vehicle. From the beginning of 2024, it is also possible to apply for a

[17] a battery electric vehicle

[18] a plug-in hybrid electric vehicle

purchase subsidy (EUR 6,000–50,000 per vehicle) for hydrogen-powered trucks. During the period 2022–2024, a total of EUR 12 million have been directed to these subsidies.

According to an estimate by VTT Technical Research Centre of Finland, the subsidy for purchasing electric cars will reduce greenhouse gas emissions from transport by approximately 0.019 million tonnes of CO_2 eq. in 2030 and 0.011 million tonnes of CO_2 eq. in 2040. Purchase subsidies for electric and gas-powered trucks and vans would reduce emissions by around 0.009 million tonnes of CO_2 eq. in 2030 and 0.002 million tonnes of CO_2 eq. in 2040.

Finland also supports the electrification of transport through tax changes. The taxable value of zero-emission and low-emission company cars has been temporarily reduced until the end of 2025. In the spring of 2024, the Government decided to extend this reduction for zero-emission vehicles benefit into 2026–2029 while increasing the daily vehicle tax of 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 2027, a new Emissions Trading System for distributors (ETS2) will start in the EU (see Section 2.2.1). According to estimates made in Finland, the ETS2 will reduce traffic emissions by approximately 0.04–0.4 million tonnes of CO_2 eq. in 2030.

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 plannings through, for example, agreements on land use, housing and transport (MAL agreements). 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).

During 2018–2023, a total of EUR 86.5 million have been directed to 248 projects in municipalities of different sizes from the investment programme for walking and cycling. During 2018–2023, a total of EUR 429.4 million have 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 the years 2020–2022. According to an estimate by the Finnish Transport and Communications Agency (2020), the investment programme for walking and cycling could reduce emissions by around 0.004 million tonnes/year and government grants for public transport by around 0.008 million tonnes/year. There is no separate assessment of the emissions reduction impacts of the MAL agreements. 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, and employer-provided bicycles are tax-free up to EUR 1,200 of taxable value per year.

The regulation related to the HCT vehicle combinations for road transport[19] 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. In addition, the new emissions trading system (ETS2) will probably affect the number of kilometres driven and thereby reduce emissions.

The update of the National Transport System Plan (Traffic 12 plan) was launched in 2023. The Traffic 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[20]. The plan includes an assessment of the current state of the transport system and changes in the operating environment, goals for the national transport system, and measures to achieve the goals of the programme. In addition, the plan includes a state funding programme and an impact assessment of the plan. The updated objectives are functionality, safety and sustainability. The action plan is currently under preparation and the agreements on land use, housing and transport are being negotiated. In the national transport system plan, sustainability will most probably be promoted by maintaining existing structures and networks and making their use more efficient.

Summary of policies and measures

A summary of the policies and measures in the transport sector is presented in the PAM web form.

2.2.3 International bunkers

Adopted and implemented policies and measures

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

Shipping

Related 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, i.e. close to, 2050. In addition, the 2023 strategy includes levels of ambitions that address the carbon intensity of international shipping and the uptake of zero and near-zero GHG technologies by 2030. In order to reach the levels of ambitions, the IMO is currently developing so-called mid-term measures comprising a goal-based marine fuel standard and a maritime GHG emissions pricing mechanism that will enter into force in 2027 according to the 2023 IMO strategy.

[19] 729/2018

[20] 503/2005

The EU MRV Regulation on 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 greater than 5000 gross tonnage, irrespective of their flag, undertaking following 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 covers also 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 the 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). Under the amendments, ships of 5,000 gross tonnage and above are required to 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 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, which requires 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) would be achieved. The new regulations on EEXI and CII are foreseen to be implemented in Finland's national legislation as of 2024.

Since 2024, the EU Emission Trading System is extended to ships of 5000 gross tonnage and above calling at European ports, regardless of their flag. The emissions from shipping will be phased in gradually. The shipping companies will have to surrender allowances for 40 per cent of their emissions reported for year 2024, for 70 per cent for year 2025 and 100 per cent from 2026 onwards.

Starting from 2025, the FuelEU Maritime regulation[21] sets maximum limits for the yearly average GHG intensity of the energy used by ships above 5000 gross tonnage calling at European ports, regardless of their flag. The level of required reduction will increase gradually reaching up to 80 per cent reduction by 2050 compared to 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 on-shore power supply or zero-emission technologies which comply with the requirements provided for in the regulation, for all their electrical power demand at berth.

[21] 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

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 from 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 emission 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 during 2024–2035 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. In order 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 five per cent by 2030. This is compared to a situation where these types of fuels are not used. The target is global and non-binding. Member states submit every three years state action plans on reduction of CO_2 emissions from international aviation. Finland's 5th Action Plan to Reduce CO_2 Emissions from Aviation was submitted to the ICAO in 2021 and the updated Action Plan will be completed by the end of 2024.

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 out-set. 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. On the other hand, the system enables additional purchases of emissions rights if it will be very expensive or impossible to reduce emissions by means of new technology, for example. The Commission has estimated that the EU ETS has reduced aviation CO_2 emissions in total by more than 17 million tonnes per year.

The EU Emissions Trading System (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 to 2005. Several key provisions of the Directive were strengthened and the scope of the scheme extended. Aviation has been included in the EU ETS since 2012, and it applies to flights between airports in the European Economic Area. During aviation's third emissions trading period's first years in 2021–2023, the total number of emissions 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 for the years 2028–2030 it will be 4.4 per cent. CORSIA will be integrated into the EU ETS and will be implemented in it. For the aviation sector[22], free allocation of emission allowances will be removed as of 2026.

[22] https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-aviation_en

The ReFuelEU Aviation Regulation[23] 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 starts in 2025 with a mandate of 2 % SAF, and it will gradually increase to a 70 % blending obligation in 2050. From 2030, 1.2% of fuels must also be synthetic fuels, rising to 35% in 2050. Aircraft operators departing from EU airports must refuel with the aviation fuel necessary to operate the flight. This avoids the excessive emissions related to extra weight 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 are considered Union airports in 2025. The Energy Authority is the competent authority regarding aviation fuel suppliers, and The Finnish Transport and Communications Agency is the competent authority regarding aircraft operators and Union airport managing bodies.

According to the AFIR Regulation[24], all airports of the TEN-T[25] 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 Black Carbon (BC) emissions also have a large impact on climate change, especially in the polar regions, and Finland is committed to decreasing black carbon emissions. Accordingly, the Finnish Transport and Communications Agency Traficom with the Finnish Meteorological Institute (FMI), and VTT Technical Research Centre of Finland Ltd have been conducting studies to test the candidate measuring methods and collect data on black carbon emissions from shipping. The results of these studies have been introduced at the IMO. In 2021, the IMO adopted a resolution urging Member States and ship operators to voluntarily use distillate or other cleaner alternative fuels or methods of propulsion safe for ships and could contribute to the reduction of black carbon emissions when operating in or near the Arctic and report on measures and best practices to reduce black carbon emissions from shipping. The MEPC[26] 82 meeting in October 2024 adopted resolutions MEPC.393(82) on Guidance on best practice on recommendatory

[23] 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)

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

[25] the trans-European transport network

[26] International Marine Organization's Marine Environment Protection Committee

goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping and MEPC.394(82) on Guidelines on recommendatory Black Carbon emission measurement, monitoring and reporting.

Within the EU ETS for aviation, a MRV (monitoring, reporting and verification) system for non-CO_2 aviation effects will apply from 1 January 2025, calculating CO_2 equivalent per flight. By the end of 2027, the Commission will deliver a report on the results and if appropriate, will make a legislative proposal to address non-CO_2 effects of aviation.

In February 2024, the Ministry of Transport and Communications launched work to prepare a national programme for alternative transport fuels distribution infrastructure. 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. The programme[27] was published in November 2024.

Summary of policies and measures

A summary of the policies and measures for the international bunkers is presented in the PAM web form.

2.2.4 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 the process emissions. This is typically not the result of a single measure but several measures strengthening the overall feasibility of new technology investments.

In the WEM 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 the process emissions. The measures are the same as those for reducing the energy-sector emissions and a description of them can be found in Section 2.2.1. 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.

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[27] 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

F-gases

The share of F-gas emissions (HFCs, PFCs and SF_6) was two per cent of the total greenhouse gas emissions in 2022. Emissions of NF_3 are not occurring in Finland. F-gases are emitted from various applications that use these industrial gases, which are highly harmful 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 of the emissions 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 2008, emissions have by now decreased by more than 40 per cent. PFC emissions are very low, and they have decreased significantly from the peak level in late 1990s. SF_6 emissions are also low (four per cent of the total F-gas emissions in 2022) and the peak level of SF_6 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 fluctuation in the total annual emissions level due to the use of SF_6 in specific applications in which the consumed amount of SF_6 varies year-on-year. F-gases are not produced in Finland.

The existing measures will reduce HFC emissions, and therefore the total F-gas emissions, efficiently. The most important legislation affecting the use and emissions of these gases is the EU F-gas regulation[28]. In addition, the so-called EU MAC Directive (Mobile Air-Conditioning Directive[29]) 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 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. 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 SF_6 emissions until 2035 due to the increased use of SF_6 in electricity distribution equipment. However, the restrictions introduced in the EU F-gas regulation[30] for the use of SF_6 in electricity distribution equipment will stop the increase of emissions after 2035.

Planned policies and measures

F-gases

As additional measures to little speed up the emissions reductions, accelerated transition to natural refrigerants and the lifecycle management of refrigerants will be promoted through information and regulatory policies. The measures will include updating the criteria for public green procurement, promoting the harmonisation of norms and standards related to building services and building regulations in a direction that

[28] 573/2024

[29] 2006/40/EC

[30] (573/2024)

enables natural refrigerants. In addition, a report for a national plan for the lifecycle management of refrigerants will be prepared and opportunities to promote producer responsibility and systemic promotion of the circular economy will be explored.

Summary of policies and measures

A summary of the policies and measures in the industrial processes and product use sector is presented in the PAM web form.

2.2.5 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 multi-functional agriculture include taking greenhouse gas emissions, the possible need for adaptation measures, and other environmental and socioeconomic aspects into account. These objectives can be reached through the Common Agricultural Policy (CAP) of the EU, 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 would probably not reduce global greenhouse gas emissions because domestic production would 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, though, 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 strengthen 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 compared to 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 the 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 the rural development funds to environmental and climate measures at the national level. In addition to this, 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 to the previous programming period, the Finnish CAP Strategic Plan has increased the environmental and climate ambition. According to the environmental impact assessment of Finland's current CSP, greenhouse gas emissions from agriculture would decrease by around 0.8 million tonnes CO_2 eq. per year compared to the previous CAP funding period.

Finland's CAP Strategic Plan includes measures that, in addition to their impacts on water bodies, also contribute to increasing and preserving carbon in soil. The emission reduction impact will affect both the land use sector and the agricultural sector. 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 their management, and establishing and managing wetlands (including managed climate wetlands). An investment subsidy is also available for 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.

Since 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 Change Policy Plan and in the Climate Plan for the Land Use Sector. The Medium-term Climate Change Policy Plan is currently under revision and the new version will be published in 2025. The emissions reduction measures proposed in the current Medium-term Climate Change Policy Plan related to land use change include restricting the clearing of fields, restricting the transfer of previous peat production areas into agricultural use, the afforestation of wasteland and the conversion of agricultural land into climate wetlands. Measures related to arable land use include the cultivation of wet peatlands (paludiculture), adding carbon to fields by cultivating grass instead of annual crops, and introducing precision farming methods. In addition, efforts are made to reduce methane emissions from dairy cows through feeding methods.

The Medium-term Climate Change Policy Plan has also highlighted a number of measures that are likely to reduce greenhouse gas emissions from agriculture in the future but for which the emission impact cannot be calculated at the moment. Such measures include improving the real estate composition of fields, changes in the age structure of cattle, increasing 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, 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 Law 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 at the national restoration plan during 2024–2026.

Finland does not have 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, i.e. grass. However, as more than 40 per cent of the feed of dairy cows is concentrated feed, rapeseed cake would mostly replace the currently widely used rapeseed meal, and the actual reduction in methane emissions would probably be 3–5 per cent per cow.

Of the feed additives that reduce enteric methane production, research has advanced furthest with regard to 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 Ministry of Agriculture and Forestry is funding studies and projects to develop feeding solutions applicable for Finnish grass roughage based feeding that reduce greenhouse gas emissions from the enteric digestion of bovines. The projects aim to find solutions for reducing greenhouse gas emissions related to cattle feeding in Finnish feeding systems and, in particular, enteric methane emissions produced in rumen fermentation. The projects also aim to enhance knowledge about the means for reducing emissions that are already available or will be introduced within the next 5–10 years, as well as incentives and steering instruments through which the introduction and use of such means can be promoted. The projects started in autumn 2022.

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 the conditions for an organic fertiliser market that functions well and thereby to ensure efficient recycling and use of nutrients. An experimental nutrient recirculation programme has run 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) for the production of 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, its storage and its 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 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 needed on the use and effects of gender-selected semen, but the method is already rapidly gaining popularity.

The Medium-term Climate Change Policy Plan highlights the reduction of edible food waste and promotion of eating in accordance with 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[31] and the Government Decree on Waste[32] 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 towards more plant-based consumer diet will change agricultural production and land-use in a direction with lower emissions, but the concrete climate impact is difficult to estimate. 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. Then structural development and productivity will progress, and the change in production and land use will remain small. Whether consumers reduce their consumption of meat and dairy products as assumed in the scenario 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, together 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 is currently preparing a long-term strategy for Finnish food production. The strategy work will create a vision of what kind of food system Finland will have in 2040, which measures are needed to achieve the vision, and what kind of agricultural changes Finland should be prepared for. The strategy will also take into account perspectives related to climate change. 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 will be drawn up in parliamentary cooperation.

Summary of policies and measures

A summary of the policies and measures in the agriculture sector is presented in the PAM web form.

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[31] 646/2011

[32] 978/2021

2.2.6 Land use, land-use change and forestry

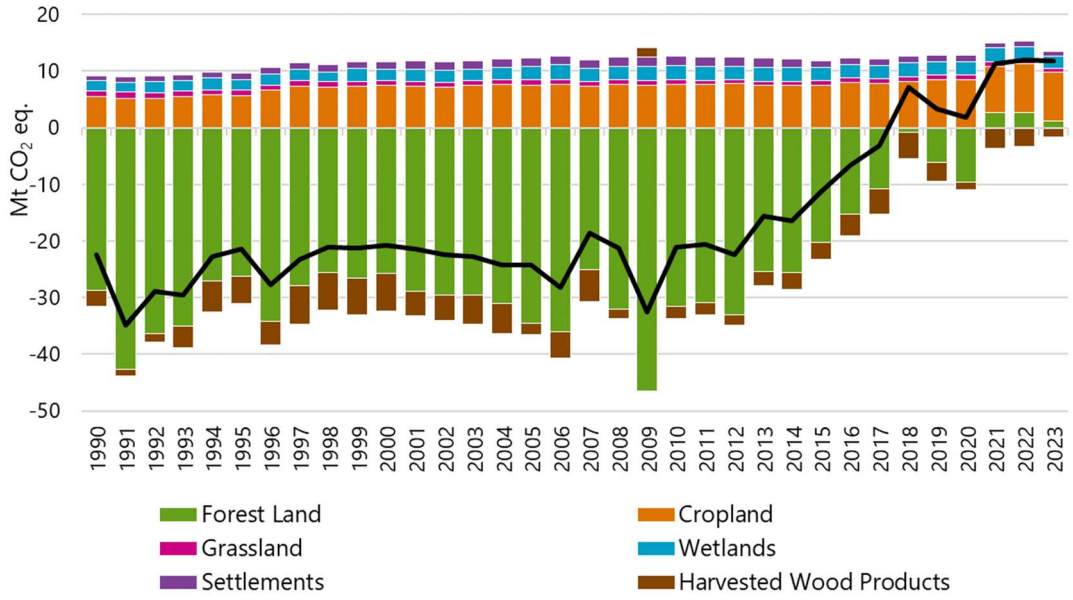
Adopted and implemented policies and measures

The overall LULUCF sector has for many years been a net sink in Finland because its emissions have been smaller than the removals. However, this net sink from the LULUCF sector can significantly vary year to year. The first indicators regarding the LULUCF sector turning into a source of emissions instead of a net sink were seen in the Statistics Finland's preliminary data in spring 2022. In December 2023, the national GHG inventory data revealed that the LULUCF sector had been a source of emissions for the first time already in 2018 (Figure 4). These changes in the net sink level compared to previous estimates of the level of emissions and removals in the LULUCF sector is a consequence of a decreasing trend of forest's net sink, which according to the preliminary results of 2023 GHG inventory turned to a net source in 2021.

The trend can be explained by declined volume increment in forests and increased volume of harvested roundwood as well as due to the change on weather conditions. The latter has particularly had impact on soil emissions. The net sink of forest has varied from year to year, especially due to changes in the harvesting of domestic roundwood, which 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 it is removed in fellings and as a natural loss. The highest emissions come from the soils of drained peatlands in forests, on cropland and on peat production areas. In addition, smaller emissions are generated by other managed wetlands, including unsuccessfully drained forest areas or drained forest that have transformed into wetlands. Forest fires, prescribed burning and restoration burning as well as nitrogen fertilisation of forests and settlements, generate minor emissions.

Figure 4. Historical (1990 to 2023) 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 aim of the plan is 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, the 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 three million tonnes would be achieved.[33] This will also contribute to Finland's EU LULUCF target for 2030. A monitoring system for the Climate Plan for the Land Use Sector is currently under preparation. Information on the implementation volume of the policy measures will probably be available by summer 2025. The aim of this monitoring system is to measure and identify the concrete amount of emission reduction achieved per year under the Climate Plan for the Land Use Sector. The monitoring systems also tries to capture those small-scale climate measures that aren't 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 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. In addition to the measures presented above, the measures focus on, for example, 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

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

deforestation and promoting actions in peatlands. Preliminary climate impacts of the measures listed in the Plan are presented below in Table 3. However, it should be noted that currently there is no national funding outside CAP measures for paludiculture/rewetting peatlands. Also, 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 is planned to start in 2025.

Table 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		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 Mt CO_2 eq.
Ash fertilization of peatland forests	26,000 ha per year	0.18 Mt CO_2 eq.	0.40 Mt CO_2 eq.
Promotion of forest fertilization 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 July 2022 the Finnish Government approved the first Climate Plan for the Land Use Sector and as a result of the changed situational picture of the Finnish LULUCF sector, the following additional actions were decided upon:

- Start legislative work to prepare for a land use change fee. However, the preparation couldn't be completed before the parliamentary elections in spring 2023. Impact assessment was carried out in autumn 2023.
- Set as one of the objectives of the National Forestry Strategy 2035 the maintenance and increase of the carbon sink. Also set as an objective the promotion of the achievement of the carbon sink and emission targets of the Climate Act and the EU's LULUCF targets.
- Implement the METKA (Act on Temporary Forestry Incentive Scheme) scheme, which supports climate-friendly forest management. The act came into force at the beginning of 2024.
- Carry out a climate assessment study of the Forest Act and identify measures in the Forest Act that could promote sink growth in the short and long term.
- Analyse the reasons why the land use sector has become a net source of emissions and what this means in terms of meeting the 2021–2025 EU LULUCF target.

In line with Prime Minister Petteri Orpo's Government Programme, a package of forestry measures ('First Aid Kit for Forest Growth') will be prepared during 2024-2025 by the Ministry of Agriculture and Forestry to strengthen the growth of forests and carbon sequestration. The aim of the package is to gather and define actions that have already been initiated and that are to be initiated by industry and government actors, as well as to propose new measures. The goal is to find possible and acceptable additional measures, so that the targets of the Finnish National Forest Strategy 2035 and the climate goals and obligations of Finland, including the LULUCF target can be achieved, and so that the conditions for the sustainable use of forests can be ensured. In addition, the package includes an assessment of the cost-effectiveness and climate effectiveness of the measures in different time spans to the extent possible. No quantitative goal has been set for the package.

Organic soils are the main source of CO_2 emissions in the LULUCF sector. The CAP Strategic Plan for 2023–2027 and the Climate Plan for the Land Use Sector both include measures for climate-resilient use of peatland fields, such as raising the ground water 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[34] for the use of peatland fields. The roadmap was published in December 20244. In addition to these measures, the Ministry of Agriculture and Forestry is currently piloting market-based competitive tendering for rewetting peatlands and performance-based funding models for carbon sequestration. These new measures are part of Finland's increased contribution to meet the EU's climate targets.

[34] Lehtonen et al. The Natural Resources Institute Finland (LUKE) 2024: Turvepeltojen käytön tiekartta vuoteen 2050. http://urn.fi/URN:ISBN:978-952-380-980-2

The size of the managed forests sink or source depends mainly on the forest growth and harvesting rates, which result from the global demand for housing and packaging, for example. The National Forest Strategy[35] was revised in 2022 and implementation of it 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 takes into account the principle of comprehensive sustainable development and the important role of forests 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 the forests' health and ability to grow, which is a basic requisite 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 the growth and carbon capture capacity of the forests in the long term.

A significant source of emissions in the land use sector is the clearance of forest 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. Act on fixed-term support for afforestation was in force in 2021–2023. The objective of the Act was to increase the forest area and carbon sinks by supporting afforestation and to reduce greenhouse gas emissions on sites to be afforested without weakening biodiversity. The EU Deforestation Regulation entered into force in June 2023. The regulation will most likely decrease deforestation caused by agriculture in the coming years, especially as it hinders the clearing of forest for grazing. Public financing for private forest owners has in previous years been around EUR 48–60 million euros annually. Financing instruments until the end of 2023 were Act on the Financing of Sustainable Forestry[36] and Act on fixed-term support for afforestation. From 2024 onwards the Act on Temporary Forestry Incentive Scheme has been in force. Also, the management fees for afforestation made between 2021–2023 will continue until 2033. The general objectives of forestry financing is 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 200 million euros in 2022 for forest management and improvement work.

To tackle the challenging ongoing situation in the LULUCF sector, the 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 in the beginning of 2024[37]. 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 implementation or on continuation of the preparation.

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

[36] 34/2015

[37] 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

The Catch the Carbon government programme was a concreate example of an innovative policy instrument advancing climate measures in the LULUCF sector. The programme ended in 2024. Close to 200 individual research, development and innovation projects were funded under this programme. The aim of the overall programme was to reduce greenhouse gas emissions both in the LULUCF sector and in agriculture and also to enhance carbon sinks and reservoirs. The final climate impact of these projects is difficult to assess. The project results and lessons learnt will be a large input into Finland's future policy preparation concerning agriculture, forestry and land use changes. In addition, during the annual budgetary negotiations in September 2024, the Government decided on 2 million euros additional funding for developing the national greenhouse gas inventory.

Summary of policies and measures

A summary of the policies and measures in the land use, land use and forestry sector is presented in the PAM web form.

2.2.7 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 around 47 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. On the other hand, carbon dioxide emissions from waste incineration have been growing because of increased incineration capacity. 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 scheme in the coming years. The following presents various policies of reducing emissions in the waste sector.

The Waste Tax Act[38] (1126/2010) 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. The industrial landfills are also under taxation. The waste tax has been EUR 80 per tonne since 2023.

Waste legislation was mainly reformed in 2021. The key objective of the reform is to reduce the amount of waste and increase reuse and recycling. The separate collection obligations for waste became stricter, and therefore more waste, especially municipal waste, packaging waste and construction and demolition waste, will be directed to recycling instead of waste incineration. The national waste Plan, updated in 2022, aims to prevent waste generation and, together with legislative amendments, to raise the recycling rate. These policy measures will indirectly reduce greenhouse gas emissions in the waste sector in the longer term, but their potential for reducing emissions is difficult to estimate.

[38] 1126/2010

The restrictions on the landfilling of biodegradable municipal solid and other organic wastes have been made stricter. From 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 increased the incineration of waste and decreased landfilling.

The estimated total emissions reduction of waste management measures is roughly 4 million tonnes of CO_2 eq. per year in 2025–2035.

Summary of policies and measures

A summary of the policies and measures in the waste sector is presented in the PAM web form.

2.2.8 Land-use planning and spatial structure

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

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 negative 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 the regions in Finland 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 ex-ample, 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. The location of a dwelling 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 the PAM web form.

2.2.9 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, life cycle 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 from 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.

The current energy tax structure for energy used in transportation is illustrated in Figure 5.

The energy content tax for gasoline is approximately EUR 60.5 per MWh (the benchmark rate) and the carbon dioxide tax for life-cycle emissions is EUR 62 per tCO_2.[39] For gas oil, the energy content tax is reduced by EUR 25.95 per MWh compared to the benchmark rate. Tax rates for gaseous fuels used in transportation are also lower than the benchmark rates for transport use, as gaseous fuels are taxed with benchmark rates of heating use. Also, the energy tax rate of electricity used in road transportation is lower. For passenger 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. According to the General Government Fiscal plan, the taxation of liquid fuels used for transportation will be reduced by a total of EUR 100 million by 2027.

The energy tax structure for fuel used for heating and mobile machinery and for electricity is illustrated in Figure 6.

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 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 6).

The energy content tax for oil products used in professional agriculture (excluding transport use) is rebated. 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, mining, certain data centres and certain heat pumps and agriculture is at the EU minimum level, EUR 0.5 per MWh (class II). For households, services etc. the energy tax of electricity is EUR 22.4 per MWh. Small-scale production of electricity for own use is exempt.

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[39] This equals approximately a tax rate of EUR 74–75 per tCO_2 applied to emissions of fuel combusted. The carbon dioxide tax was reduced from EUR 77 to EUR 62 per tCO_2 from the beginning of 2024.

Figure 5. Current energy tax structure and rates for energy used in transportation, EUR/MWh

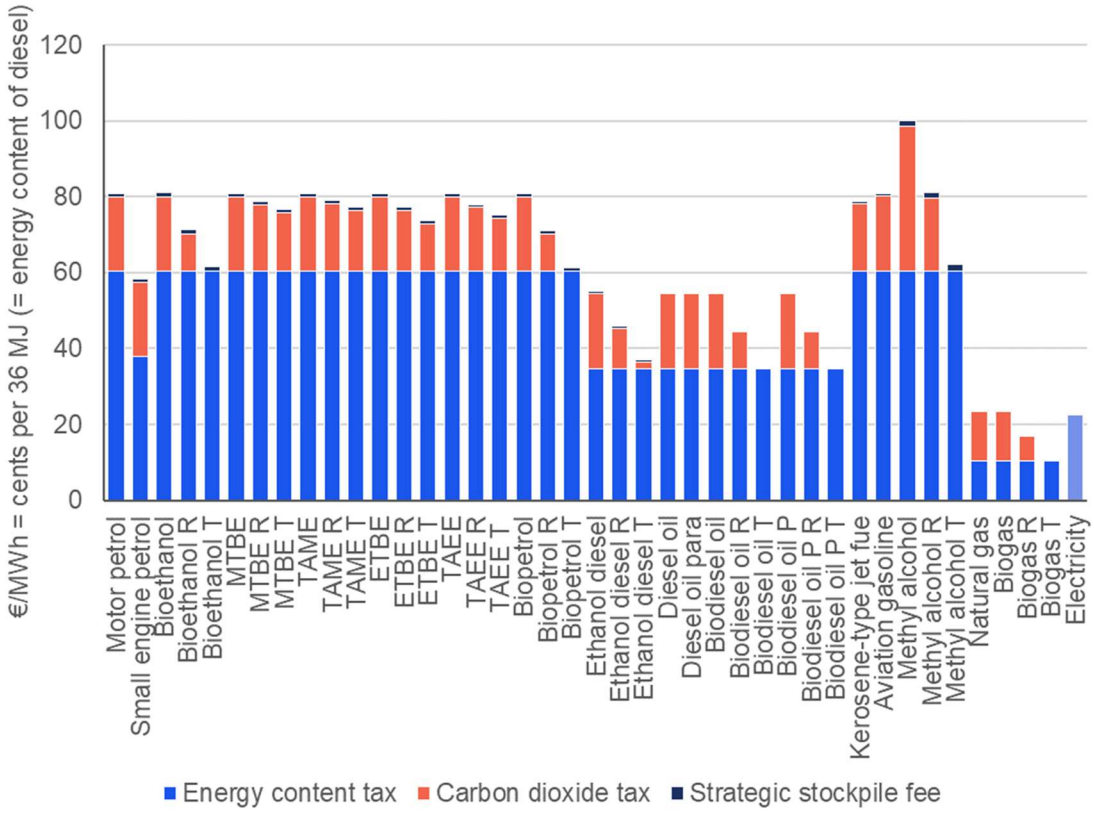
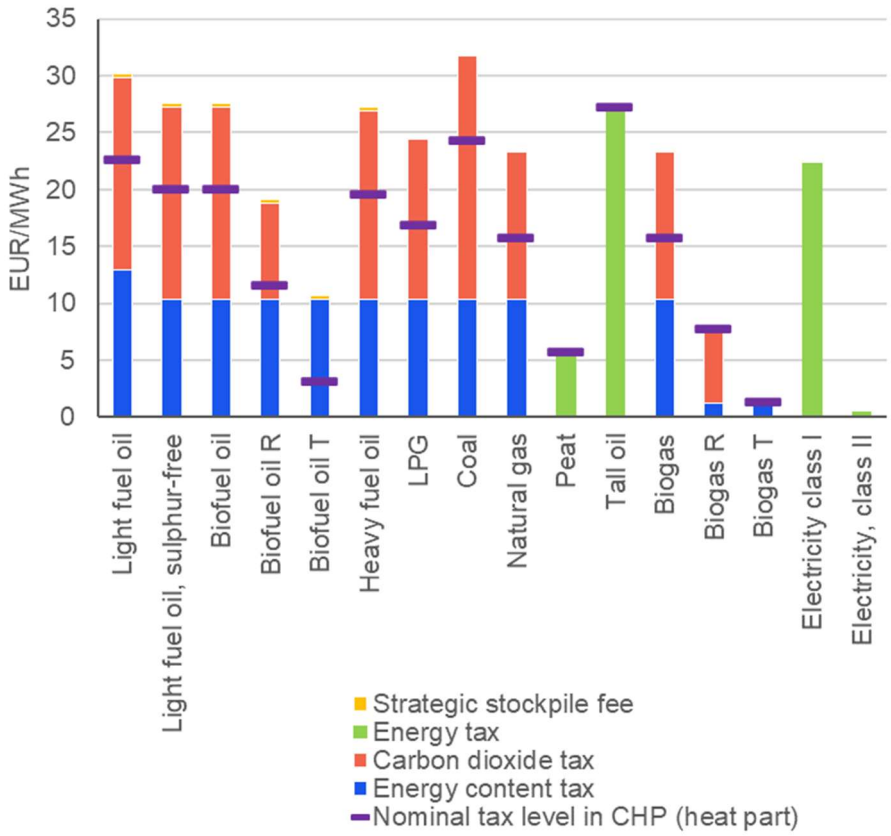


Figure 6. Tax rates for fuels used in heating and mobile machinery, EUR/MWh



Government expenditure on energy and climate policy

The Finnish government supports the transformation to a greener economy with a variety of different subsidies. The total Government expenditures on energy and climate policy have increased significantly in recent years, with the budget for 2022 being EUR 2,554 million. This expenditure covers a wide range of sectors, and the largest outlays are in subsidies given to energy and 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 the public economy's other expenditure needs.

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 230 million for 2022 (including RRF funding), which is substantially higher than just a few years ago, when it was around EUR 50 million.

In addition, 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 Government's key projects related to energy (in total, EUR 100 million between 2016 and 2018), energy

projects replacing coal (in total, EUR 90 million between 2020 and 2021), and current Recovery and Resilience Facility (RRF) energy projects (around EUR 500 million between 2022 and 2023) and large demonstration projects. Initially, a total of 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 a total of 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.

On top of these subsidies, the Government also actively provides support for R&D projects and rail projects and funding for private sector projects that aim to cut emissions. While this support is divided over several smaller measures, they amount to a total of several hundred million euros annually.

A compilation of funding related to the energy and climate policy from 2018 to 2022 under the General Government Fiscal Plan is presented in Table 4.

Table 4. Funding under the current General Government Fiscal Plan

Appropriation	2018	2019	2020	2021	2022
			EUR million		
MINISTRY OF ECONOMIC AFFAIRS AND EMPLOYMENT					
Energy aid	58	47	61	101	231
Investment and operating subsidies for renewable energy and new energy technologies	354	215	337	294	135
Subsidies for green R&D and innovation	120	121	130	143	176
Other measures	189	146	155	180	190
MINISTRY OF AGRICULTURE AND FORESTRY					
Agri-environment payment measures	218	218	185	236	263
Other measures	313	313	398	353	413
MINISTRY OF TRANSPORT AND COMMUNICATIONS					
Investment in rail infrastructure	0	0	8	26	123
Other measures	150	127	521	267	281
MINISTRY OF THE ENVIRONMENT					
Investment subsidies for lower emission heating systems	65	70	306	261	323
Other measures	85	86	116	105	105
MINISTRY FOR FOREIGN AFFAIRS					
Development aid for environmental, water and energy related projects	144	159	199	266	283
Other measures	65	70	236	186	184
TOTAL appropriations	1,761	1,573	2,651	2,418	2,706

3 PROJECTIONS

3.1 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 modelled in an extensive project 'Baseline scenarios for energy and climate policy package towards zero emissions' (PEIKKO)[40] financed by the Government's analysis, assessment and research activities. 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. For this report, the projections of the PEIKKO project have been updated with information and data on a few recently adopted or implemented policy measures and the Commission's most recent recommendation on international fuel and carbon prices. The resulting projection is called the WEM projection.

At the time of writing, the Government, including a ministerial working group, is planning new policy measures compared to the measures in the WEM projection. These measures will be assessed and, whenever feasible, included in a new WAM (With Additional Measures) projection. The modelling process has already commenced but is not yet complete. 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. 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 WEM projections. This is done in Section 3.4.

The Covid-19 pandemic and its assumed effects on the economy were considered in the modelling of the WEM projection whose starting point is the year 2022. In contrast to 2023 NECPR, the energy crisis and changed energy scene following Russia's unprovoked and unjustified invasion of Ukraine are now 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 from the national forest inventory on a decline in tree growth now form the base for the projection work. A part of the measures included in the WAM projection of the 2023 NECPR has been implemented and is now part of the WEM projection, the expansion of the emissions trading system (so called ETS2) being the most significant in terms of emissions reductions.

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

The WEM projections' starting point is 2022. Climate and energy policies and measures that have been implemented or adopted by end of June 2024are as far as possible included in the "With Existing Measures" (WEM) projection. The policies and measures included in the WEM projection, including estimated impacts on greenhouse gas emissions, are presented in more detail in Chapter 2. The original time horizon of current projections is mid-term and targeted to the years 2030-2040. The projection figures for 2040-2050 are approximate and include large uncertainties with respect to, among others, technology development and deployment.

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 WEM projection, the annual average increase in the national economic output is 1.3 per cent from 2020 to 2030 and 1.7 per cent from 2030 to 2040.

Regarding the forest industry, the basis for the WEM projection is the same as in the 2023 NECPR but the latest market development, including some production capacity closures, has been taken into account. As a result, compared to the 2023 NECPR, 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.

Table 5 shows a summary of the main assumptions of the WEM projection for 2020 to 2035. Numerical values for key variables and assumptions are presented in the Parameter excel-file in Reportnet 3.

Table 5. Assumption of the WEM projection

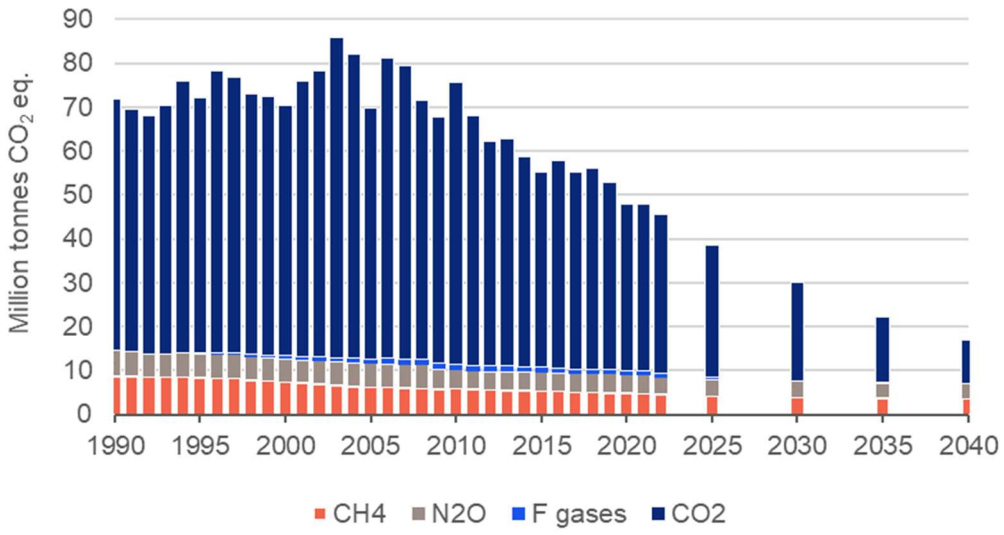
Parameter	Trend 2020 to 2035
GDP growth	1.4 per cent annually
Structure of economy	Increasing share of services
Structure of industry	Less capital and energy intensive
Population growth	Increases by 0.1 per cent annually until 2030 after which the population starts to decrease slowly
Population structure	Ageing
Technology development	Gradual introduction of improved and more energy efficient technology, increased electrification

3.2 ‘With Existing Measures’ projection

3.2.1 Total effects

Total emissions in the WEM projection for 1990 to 2040 are shown in Figure 7 (total emissions without the LULUCF sector) and in the national projections data file in Reportnet 3. Compared with the 1990 base year, the total greenhouse gas emissions without LULUCF are projected to be 58 per cent lower in 2030, and 76 per cent lower in 2040. The corresponding figures for CO_2 emissions are 61 and 82 per cent. CH_4 emissions are expected to continue to decline steadily, being 55 per cent lower in 2030 and 59 per cent lower in 2040 than in 1990. N_2O emissions are projected to decrease the least, but still being 39 per cent lower in 2030 and 43 per cent lower in 2040 than in 1990. The amount of emissions from F-gases is small and expected to decrease in the coming years.

Figure 7. Greenhouse gas emissions without LULUCF by gas according to the latest greenhouse gas emission inventory (1990 to 2022) and the WEM 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 8 and Table 6. The historical ETS emissions correspond to the EU ETS scope of the emissions trading period from 2013 to 2022. The emissions in the EU ETS sector reached their peak in the mid-2000s and have declined since. In 2022, emissions in the EU ETS sector accounted for 42 per cent of the total greenhouse gas emissions, whereas the non-ETS sector accounted for 58 per cent. The ETS emissions are expected to decrease further in the future being 70 per cent lower than the 2005 level in 2030 and 90 per cent lower in 2040.

The emissions from the non-ETS sector have decreased steadily since 2005, and the decrease is expected to continue. In the WEM projection, the emissions from the non-ETS sector in 2030 are 45 per cent, and in 2040, 61 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.

Figure 8. The split of greenhouse gas emissions between the EU ETS sector and the non-ETS sector (2005 to 2022) based on the latest greenhouse gas inventory and the WEM projection (until 2040). The development of the total emissions without the LULUCF sector is also presented.

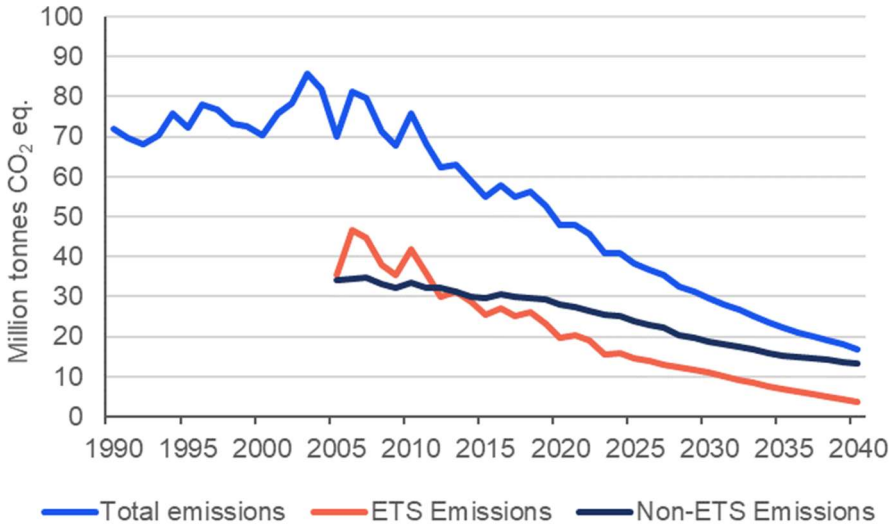


Table 6. Historical (2005 to 2022) and projected (2025 to 2040) greenhouse gas emissions in the Non-ETS and ETS sector and civil aviation based on the latest greenhouse gas inventory and the WEM projection, respectively

	Historical				WEM Projection			
	2005	2010	2020	2022	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Non-ETS	34.3	33.6	28.1	26.5	23.9	18.9	15.4	13.4
ETS	35.3	41.9	19.6	19.0	14.3	10.7	6.5	3.4
Civil aviation, CO_2	0.3	0.2	0.1	0.1	0.2	0.3	0.3	0.3
Total emissions	69.9	75.7	47.8	45.7	38.4	29.8	22.2	17.0

The development of total emissions regarding the number of inhabitants, primary energy use, and economic development is presented in Table 7. All indicators show a steady downward trend that continues in the WEM projection. Today, the emissions are decoupled from both the GDP growth and energy use development and decline steadily.

Table 7. Greenhouse gas emission intensity based on the latest greenhouse gas inventory for 2010-2022 and the WEM projection for 2025–2040

	Historical			WEM projection			
	2010	2020	2022	2025	2030	2035	2040
Emissions per capita, tonnes CO_2 eq. /capita	14.04	8.61	8.16	6.9	5.4	4.0	3.2
Emissions per GDP, kg CO_2 eq./EUR	0.30	0.18	0.15	0.14	0.10	0.07	0.05
Emissions per primary energy, tonnes CO_2 eq./MWh	0.18	0.13	0.13	0.10	0.08	0.06	0.05

3.2.2 Sectoral emissions

Energy

The energy sector is strongly affected by policy measures to reduce the 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 only half completed, and the emissions will decline further in the energy sector. As many of the changes involve or concern investments like power generation capacity, 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. However, over 90 per cent of the Finnish electricity production is emissions-free today and the positive development is expected to continue further, resulting in lower and less varying total greenhouse gas emissions for Finland.

In the WEM projection, the most significant recent change in electricity production is the start-up of a new 1,600 MW nuclear power plant unit in 2022. Going forward, a significant increase is expected in use of renewable energy sources and waste heat both in electricity and heat production. Use of coal for energy is banned from May 2029, and use of peat will rapidly decrease already in the 2020s 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 WEM 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. District heat production from heat-only plants is expected to slightly increase its share at the expense of combined heat and power production, which has been struggling with feasibility. Low electricity prices in the 2010s and rising prices of emission allowances and fuel prices in the 2020s have challenged combustion-based heat and power production.

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 re-placing 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 is shifting from fossil fuels (especially coal and natural gas) and peat to renewables and nuclear power. In district heating and industry, fossil fuels are increasingly being replaced with renewables and waste heat recovery. 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) could reduce emissions even further, but its timing is equally difficult to estimate, and it has therefore been

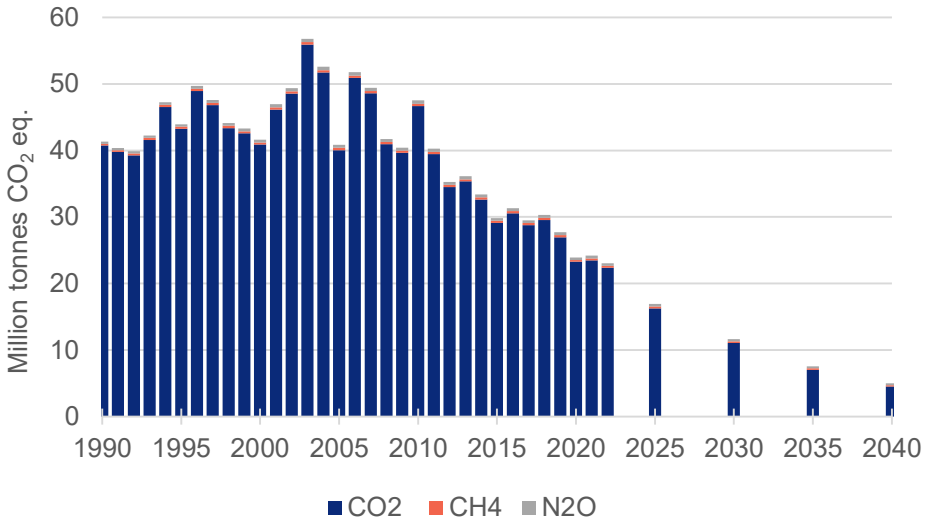
omitted from the WEM projection. Electrification is also true of other sectors like transport, due to which (with Finland's biofuel and other policies) the refining volumes of fossil oil are also decreasing.

The historical and projected emissions from the energy sector (excluding transport) in the WEM projection are presented in Table 8 and Figure 9. 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.

Table 8. Historical (1990 to 2022) and projected (2025 to 2040) greenhouse gas emissions from the energy sector (excluding transport) based on the latest inventory and the WEM projection, respectively

	Historical				WEM Projection			
	1990	2010	2020	2022	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Total emissions	41.3	47.5	23.9	23.1	16.9	11.6	7.5	5.0
CO_2	40.8	46.7	23.3	22.4	16.3	11.1	7.0	4.5
CH_4	0.2	0.4	0.3	0.3	0.3	0.3	0.2	0.2
N_2O	0.3	0.5	0.4	0.4	0.4	0.3	0.3	0.3

Figure 9. Historical (1990 to 2022) and projected (2025 to 2040) greenhouse gas emissions from the energy sector (excluding transport) based on the latest greenhouse gas inventory and the WEM 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 condensing power 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 energy sector emissions are smoother in the future years (i.e. they have less interannual variability) of the WEM 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 WEM projection, the CO_2 emissions from individual heating of residential and commercial buildings decrease from the recent 1.3 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 2.0 million tonnes by 2030 and 1.4 million tonnes by 2040. The reasons for this favourable development are more efficient equipment (including some electric machinery), a more efficient use of the equipment and increased amounts of bioliquids. The current level of emissions from non-ETS industrial energy use is around 0.6 million tonnes of CO_2 eq. in the WEM projection from where it decreases in coming years 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 0.5 million tonnes of CO_2 eq. comes from machinery. By 2030 and 2040, the energy-related emissions in agriculture and forestry are expected to decrease to 1.0 and 0.6 million tonnes of CO_2 eq., respectively.

Transport

Greenhouse gas emissions from domestic transport (without domestic aviation) totalled 9.7 million tonnes of CO_2 eq. in 2022. Transport emissions account for approximately a fifth of Finland's total greenhouse gas emissions and some 36 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 2022, greenhouse gas emissions from transport (without domestic aviation) dropped by some 2.9 million tonnes in total, or by 23 per cent.

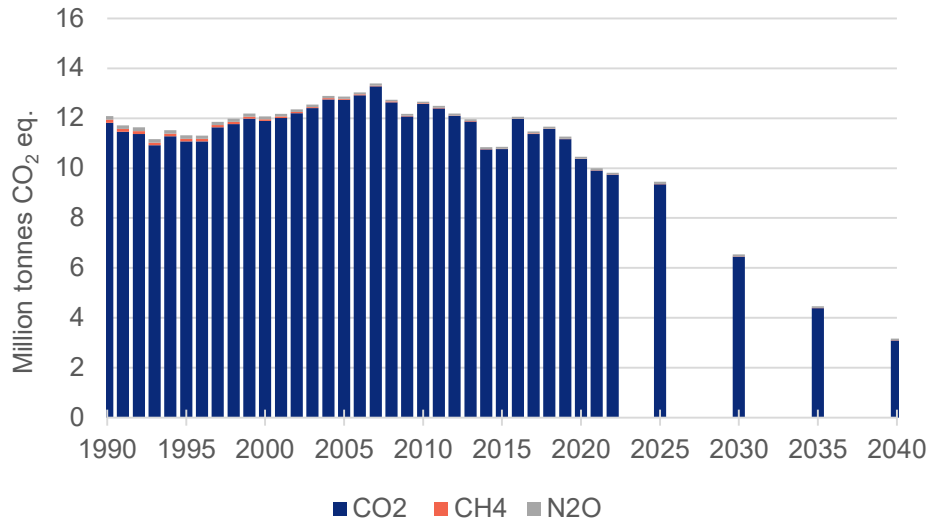
Table 9 and Figure 10 present the historical and projected greenhouse gas emissions. The WEM projection for transport is based on the traffic performance projected until 2030 by the Finnish Transport and Communications Agency Traficom. In road transport, the transport performance of passenger cars is 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 passenger car performance will grow by 6.3 per cent from 2021. Truck performance is estimated to grow by 8.3 per cent in the same time. Other key assumptions in the WEM 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 WEM 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 will stop completely. The third factor having a substantial impact on transport greenhouse gas emissions in the WEM 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 legislation previously in force This results in a temporary increase of the emissions from transport until 2027.

Most of the measures will be focused on road transport where, with existing measures (WEM), emissions could be reduced by approximately 51 per cent, or 6.0 million tonnes of CO_2 eq., by 2030 and by approximately 72 per cent, or 8.5 million tonnes of CO_2 eq., by 2040 compared to 2005. In the period 2005–2022, the emissions fell by approximately 2.7 million tonnes.

Table 9. Historical (1990 to 2022) and projected (2025 to 2040) greenhouse gas emissions from transport based on the latest greenhouse gas inventory and the WEM projection, respectively

	Historical				WEM Projection			
	1990	2010	2020	2022	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Total emissions	12.1	12.7	10.5	9.8	9.5	6.5	4.5	3.2
CO_2	11.8	12.6	10.4	9.7	9.4	6.5	4.4	3.1
CH_4	0.13	0.03	0.01	0.01	0.01	0.01	0.01	0.01
N_2O	0.14	0.07	0.08	0.07	0.08	0.08	0.07	0.05

Figure 10. Historical (1990 to 2022) and projected (2025 to 2040) greenhouse gas emissions from transport based on the latest greenhouse gas inventory and the WEM projection, respectively



International bunkers

According to the most recent GHG emission inventory, the total fuel consumption of international bunkers for international marine transport was 13,909 TJ in 2022, which is similar to the amount (13,522 TJ) prior to the pandemic in 2019. In contrast, the pandemic affected international aviation, as according to the most recent GHG emission inventory, the fuel consumption for international aviation was 22,261 TJ in 2022 and the corresponding fuel consumption prior to the pandemic in 2019 was 35,166 TJ.

According to the EUROCONTROL base scenario, the annual flight growth rate for Finland between 2024 and 2030 will be an average of 2.6 per cent[41]. This forecast is subject to various uncertainties, such as the possibility of deterioration/unforeseen geopolitical events, economic shocks, and ongoing challenges in

[41] EUROCONTROL Seven-Year Forecast 2024-2030 - Spring 2024 Update; https://www.eurocontrol.int/sites/default/files/2024-02/eurocontrol-seven-year-forecast-2024-2030-february-2024.pdf

the aviation industry. Although air traffic is predicted to grow, the various measures and especially alternative fuels will reduce the emissions. In the case of marine bunkers, the emissions are estimated to decrease in the future. The annual average decrease of emissions by 2030 is estimated to be about one per cent.

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. In the WEM 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 WEM projection, it is assumed that the industrial use of fossil fuels decreases 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), which would be produced with hydrogen either in Finland or Sweden. However, the exact timing of this shift is still a significant uncertainty. The assumption in the WEM projection for 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 WEM projection, the replacement will be fully implemented by 2035. 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 not yet finally decided but are expected to decrease industrial emissions further in the future.

In 2022, F-gas emissions totalled 0.8 million tonnes of CO_2 eq., which currently equals approximately three per cent of emissions in the effort sharing sector and two 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 40 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 WEM projection for F-gases includes the impacts of the EU F-gas Regulation[42] 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 0.23 million tonnes of CO_2 eq. by 2030 and further to 0.11 million tonnes of CO_2 eq. by 2040.

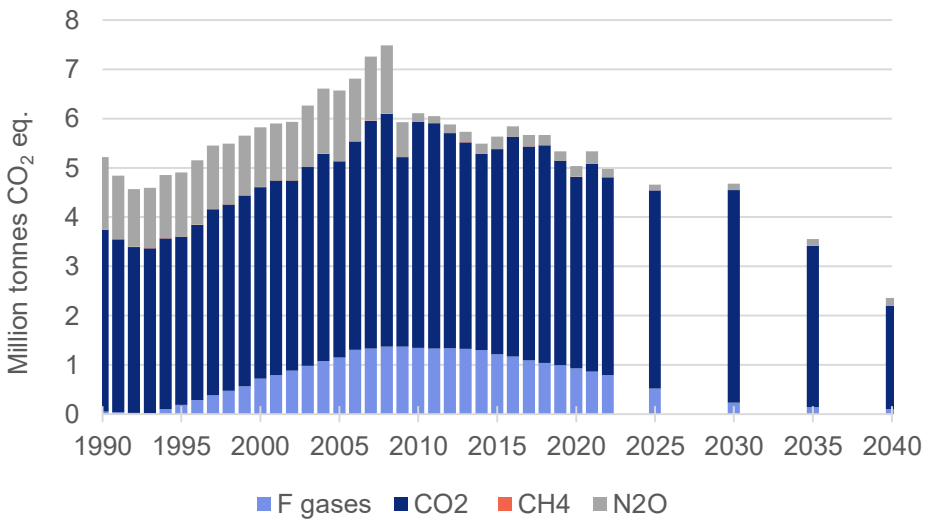
[42] 573/2024

Emissions from solvent and other product use are expected to remain at their present level in the WEM projection. Historical and projected greenhouse gas emissions from industrial processes and other product use are presented by gas in Table 10 and Figure 11.

Table 10. Historical (1990 to 2022) 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 WEM projection respectively

	Historical				WEM Projection			
	1990	2010	2020	2022	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Total emissions	5.2	6.1	5.0	5.0	4.7	4.7	3.6	2.4
CO_2	3.7	4.6	3.9	4.0	4.0	4.3	3.3	2.1
CH_4	0.0	0.0	0.0	0.0	NE	NE	NE	NE
N_2O	1.47	0.17	0.22	0.17	0.11	0.13	0.14	0.16
F gases	0.05	1.35	0.93	0.79	0.52	0.23	0.14	0.11

Figure 11. Historical (1990 to 2022) 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 WEM projection, respectively



Agriculture

In recent years, changes in the emissions from agriculture have been small. The emissions reported by Finland in the agricultural sector in 2023 totaled about 6.0 million tonnes of CO_2 eq. The agricultural sector is the second most significant source of greenhouse gas emissions in Finland, accounting for approximately 15 per cent of Finland's total emissions and approximately 23 per cent of emissions from the effort sharing sector. Emissions from the agricultural sector have remained approximately at the same level between 2005 and 2023 (Table 11). Agriculture WEM projections were updated in January 2025 (Table 11, Table 12 and Figure 12). In the WEM 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 2023 level. After

this, the emissions from agriculture are expected to remain between 5.6 and 5.5 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, and the effect of the measures targeted at peatlands will abate after 2035. The minor decrease in livestock numbers and the increased share of anaerobically digested manure will reduce emissions from manure processing and manure application by around 0.19 million tonnes of CO_2 eq. by 2040. The N_2O emissions from agricultural soils are expected to decrease by around 0.26 million tonnes of CO_2 eq. by 2035 and remain around at that level until 2040. Energy-related emissions related to agriculture are reported in the energy sector and not included in Table 11 and Table 12.

Table 11. Historical (1990 to 2023) and projected (2025 to 2040) greenhouse gas emissions from the agriculture sector based on the latest greenhouse gas inventory and the WEM projection, respectively

	Historical				WEM Projection			
	1990	2010	2020	2023	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Total emissions	7.8	6.5	6.4	6.0	5.9	5.6	5.5	5.5
CO_2	0.6	0.3	0.2	0.3	0.2	0.2	0.2	0.2
CH_4	3.2	2.8	2.8	2.6	2.5	2.5	2.5	2.5
N_2O	3.9	3.4	3.4	3.1	3.1	2.9	2.8	2.8

Figure 12. Historical (1990 to 2023) and projected (2025 to 2040) greenhouse gas emissions from agriculture based on the latest greenhouse gas inventory and the WEM projection, respectively

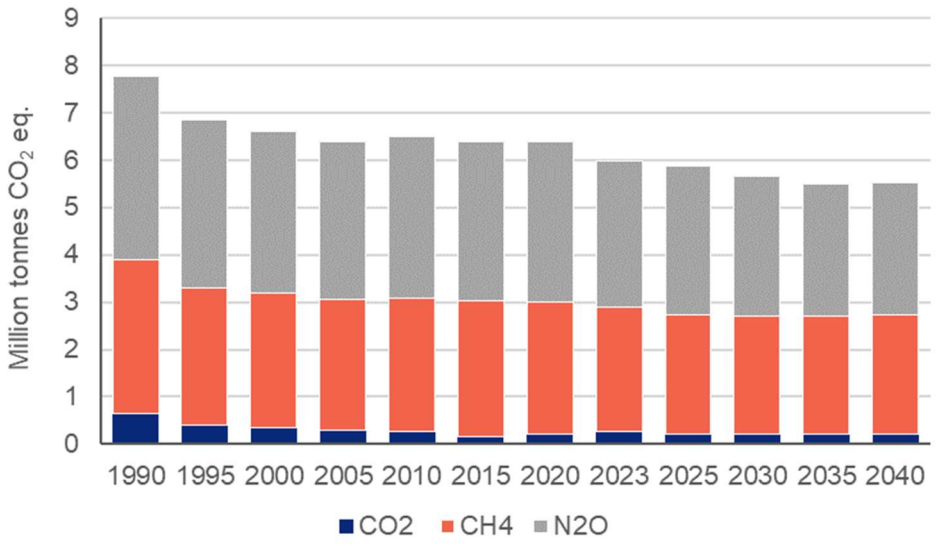


Table 12. Projected greenhouse gas emissions for 2025 to 2040 by categories and the emissions in 2023[43]

	Historical	WEM Projection			
	2023	2025	2030	2035	2040
	million tonnes CO_2 eq.				
WEM - total	5.98	5.87	5.65	5.50	5.51
Enteric fermentation, CH_4	2.11	2.04	2.03	2.07	2.11
Manure management, CH_4	0.52	0.50	0.46	0.43	0.40
Manure management, N_2O	0.28	0.27	0.25	0.23	0.21
Agricultural soils, N_2O	2.82	2.85	2.69	2.56	2.58
Liming and urea application, CO_2	0.26	0.21	0.21	0.21	0.21

LULUCF

In 2023, the LULUCF sector as a whole acted as a source of 11.8 million tonnes of CO_2 eq. because the total removals resulting from the sector were smaller than the total emissions. The net emissions in 2023 were 29 per cent of the total national emissions, which did not include the LULUCF sector. The change to the 2022 net emissions from the 1990 net removals was 153 per cent and from the 2022 net emissions -1 per cent.

The LULUCF sector was a net sink from 1990 to 2017, after which the sector has been a net source of emissions. Forest land has been a net sink from 1990 to 2020. There was a decreasing trend in the Forest Land net sink from 2010 onwards, but the sink slightly increased from 2019 to 2020. Since 2021, Forest Land has been a net source of emissions. The other land-use categories have comprised net sources during the whole time series. Harvested Wood Products have overall been a net sink, except for the year 2009. The low levels of roundwood fellings at the beginning of the 1990s and mid-2000s, and again after the financial crisis in 2008/2009, are the cause of the high removals of the LULUCF sector during those periods of time. There are several reasons why the sector has moved from being a net sink to becoming a net source. The main reasons are that commercial fellings have increased, and at the same time, the tree volume increment has decreased according to the National Forest Inventory. Since 2007, wood export duties from Russia have gradually increased and the imports into Finland were completely cut off in 2022. This has put pressure on domestic wood harvests in Finland. Also, the emissions from organic soils have increased considerably, while the carbon sink of mineral soils has decreased, turning into a source of emissions in recent. According to the 13th National Forest Inventory data, there has been a negative change in the volume of some biomass components compared to the stem volume, having an impact on the amount of carbon that ends up into the soil.

For forest land, tree biomass was a sink with −13.2 million tonnes of CO_2 of net removals in 2023. Harvested wood products were a net sink of −1.7 million tonnes of CO_2 eq. Mineral soils on forest land were a source of 0.4 million tonnes of CO_2, whereas organic forest soils were a source of 11.6 million tonnes of CO_2. Other emission sources in the forest land category are methane and nitrogen oxide emission from

[43] Baseline scenarios for energy and climate package towards zero emissions (in Finnish). http://urn.fi/URN:ISBN:978-952-383-219-0

drained organic forest lands (2.35 million tonnes CO_2 eq.), and minor emissions from nitrogen fertilisation (0.01 million tonnes of CO_2 eq. in 2023) and biomass burning in forest fires and in controlled burning (0.002 million tonnes of CO_2 eq. in 2023). Croplands were also a source of emissions in the LULUCF sector with 8.65 million tonnes of CO_2 eq. in 2023. Other emission sources in the LULUCF sector include grasslands (0.70 million tonnes CO_2 eq. in 2023) and wetlands (2.20 million tonnes CO_2 eq. in 2023), of which peat production areas accounted for 1.73 million tonnes of CO_2 eq. in 2023.

The LULUCF WEM scenario was prepared as a part of the Baseline scenarios for energy and climate package towards zero emissions in June 2024. However, the LULUCF scenario was updated already in January 2025 due to methodological changes. In the most recent scenario, the LULUCF sector is a source of net emissions between the years 2025 and 2055.

Table 13. Historical (1990 to 2023) and projected (2025 to 2040) greenhouse gas emissions from the LULUCF sector based on the latest greenhouse gas inventory and the WEM projection, respectively

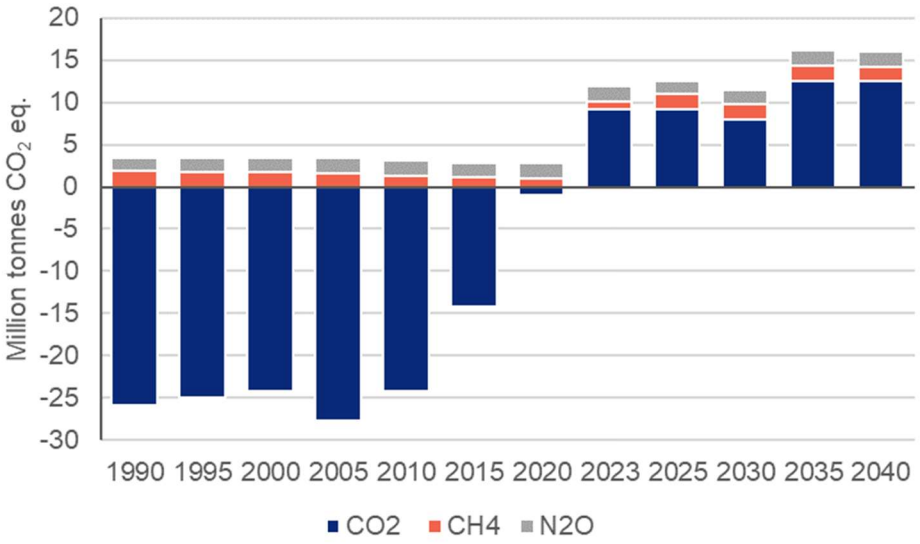
	Historical				WEM Projection			
	1990	2010	2020	2023	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Total emissions	-22.4	-21.0	1.8	11.8	12.6	11.5	16.2	16.0
CO_2	-25.8	-24.2	-1.0	9.1	9.1	7.9	12.5	12.5
CH_4	1.9	1.3	1.0	0.9	1.9	1.9	1.8	1.7
N_2O	1.5	1.9	1.8	1.8	1.5	1.7	1.8	1.9

Table 14. Projected greenhouse gas emissions for 2025 to 2040 by categories and the emissions in 2023[44]

	Historical	WEM Projection			
	2023	2025	2030	2035	2040
	million tonnes CO_2 eq.				
WEM - total	11.8	12.6	11.5	16.2	16.0
Forest land	1.1	7.0	6.7	10.6	10.1
Cropland	8.7	6.7	5.9	6.0	6.4
Grasslands	0.7	0.8	0.8	0.8	0.8
Wetlands	2.2	2.1	1.6	1.4	1.3
Settlements	0.8	1.2	1.2	1.0	0.8
HWP	-1.7	-5.2	-4.7	-3.5	-3.3

[44] 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

Figure 13. Historical (1990 to 2023) and projected (2025 to 2040) greenhouse gas emissions and removals from the LULUCF sector based on the latest greenhouse gas inventory and the WEM projection, respectively



Forest land will continue to be a net source of emissions during the period from 2025 to 2040 in the updated WEM projection. Only in 2055, forest land will become a small net sink. In the WEM projection, the surface area of forest land decreases by only around 5,000 ha until 2055. In 2024–2055, the area of deforestation will be around 300,000 hectares, about the same as the afforestation area. Deforestation is mainly caused by construction. Most of the new forest land comes from grassland (around 102,000 hectares), but also from other land use categories, such as peat production areas (47,000 hectares) and cropland (25,000 hectares). The area to be cleared as arable land from forest land is relatively small, totalling approximately about 31,000 hectares over the period 2024–2055.

In the WEM projection, the estimate of annual roundwood removals is 77.4 million cubic metres in 2019–2028. In 2029–2038, the estimated roundwood removals will average 81.9 million cubic metres per year, which will slightly decrease, reaching a level of 80.5 million cubic metres in 2049–2058.

Cropland and grassland are a net source of greenhouse gas emissions in Finland. The CO_2 emissions in 2023 were 8.65 million tonnes of CO_2 eq. for cropland and 0.70 million tonnes of CO_2 eq. for grasslands. In the WEM projection, the emissions are projected to be 6.03 million tonnes of CO_2 eq. for cropland and 0.77 million tonnes of CO_2 eq. for grasslands by 2035. The WEM projection estimates that the area of arable land will decrease by approximately 80,000 hectares by 2055.

The Harvested Wood Products (HWP) pool was a net sink of 1.66 million tonnes of CO_2 in 2023. HWP has been a net sink over the period 1990–2023, except in 2009. The annual fluctuations in the time series are generally due to changes in the economic situation and the demand for wood products. In the WEM projection, the sink of HWP decreases over time during the reference period. As the production increases, the sink also grows, but as production remains at the same level, the removal of the old carbon stock starts to reduce the sink. As the lifetime of paper and paperboard is considerably shorter than that of solid wood products, the category is more sensitive to changes in production and produces net emission in some years.

The total emissions from wetlands were 2.20 million tonnes of CO_2 eq. in 2023. The emissions have increased by 0.44 million tonnes CO_2 eq. compared to 1990, when they were 1.76 million tonnes of CO_2 eq. In the WEM projection, the emissions from wetlands are expected to decrease to 1.30 million tonnes of CO_2 eq. by 2040. The most significant source of emissions are the peat extraction areas. The decreasing trend in emissions from wetlands is due to the decreasing energy use of peat, resulting in a smaller area being needed for peat extraction.

Projection for LULUCF accounting categories as specified in the Regulation (EU) 2018/841

Projections of LULUCF accounting categories under the Regulation (EU) 2018/841 were compiled from the WEM projection for the period 2021–2025. CH_4 and N_2O emissions from drainage of organic soils and direct N_2O emissions from nitrogen mineralization were allocated into correct accounting categories. Direct N_2O emissions from forest fertilization, CH_4 and N_2O emissions from controlled burning and wildfires on forest land, and emissions and removals from harvested wood products were allocated into managed forest land.

The sum of accounted emissions and removals are projected to be 115.3 million tonnes of CO_2 eq. in the period 2021–2025 before the use of any flexibilities (Table 15). Greenhouse gas inventory data of the preliminary 2023 submission were used to calculate the average annual emissions and removals for managed cropland and managed grassland in the base period 2005–2009. These were 5.8 million tonnes of CO_2 eq. for managed cropland and 0.7 million tonnes of CO_2 eq. for managed grassland. The forest reference level for managed forest land is -29.4 million tonnes of CO_2 eq. for the period 2021–2025 (Annex to Commission delegated regulation (EU) 2021/268[45]) and the preliminary, unofficial technical correction to the forest reference level is 10.1 million tonnes of CO_2 eq[46]. Finland has chosen not to include managed wetlands in the scope of its commitment.

[45] Commission delegated Regulation (EU) 2021/268 of the 28 October 2020 amending Annex IV to Regulation (EU) 2018/841 of the European Parliament and of the Council as regards the forest reference levels to be applied by the Member States for the period 2021-2025.

[46] https://www.luke.fi/fi/ajankohtaista/teemat-ja-kampanjat/metsien-vertailutason-laskenta/metsien-vertailutason-toinen-tekninen-korjaus (in Finnish)

Table 15. Projected emissions and removals from 2021 to 2025 by LULUCF accounting categories

Accounting category	Projection	Total cumulative emissions/removals (million tonnes CO_2 eq.) 2021–2025
Afforested land	WEM	0.1
Deforested land	WEM	13.5
Managed cropland	WEM	2.6
Managed grassland	WEM	-0.5
Managed forest land, including harvested wood products	WEM	99.6
Managed wetland	WEM	Not selected

Waste

Greenhouse gas emissions from waste management (excluding incineration) totalled 1.7 million tonnes of CO_2 eq. in 2022, or 6 per cent of Finnish emissions in the effort sharing sector. 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 45 per cent from 2005 to 2022. 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 WEM projection, emissions from the waste management sector will decrease by around 60 per cent by 2030 compared to the 2005 levels.

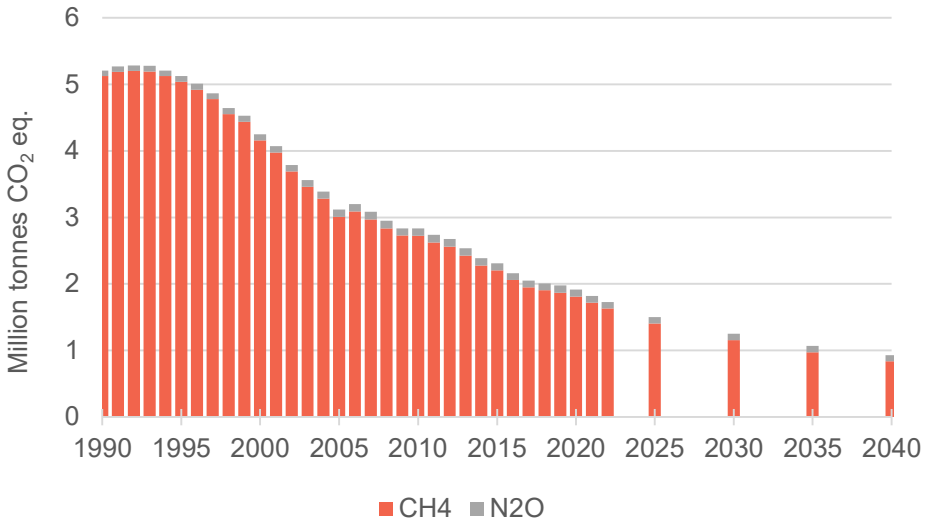
Emissions from facilities that burn municipal waste are mainly included in the effort sharing sector, while emissions from co-incineration plants belong to the EU ETS. The waste incineration emissions of the effort sharing sector have increased significantly since 2005. The increase in emissions is due to the increase in the energy utilisation of municipal waste. About 55 per cent of the municipal waste generated in 2022 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 2022, 0.7 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.

Historical and projected greenhouse gas emissions from the waste sector are presented by gas in Table 16 and Figure 14.

Table 16. Historical (1990 to 2022) and projected (2025 to 2040) greenhouse gas emissions from the waste sector based on the latest greenhouse gas inventory and the WEM projection, respectively (waste incineration not included)

	Historical				WEM Projection			
	1990	2010	2020	2022	2025	2030	2035	2040
	million tonnes CO_2 eq.				million tonnes CO_2 eq.			
Total emissions	5.2	2.8	1.9	1.7	1.5	1.2	1.1	0.9
CH_4	5.1	2.7	1.8	1.6	1.4	1.2	1.0	0.8
N_2O	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Figure 14. Historical (1990 to 2022) and projected (2025 to 2040) greenhouse gas emissions from the waste sector based on the latest greenhouse gas inventory and the WEM projection, respectively (waste incineration not included)



Indirect CO_2 emissions

The WEM projection for indirect CO_2 assumes that their share of the total national emissions without LULUCF will remain at the present level, 0.1 per cent of total national emissions without the LULUCF sector.

3.3 'With Additional Measures' projection

At the time of writing, the Government, including a ministerial working group, is planning new policy measures compared to the measures in the WEM projection. These measures will be assessed and, whenever feasible, included in a new WAM (With Additional Measures) projection. The modelling process has already commenced but is not yet complete. Therefore, no WAM projection is available for this report.

3.4 Assessment of aggregate effect of policies and measures

The aggregated estimates for the greenhouse gas reduction impacts of the individual implemented, adopted and expired policies and measures presented in Section 2.2 are 58 and 74 million tonnes CO_2 eq. for 2025 and 2030 (without LULUCF), respectively. The emissions reduction potential for planned

measures is in most cases not (yet) available. Table 17 presents the total effect of current policies and measures which has been calculated with a bottom-up approach.

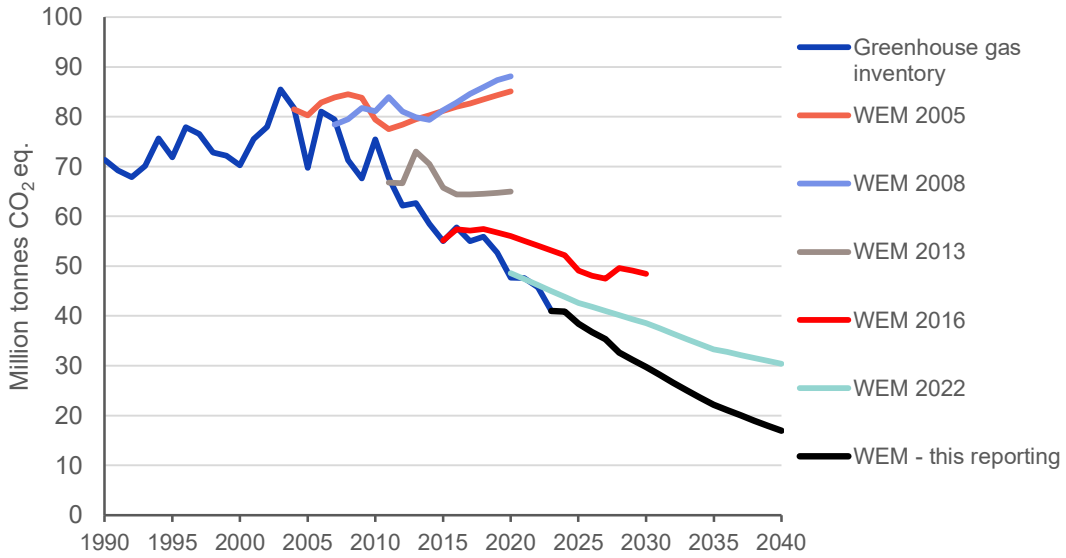
Table 17. The total effect of the policies and measures (PaMs) calculated based on estimated impact of PaMs for the years 2025, 2030, 2035 and 2040. The total emissions in 2022 based on the most recent inventory are also given as a comparison

	Total emission	Total effects of PaMs			
	2022	2025	2030	2035	2040
Without LULUCF, million tonnes CO_2 eq.	45.7	58.2	74.0	82.2	71.7

The estimated total effect of policies and measures contains noticeable uncertainties. The mitigation impact has not been estimated for all policies and measures. Furthermore, the impact estimates of individual policies and measures are not always fully additive, which may result in an overestimation of the mitigation impact in certain sectors. The overlapping effect of measures has been paid due attention to in the case of the simultaneous increase of biofuel content and energy efficiency in machinery, the transport sector, and heating, for example. 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 WEM projections from earlier reporting rounds. Figure 15 shows Finland's greenhouse gas emissions in the WEM projections in the last four national climate and energy strategies, i.e. strategies from 2005, 2008, 2013, 2016 and 2022, as well as in this reporting. The WEM projections in the first four national climate and energy strategies 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 15. Greenhouse gas emissions according to the most recent inventory for 1990 to 2022 and in the WEM projections of the climate and energy strategies published in 2005, 2008, 2013, 2016 and 2022, and the WEM projection of this reporting



The main difference between the projections shown in Figure 15 is that most planned measures from the previous WAM projections have been implemented since the previous reporting and are therefore included in the following WEM projections. The biofuel distribution obligation in road transport is one of the measures with the greatest impact. Another significant difference since the WEM 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 are being shut down ahead of time due to market circumstances and the prohibition of coal energy use. Electrification of society and introduction of new emissions-free technology in all sectors are advancing earlier and faster than previously expected.

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 even upwards in the projections from 2005 and 2008. In turn, the WEM projection of this reporting and the one published in 2022 are clearly in decline.

For comparison purposes, the WEM 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 greenhouse gas inventory is around 40 million tonnes of CO_2 eq. in 2020. By 2030 the gap to the projection of this reporting would presumably increase to over 60 million tonnes of CO_2 eq. 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 74 million tonnes of CO_2 eq. emissions reduction in 2030.

3.5 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 WEM 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. In the sensitivity analyses, energy uses in the transport sector and buildings remain unchanged.

The manufacturing industry uses about 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 WEM projection, even though some product groups already decrease (e.g. paper manufacturing) in the base case WEM. In the sensitivity analyses, the annual growth of the product volumes in the forest and metal industries varies by 1 percentage point in both directions from 2022 compared to the WEM 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 WEM assumptions. No dynamic effects were considered.

The results of the sensitivity analyses are presented in Table 18 below. The overall effect of a lower economic growth (WEM−) results in a steadily decreasing gross final energy consumption in contrast to a higher economic growth (WEM+), where the energy use is almost flat over time.

In 2030, the gross final energy consumption would be only 275 TWh in the low growth case, but 290 TWh in the high growth case compared to 282 TWh in the base case WEM. The corresponding figures for primary energy consumption are 364 TWh (WEM−), 381 TWh (WEM+), and 372 TWh (base case WEM). 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 0.7 million tonnes of CO_2 eq. from the emissions in the base case WEM projection.

Most of the emission increase and reduction would take place in the ETS sector, with only a 0.1 to 0.2 million tonnes of CO_2 eq. reduction in the non-ETS sector.

Table 18. Main results for the sensitivity analysis on how the economic growth rate affects the overall energy balance and GHG emissions

	Unit	2022	2030			2040		
			WEM	WEM +	WEM -	WEM	WEM +	WEM -
GHG emissions								
Total excluding LULUCF	Mt CO_2 eq.	45.7	29.8	30.5	29.1	17.0	17.6	16.4
Total ETS	Mt CO_2 eq.	19.0	10.7	11.3	10.1	3.4	3.8	3.0
Total non-ETS	Mt CO_2 eq.	26.5	18.9	19.0	18.8	13.4	13.5	13.2
Primary energy consumption	TWh	360	372	381	364	354	375	336
Gross final energy consumption	TWh	288	282	290	275	266	285	250

WEM +, projection with higher economic growth than the WEM projection

WEM -, projection with lower economic growth than the WEM projection

Source for historical data: Energy Statistics and Finnish Energy

4 METHODOLOGY

4.1 Approach and responsibilities

The approach and responsibilities in preparing the projections have not changed since the 2023 NECPR reporting.

The reported WEM projections are integrated energy and climate projections based on comprehensive modelling and assessments conducted by experts from various research fields. The projections are updated versions of projections modelled in an extensive project 'Baseline scenarios for energy and climate policy package towards zero emissions' (PEIKKO)[47] financed by the Government's analysis, assessment and research activities. 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 are used as the scientific base for the preparation of the Government's energy and climate strategy. A report describing modelling assumptions and results will be published in mid-2025 by the research consortium.

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 WEM 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. The Ministry of the Environment was responsible for the projection regarding space heating, the analysis of the regional and urban structure, and emission 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 from the transport sector and international bunkers. The Ministry of Agriculture and Forestry oversaw the calculation of emissions and removals in the agriculture and land use, land-use change, and forestry sectors. The Ministry of Finance was responsible for forecasting short-term economic development and taxation.

The sectoral projections, assessments of policies and measures, and other calculations, modelling, and analysis were made by expert organisations, research institutes, and consultants selected for the purpose by the ministries. The following authorities and expert organisations contributed to the reporting: the Energy Authority; 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.

[47] Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO), http://urn.fi/URN:ISBN:978-952-383-219-0

4.2 Assumptions underlying calculations

Key variables and assumptions including specific sectoral and category-specific data are given in "*Table 3: Reporting on parameters/variables for projections*" that is submitted through the Reportnet 3 portal. A detailed description of assumptions and key variables can also be found in Finland's First Biennal Transparency Report[48], Annex 3.

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 increases.

The Covid-19 pandemic and its assumed effects on the economy were considered in the modelling of the WEM projection whose starting point is the year 2022. In contrast to the 2023 NECPR, the energy crisis and changed energy scene following Russia's unprovoked and unjustified invasion of Ukraine are now 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 from the national forest inventory on a decline in tree growth now form the base for the projection work. A part of the measures included in the WAM projection of the 2023 NECPR has been implemented and is now part of the WEM projection, the expansion of the emissions trading system (so called ETS2) being the most significant in terms of emissions reductions.

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 WEM projection, the annual average increase in the national economic output is 1.3 per cent from 2020 to 2030 and 1.7 per cent from 2030 to 2040.

The fuel taxation structure takes into account energy content and lifetime carbon dioxide emissions. They are applied to two categories shown in Figure 5 and described in more detail in Section 2.2.9. 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. The taxation structure and levels 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.

[48] Finland's First Biennal Transparency Report, https://unfccc.int/first-biennial-transparency-reports

4.3 Description of models and methods

A fairly large number of models are applied for the preparation of the greenhouse gas emission projections and for impact assessment of policy measures. These are described in the Model factsheet file in the Reportnet 3 portal and in detail in Finland's First Biennal Transparency Report, Annex 3.

A detailed description of methodologies and the process for collection and use of data is available in Finland's National System for Policies and Measures and Projections in the Reportnet 3 portal.

5 UPDATES OF THE LONG-TERM STRATEGY

In 2020, Finland submitted its Long-Term Strategy to the EU in accordance with the Implementing Regulation Act 2018/1999. The strategy includes Finland's latest national climate target, which is to achieve carbon neutrality by 2035. The Long-Term Strategy has not been updated since 2020.

For the assessment of the contribution of reported policies and measures applied in Finland to the achievement of Finland's long-term strategy, information is given in the reporting portal Reportnet 3 under the data flow of National greenhouse gas policies and measures - Reporting year 2025. Examples of policies that have been estimated to have a significant contribution, either absolutely or relatively, are the EU ETS, phasing out coal in energy production, promoting wind power, promoting new energy technology, implementing ecodesign and labelling, energy efficiency agreements, building regulations and standards, biofuel distribution obligation, CO_2 emission performance standards for vehicles, F-gas regulations and promotion of sustainable management and use of forest. Not all the reported policies have, however, contribution to the achievement of Finland's long-term strategy and in some cases contribution has been estimated to be weak or it is difficult to quantify. Example of policies which contribution is difficult to estimate are for example energy taxation, information campaigns, advice service and programmes increasing knowledge and promoting for example innovations.

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PROJECTED EU ETS AND NON-ETS SHARES OF GHG EMISSIONS

The split is based on GHG inventory data for the years 2020-2022.

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	48	52
Manufacture of wood and of products of wood	7	93
Manufacture of paper and paper products	95	5
Petroleum refining	98	2
Chemical industry excl. petroleum refining	79	21
Manufacture of non-metallic mineral products	88	12
Manufacture of basic metals, iron and steel production	100	0
Manufacture of basic metals, non-ferrous metal production	0	100
Other manufacturing industry	3	97
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	91	9
Chemical industry, hydrogen production	100	0
Chemical industry, production of phosphoric acid, 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