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Environment Finland

Medium-term Climate Change Policy Plan

Towards a carbon-neutral society in 2035

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Medium-term Climate Change Policy Plan

Towards a carbon-neutral society in 2035

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Abstract

The creation of a Medium-term Climate Change Policy Plan is provided for in the Climate Change Act. This is Finland's second climate change policy plan and it is based on the tightened emissions reduction obligation proposed by the European Commission for 2030 and the climate policies in Prime Minister Marin's Government Programme.

The Climate Change Policy Plan applies to the effort sharing sector, i.e. sectors outside emissions trading, except for the land use sector. The effort sharing sector comprises the emissions from transport, agriculture, building-specific heating, non-road mobile machinery, waste management and F-gas emissions and some emissions from industry and energy consumption outside the emissions trading system.

The Commission's proposed emissions reduction obligation for Finland's effort sharing sector for 2030 is 50% compared to the 2005 level, while the Government Programme has set an objective of making Finland carbon-neutral by 2035. The current measures are not sufficient to attain these objectives. The Medium-term Climate Change Policy Plan investigates the actions needed to close the gap and how the emissions of the effort sharing sector can be reduced to make carbon-neutrality achievable.

The plan has been prepared in parallel with the climate and energy strategy and is based on common scenario calculations. The plan also investigates cross-disciplinary themes like regional climate efforts and consumption.

Keywords environmental protection, plans, emissions, climate policy, carbon neutrality

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Keskipitkän aikavälin ilmastopolitiikan suunnitelma Kohti hiilineutraalia yhteiskuntaa

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Tiivistelmä

Keskipitkän aikavälin ilmastopolitiikan suunnitelman laatimisesta on säädetty ilmastolaissa. Järjestyksessään toisen ilmastosuunnitelman lähtökohtia ovat EU:n komission ehdottama vuoden 2030 kiristynyt päästövähennysvelvoite ja Marinin hallitusohjelman ilmastolinjaukset.

Ilmastosuunnitelma koskee ns. taakanjakosektoria eli päästökaupan ulkopuolisia sektoreita maankäyttösektoria lukuun ottamatta. Taakanjakosektorille kuuluvat liikenteen, maatalouden, rakennusten erillislämmityksen, työkoneiden, jätehuollon ja F-kaasujen päästöt sekä päästökaupan ulkopuolisen teollisuuden ja muun energiankäytön päästöjä.

Komission ehdotuksen mukaan Suomen päästövähennysvelvoite taakanjakosektorille vuodelle 2030 on 50 % verrattuna vuoden 2005 tasoon, ja hallitusohjelmassa tavoitteeksi on asetettu, että Suomi on hiilineutraali vuoteen 2035 mennessä. Nykyiset toimet eivät riitä tavoitteiden saavuttamiseen. Keskipitkän aikavälin ilmastopolitiikan suunnitelmassa arvioidaan millä toimilla ero saadaan kurottua umpeen, ja miten päästöt vähenevät taakanjakosektorin osalta niin, että hiilineutraaliustavoite on mahdollista saavuttaa.

Suunnitelmaa on valmisteltu rinnakkain ilmasto- ja energiastrategian kanssa ja laatimisen perustana on yhteiset skenaariolaskelmat. Suunnitelmassa tarkastellaan myös poikkileikkaavia teemoja, kuten alueellista ilmastotyötä ja kulutusta.

Asiasanat ympäristönsuojelu, suunnitelmat, päästöt, ilmastopolitiikka, hiilineutraalius

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Klimatpolitisk plan på medellång sikt Mot ett klimatneutralt samhälle

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Klimatlagen föreskriver att det ska utarbetas en klimatpolitisk plan på medellång sikt. Utgångspunkten för den här klimatplanen, som är den andra i ordningen, är den av EU-kommissionen föreslagna skärpningen av åtagandet att minska utsläppen fram till 2030 och klimatriktninjerna i Sanna Marins regeringsprogram.

Klimatplanen gäller den så kallade ansvarsfördelningssektorn, det vill säga de sektorer som inte omfattas av utsläppshandeln med undantag för markanvändningssektorn. Till ansvarsfördelningssektorn hör utsläppen från trafik, jordbruk, separat uppvärmning av fastigheter, arbetsmaskiner, avfallshantering och F-gaser samt utsläppen från industrin utanför utsläppshandeln och från annan energiförbrukning.

Enligt kommissionens förslag ska Finland fram till 2030 halvera utsläppen inom ansvarsfördelningssektorn från utsläppsnivån 2005, och regeringsprogrammet sätter som mål att Finland är klimatneutralt senast 2035. De nuvarande åtgärderna är inte tillräckliga för att målet ska uppnås. I den klimatpolitiska planen på medellång sikt görs en bedömning av vilka åtgärder som behövs för att vi ska komma i kapp, och hur utsläppsminskningen inom ansvarsfördelningssektorn ska bli tillräcklig för att klimatneutralitetsmålet ska vara möjligt att uppnå.

Planen har beretts parallellt med klimat- och energistrategin utgående från gemensamma scenariekalkyler. Planen behandlar också övergripande teman, såsom regionalt klimatarbete och konsumtion.

Nyckelord miljövård, planer, utsläpp, klimatpolitik, klimatneutralitet

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Summary

The creation of a Medium-term Climate Change Policy Plan is provided for in the Climate Change Act. This is Finland's second Climate Change Policy Plan and it is based on the tightened emissions reduction obligation proposed by the European Commission for 2030 and the climate policies defined in Prime Minister Marin's Government Programme.

The Climate Change Policy Plan applies to the effort sharing sector, i.e. sectors outside emissions trading, except for the land use sector. The effort sharing sector comprises the emissions from transport, agriculture, building-specific heating, non-road mobile machinery, waste management and F-gas emissions and some emissions from industry and energy consumption outside the emissions trading.

The Commission's proposed GHG emissions reduction obligation for Finland's effort sharing sector for 2030 is 50% compared to the 2005 level, while the Government Programme has set an objective of making Finland carbon-neutral by 2035. The actions now included in the baseline scenario are not sufficient to achieve this. The Medium-term Climate Change Policy Plan investigates the actions needed to close the gap and how the emissions of the effort sharing sector can be reduced to make carbon-neutrality achievable.

The plan has been prepared in parallel with the climate and energy strategy. The plan also investigates cross-disciplinary themes like the significance of regional climate efforts and consumption. The plan is based on scenarios created in the HIIISI project led by VTT Technical Research Centre of Finland; the same scenarios are also the basis of Finland's Climate and Energy Strategy.

According to the Commission's proposal, Finland's GHG emissions reduction obligation for 2030 in Finland's effort sharing sector would tighten from 39% to 50% compared to the 2005 level. The emission level corresponding to Finland's obligation for 2030 would be 17.2 Mt CO₂-eq. The proposal increases Finland's obligation by 3.8 Mt CO₂-eq compared to the emissions reduction obligation set in the legislation currently in force. In practice, the obligation set by the EU is comprised of the linear reduction trajectory for the years 2021–2030.

Emissions in the effort sharing sector must continue to fall after 2030 in order to achieve carbon neutrality. The WAM scenario calculated by VTT achieves the climate targets and sets the level of emissions in the effort sharing sector at 14.5 Mt CO₂-eq in 2035. This estimate of the effort sharing sector's share was used to assess the sufficiency of the

measures to reach the carbon neutrality target. The emissions in the effort sharing sector need to fall by almost 50% from the 2020 level in 15 years.

The decisions on the Medium-term Climate Change Policy Plan will be made before the final contents of the EU Effort Sharing Regulation, LULUCF Regulation and Emissions Trading Directive are known. This causes uncertainties in terms of Finland's emissions reduction obligation, the exact determination of the emissions reduction trajectory and means of flexibility, among other things. Negotiations on the Commission's proposals are underway, and decisions can be expected within a year. It is unlikely that the EU will change its proposed national emissions reduction commitments significantly, and in any case, halving the emissions in the effort sharing sector supports Finland's own carbon neutrality target.

Additional measures to reduce emissions

According to the baseline scenario, the emissions of the effort sharing sector will fall to 22.8 million tonnes in 2030 and then further to 20.5 million tonnes in 2035. To be in line with the -50% obligation proposed by the Commission for Finland, the emissions should be 17.2 Mt CO₂-eq, in 2030, which leaves a gap of 5.6 Mt between the current measures and the obligation in 2030. This gap will be bridged by additional measures that form an action plan which will implement the climate objectives of the effort sharing sector.

In the situation for 2035, the gap between the baseline scenario and the 14.5 Mt CO₂-eq, emissions level is 6.1 Mt CO₂-eq. However, the starting point of the Climate Change Policy Plan is to speed up the emissions reductions so that the emissions of the effort sharing sector will be at the new target level in 2030. As a result, the need for additional measures in 2030–2035 will have to be assessed separately, and it will not be possible to use the baseline scenario as the basis for calculations anymore. The difference between the assumed target levels for 2030 and 2035 is 2.7 Mt CO₂-eq, which can be partially covered by the current actions and partially with new political actions. However, the need for new measures in 2030–2035 will depend on the actual emissions level achieved in 2030 and also on the emission trends in the emissions trading and land use sectors.

The action plan of the Climate Change Policy Plan consists of sector-specific additional actions and cross-sectoral actions associated with municipal climate actions and consumers. In addition, the action plan contains a one-off flexibility and LULUCF flexibility for the 2030 target, which means that the corresponding extra GHG emissions must be reached in the emissions trading and land use sectors.

The Climate Change Policy Plan contains emissions reduction measures from all sectors that the plan applies to. All sectors have to carry out measures in order to reduce emissions in line with the targets. The current estimate indicates that the measures in the action plan will be able to reduce emissions by an additional 5.7 Mt by 2030 compared to the baseline scenario, including the flexibilities, which means that the emissions reduction obligation would be achieved. For 2035, the emissions will fall to 15.5 Mt CO₂-eq. Achieving the 14.5 Mt level would require approximately 1.0 Mt of additional measures. Alternatively, corresponding extra emissions reductions could be gained from the emissions trading or land use sectors. The table 1 contains the emissions reduction figures for each sector in the action plan of the Climate Change Policy Plan.

Table 1. Sector-specific estimates of emissions reductions in the action plan of the Medium-term Climate Change Policy Plan (Mt CO₂-eq). The 2030 reductions have been calculated in relation to the baseline scenario, and the additional reductions by 2035 in relation to a situation in 2030 in which the emissions reductions have been met. The reduction target for 2030 is 5.6 Mt CO₂-eq, which would be met with the planned actions.

	2030	2035
Transport (see Chapter 6.2.1)	1.3	0.9
Agriculture (see Chapter 6.2.2)	0.6	0.1
Building-specific heating (See Chapter 6.2.3)	0.7	
Non-road mobile machinery (see Chapter 6.2.4)	0.5	
Waste treatment (see Chapter 6.2.5)	0.1	
F-gases (see Chapter 6.2.6)	0.3	0.1
Industry and other emissions (see Chapter 6.2.7)	0.7	0.1
Municipal actions (see Chapter 6.3.1)	0.2	0.1
Actions by consumers (see Chapter 6.3.2)	0.2	0.1
One-off flexibility	0.7	
LULUCF flexibility	0.4	
Impact of the current actions in 2030–2035		1.4
Total	5.7	2.8

Because of its size, the transport sector plays a key role in the overall picture. The most important emissions reduction measures for transport consist of the implementation of phase 1 and 2 of the Roadmap to fossil-free transport and the implementation of the transport sections of the Commission's new climate package. The necessity of the actions of phase 3 of the Roadmap is also investigated further.

As for agriculture, the key emissions reductions are those implemented by the EU's Common Agricultural Policy (CAP). However, the CAP cannot implement all necessary mitigation or adaptation measures in agriculture, and this would not be sensible either, since national-level measures are also needed. The agricultural emissions reduction measures presented in this document deal especially with the mitigation of emissions from peatlands, such as peatland cultivation with elevated water levels, increasing carbon sequestration in mineral soils, precision farming and reduction of methane emissions from dairy cows. These measures will reduce emissions not only in the agriculture sector, but also to a large extent in the land use sector.

Emissions from building-specific heating will be mitigated above all else by phasing out oil heating and adopting low-carbon solutions. This transformation will be supported by investment subsidies and domestic help credit. The distribution obligation of heating fuels will also be increased, which will have a strong impact on the emissions from oil heating installations that still remain. The increase of the distribution obligation will also reduce emissions from non-road mobile machinery and other consumers of oil.

The Climate Change Policy Plan specifies a number of actions for reducing consumption-based emissions. When calculating the emissions for the effort sharing sector, these reduction measures might have secondary effects on the emissions from transport, building-specific heating and agriculture, for example. Consumers will continue to be encouraged to halve their carbon footprint.

Similarly to actions that target consumption, climate actions by local governments promote emissions reductions across different sectors both directly and indirectly. Within their own municipality, local governments are responsible for zoning, land use, transport planning, ownership steering of energy companies, choices between alternative heating systems for buildings and public procurement within their own territories. Nearly 80% of GHG emissions originate from purchases made by local authorities and joint municipal authorities while the remaining 20% come from central government procurement.

This time, the Climate Change Policy Plan takes into account the emissions reduction opportunities offered by the circular economy. A circular economy offers solutions for reducing greenhouse gas emissions and mitigating other environmental effects of consumption and production. The most significant emissions reductions resulting from

the circular economy take place in production, as the use of virgin natural resources and energy required in production processes decrease.

The administrative branches commit to executing the measures specified in the plan to an extent feasible within their resources. Measures that require funding will be handled and decided on separately in the processes that deal with the budget and the General Government Fiscal Plan. Measures that require funding from the local government will be processed in the decision-making processes of the local governments.

Impacts of the plan

The impacts of the Climate Change Policy Plan have been investigated in the HISSI project, in separate sector-specific projects and also partly by public officials. The purpose is to assess the impacts from as many perspectives as possible.

The impacts on the economy arise primarily from additional investments on energy technology, but also from production processes, increased energy efficiency and electrification of transport. The investments reform the consumption and production structures, which brings significant improvements in efficiency and opens up new possibilities. The investments required to limit emissions will increase the national product for a large part of the 2020s and 2030s. During this transformation, export volumes and household consumption will fall compared to the baseline scenario, which will mitigate their stimulating effect on growth. However, more productive new technology that is also more energy- and material-efficient will allow the exports to recover and the economy to grow.

It can be stated that in general, the economic impact of the plan is fairly moderate. Employment will increase in the processing sectors and will fall in the service sector. The additional measures will primarily and directly affect the consumption of transport and housing services of households, but their indirect impact will become visible in the prices of other products and services, depending on the energy- and emissions-intensity of their production.

From the perspective of the environment, the attainment of emissions targets is estimated to have positive effects, since the reduction of emissions will prevent some large-scale, partly irrevocable and unforeseeable impacts of the climate change on the environment and the society. However, the construction of renewable energy and other infrastructure, including the production of electric vehicles and biofuels, consumes natural resources, which will partly mitigate the environmental benefits.

The mitigation of climate change will also reduce the concentration of air pollutants, although the health risks from both domestic and transboundary air pollution will remain significant. The largest domestic sources of emissions are street dust and small-scale combustion of wood, which the current climate actions do not affect very much. Exhaust emissions from transport have already fallen significantly and will keep falling as engine technology develops. NO_x emissions will fall as electric cars replace petrol and diesel cars and biogas becomes increasingly common in heavy transport. Emissions of black carbon, which warm the climate and originate mostly from transport and small-scale combustion of wood, are forecasted to fall as well.

One of the premises of the Medium-term Climate Change Policy Plan is to make the transition to low-carbon society as fair as possible. As climate actions are prepared further, their impact on fairness and equality in different sectors, employees and consumers must also be considered.

The assessment of equality was made by public officials in the Ministry of the Environment in co-operation with the Ministry of Justice and the gender impact assessment of the Climate and Energy Strategy. The assessment was performed by arranging two workshops for experts and leveraging research data and statistics. This process also took into account the observations that were expressed in the consultation rounds on the Climate Change Policy Plan and concerned actions that warrant special attention to ensure their fairness.

Engagement and monitoring

A wide and diverse range of stakeholder groups and citizens was heard during the preparation of the Climate Change Policy Plan. The preparation process also involved a citizen survey that asked for opinions on the preliminary emissions reduction measures. The survey proved very popular. The project also collaborated with the University of Turku to establish a Citizens' Panel that discussed the new measures systematically and issued a statement on them. The results of these approaches clearly indicate that citizens are both capable and willing to participate in the planning of climate policy. A large number of young people were also heard during the preparation of the Climate Change Policy Plan, and the Ministry of the Environment arranged workshops for stakeholders. The Ministry of the Environment also negotiated with the Sámi Parliament on climate actions that affect the Sámi. This wide-ranging engagement of citizens produced valuable information on the impact of various climate actions.

The hearings revealed that as a rule, citizens have a positive attitude towards climate actions, but there are also people that oppose any climate action and people who demand a more ambitious climate policy. Voluntary actions and incentives were generally more popular than actions based on coercion or pricing.

The implementation of the Climate Change Policy Plan is monitored by an Annual Climate Report submitted by the Government to the Parliament. The annual report contains information on emission trends, the achievement of emissions reduction targets and the additional measures required to reach these targets. Monitoring will also cover aspects relating to the achievement of carbon neutrality. Pursuant to the Climate Change Act, every other year the report must contain information on monitoring of the implementation of policy measures.

The Climate Change Policy Plan will be revised if the monitoring reveals that the actions in the plan are not sufficient to achieve the emissions reduction obligation. The final content of the EU legislation on the 2030 obligations might also give a reason to adjust the content of the Climate Change Policy Plan. Additionally, the emissions level required by carbon neutrality is affected by the emission trends in the emissions trading sector and the net sink of the of the land use sector.

Introduction

This is Finland's second Medium-term Climate Change Policy Plan. The first Medium-term Plan was completed in 2017. Pursuant to the Climate Change Act (609/2015), a Medium-term Climate Change Policy Plan must be created once every government term. The plan is submitted to the Parliament as a report. The Climate Change Act lays down the planning system of Finland's climate policy of which this plan is an essential component. This plan has been created in accordance with the requirements of the Climate Change Act currently in force. The ongoing reform of the Climate Change Act will affect the content and creation of the future Medium-term Climate Change Policy Plans.

The purpose of the Medium-term Climate Change Policy Plan is to determine the targets and actions of the climate policy on the so-called effort sharing sector in the medium term. This plan investigates both the attainment of the 2030 emissions reduction obligation of the effort sharing sector and the emissions reduction measures required in the sector to attain the carbon neutrality target of 2035. The effort sharing sector consists of greenhouse gases emitted by transport, building-specific heating, agriculture, waste management, non-road mobile machinery and more.

The Medium-term Climate Change Policy Plan was prepared in parallel and in coordination with the National Climate and Energy Strategy. These two preparation processes overlap in several ways. Both the strategy and this plan are based on the same background calculations and impact assessments created in the same project titled Carbon neutral Finland 2035 – measures and impacts of climate and energy policy (HIISI project; VTT Technical Research Centre of Finland 2021a) in 2021. The impact assessments will be supplemented by the HIISI-jatko (HIISI the Continuation) project that started in December 2021.

The emissions reduction target for 2030 became more specific during the preparation of this plan when the EU Commission published its proposal in July 2021 for amending the climate and energy legislation in 2030 (EU 2021a). The Commission's proposed amendment to the Effort Sharing Regulation was used as the starting point for setting the targets in this plan. According to the Commission's proposal, Finland's emissions reduction obligation in the effort sharing sector would tighten from 39% to 50% in 2030 compared to the 2005 level. Another matter that became clearer during the creation of the plan was how the emissions reduction obligation of the effort sharing sector compares to the emissions trading and land use sector in the attainment of the 2035 carbon neutrality objective.

It is likely that the 2030 emissions reduction obligation for the effort sharing sector will be significantly tighter than the previous one. Attaining it requires the adoption of new emissions reduction measures in all subsectors of the effort sharing sector. The measures were determined with special attention to their cost-effectiveness and fairness. Assessing the measures' impact on emissions always involves uncertainties which must be kept in mind when investigating future emission trends. The magnitude of the new measures or additional measures is based on an assessment based on current trends, which then serves as an input for the total need for emissions reduction. The baseline scenario is one where the current trends continue up to 2030 and 2035 and it is based on calculations made in the HISI project.

A wide and diverse range of stakeholder groups and citizens was heard during the preparation of the new emissions reduction actions. The preparation process also involved a citizen survey that asked for opinions on the preliminary emissions reduction measures. The survey proved very popular. The project also collaborated with the University of Turku to establish a Citizens' Panel that discussed the new measures systematically and issued a statement on them.

The Medium-term Climate Change Policy Plan not only covers the traditional subsectors of the effort sharing sector, but also cross-sectoral actions. The latter consists of climate actions by local governments and affecting emission trends through consumption. Many municipalities are very active in climate actions and the plan wishes to encourage all municipalities to do the same. The relative significance of consumption and consumers in climate policy has increased markedly in the last few years, which is also reflected in the scope of application of this plan. This plan also pays attention to how public procurement and circular economy are connected to climate policy.

To support the preparation of the Medium-term Climate Change Policy Plan, the Ministry of the Environment established a working group in October 2020 that consisted of officials from key ministries. The working group was strengthened by a specialist member of the Finnish Climate Change Panel. The mandate of the working group was extended to the end of September 2021. The progress of the preparation of the plan was reported regularly to the ministerial working group on climate policy.

Funding needs go through the regular procedures for the state budget and the General Government Fiscal Plan within the central government spending limits, and are matched to other spending needs.

1 International operating environment

1.1 International climate agreements

At the international level, the most important climate policy outlines were made in the UN Framework Convention on Climate Change (UNFCCC) that entered into force in 1994, in the Kyoto Protocol and the Paris Agreement. The parties to the UNFCCC are all UN member states, including Finland, three other states and the European Union. The UNFCCC obliges the parties to formulate, implement and update programmes to mitigate climate change and facilitate adaptation and to report information on emissions by sources and removals by sinks of greenhouse gases. The parties are furthermore required to promote the conservation and enhancement of carbon reservoirs and sinks.

While the UNFCCC (UN 1992) does not contain quantitative emissions reduction obligations, its supplementary Kyoto Protocol (UN 1997) imposes legally binding reduction obligations for industrial countries' greenhouse gas emissions. The Kyoto Protocol was signed in December 1997 and it entered into force in February 2005. In the first commitment period 2008–2012, the total emissions reduction obligation of industrial countries was 5.2% compared to the 1990 level. EU's obligation was 8%.

The parties to the Kyoto Protocol agreed on a second commitment period for 2013–2020 in Doha in December 2012. Soon after this, the focus of international climate policy shifted to the preparation of the Paris Agreement that steers climate policy more widely and with a more long-term approach than the Kyoto Protocol, which resulted in the second commitment period having a clearly smaller geographic scope than the first one. It took until October 2020 before the Doha Amendment was approved by a sufficient number of parties and it entered into force on 31 December 2020. The target of EU's second commitment period 2013–2020 was an emissions reduction of 20% compared to the 1990 level.

The Paris Agreement on climate change (UN 2015a) was adopted at the 21st Conference of the Parties to the UN Framework Convention on Climate Change in Paris in December 2015 and entered into force in November 2016. By April 2021, the Agreement had been ratified by 191 parties and covered 97% of global greenhouse gas emissions. The Agreement applies to the post-2020 period and is in effect until further notice. Negotiations on the specific rules for the implementation and application of the Paris Agreement, also known as the 'Katowice Rulebook' or the 'Katowice Climate Package', are still partly unfinished. The November 2021 Conference of the Parties to the UN

Framework Convention on Climate Change in Glasgow agreed on more specific rules in Article 6 on market mechanisms and the uniform and transparent reporting of climate actions and emissions.

The aim recorded in the Paris Agreement is to hold the increase in the global average temperature to well below two degrees Celsius, pursuing efforts to limit the average temperature increase to 1.5 °C above pre-industrial levels. A further objective is to strengthen the ability of the parties to adapt to climate change and foster climate resilience and to direct financial flows towards low-carbon development. In order to achieve the temperature goal, global greenhouse gas emissions will need to be brought downwards as soon as possible and quickly reduced thereafter so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.

The key elements of the Paris Agreement include the parties' obligation to formulate their nationally determined contributions (NDCs) used to declare their emissions reduction and adaptation targets and report their planned climate action. The contributions must be tightened at least every five years and must correspond to the highest possible target level of the party. The countries' collective progress towards achieving the objectives of the Paris Agreement will be assessed every five years by conducting global stocktakes. The first stocktake will be undertaken in 2023.

The NDC synthesis report (UN 2021a) published by the UNFCCC secretariat states that at present, 113 countries have reported on new commitments which, when met, will reduce emissions by approximately 12% in 2010–2030. By the end of the Glasgow Conference, the number of countries had increased to 124. In addition, 70 countries have reported that they strive towards carbon neutrality by around mid-century, which would lead to higher emissions reductions of approximately 26%. Some major economies have set their carbon neutrality target to a later point in time, for example China and Russia to 2060 and India to 2070. Before more detailed estimates are obtained from the new commitments given in Glasgow, the current NDC commitments by a total of 193 parties will lead to a 2.4 degree increase in global average temperature by the end of the century. The commitments of the parties and the way they meet the Paris Agreement targets of limiting temperature increase will be revised already in 2022.

1.2 Other international initiatives

After the Paris Agreement, the role of businesses, local government, NGOs and other non-governmental parties has increased in international climate policy. Due to the urgency and magnitude of emissions reductions, alternative methods of co-operation are needed

in addition to negotiations between states. International co-operation initiatives are collected in the Climate Initiatives Platform portal (YK 2021b) under the UN Environment Programme (UNEP). By April 2021, the portal contained 269 climate initiatives, with Finland participated in 48.

Climate and Clean Air Coalition

Established in 2012, the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC; UN 2021c) is a voluntary partnership initiative between states, intergovernmental organisations, businesses, research institutions and NGOs for the climate and clean air. The aim of the coalition is to promote emissions reductions in short-lived climate pollutants (SLCPs) and greenhouse gases and thereby protect the environment and human health, improve food and energy security and mitigate climate change. Substances considered SLCPs by the CCAC are black carbon, methane, tropospheric ozone and some HFC compounds. At present, the coalition consists of 71 states and 78 NGOs. Finland joined the CCAC in June 2012. The UN Environment Programme acts as the secretariat of the coalition.

Global Methane Initiative

Finland has participated in the Global Methane Initiative since 2008. The Global Methane Initiative is a voluntary, non-binding programme for international co-operation and information exchange for reducing methane emissions and promoting the use of methane in energy production. At present, the GMI has 46 partner states and focuses its efforts on measures in the oil and gas, biogas and coal mining sectors. The biogas sector deals with agricultural and waste management issues. The GMI carries out technology demonstrations and disseminates information on policy measures to encourage investments and identify efficient methods for reducing emissions. The goal of the initiative is to support the work of the participant countries within UNFCCC.

In the November 2021 Conference of the Parties to the UN Framework Convention on Climate Change in Glasgow, the EU and the United States launched a Global Methane Pledge that strives towards a quantitative reduction of 30% in methane emissions of human origin in 2020–2030. A total of 111 countries have joined the pledge, including Finland (as of March 2022). The pledge contains no national or sector-specific emissions reduction targets for the signatory countries. The IPCC says that in order to reach the 1.5 target of the Paris Agreement by the end of the century requires that carbon neutrality is attained by mid-century and significant reductions are achieved in the emissions of methane and black carbon. The Global Methane Pledge seeks to initiate a trend for the reduction of methane emissions that would meet the target. Meeting the target of the pledge might limit global warming by approximately 0.2 degrees by mid-century.

Air transport

The target set by the International Civil Aviation Organization (ICAO) for international air transport is carbon-neutral growth from 2020 onwards, which means that as air transport grows, its emissions will remain at the 2020 level (ICAO 2019). The target also contains a two per cent annual increase in fuel efficiency until 2050.

The primary methods for emissions reductions are technological development, operational improvements and utilisation of advanced biofuels. However, these means will not be enough to achieve the target, which is carbon-neutral growth in the near future. Therefore, in the ICAO Assembly in October 2016, the ICAO member states agreed on the implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

In the CORSIA system, airlines will offset their emissions that exceed the baseline emissions calculated from the emissions reported for 2019. This happens by using emission reduction units primarily from other sectors. The offset obligation starts in 2021, but participation in the system is initially voluntary. The second phase, 2027–2035, is mandatory for all ICAO member state, excluding some exemptions granted, for example, for the least developed countries. Finland is committed to the ICAO targets for reducing emissions from air transport.

Maritime transport

The International Maritime Organization (IMO) adopted its initial strategy (IMO 2018) on the reduction of GHG emissions from ships in spring 2018. The strategy states that the carbon intensity of maritime transport, i.e. CO₂ emissions per transport work, must be reduced by 40% by 2030 and by 70% by 2050 compared to the 2008 emissions level. In addition, all GHG emissions from international maritime traffic should peak as soon as possible and the total annual emissions should decline by at least 50% by 2050.

In the IMO Marine Environment Protection Committee (MEPC) meeting in November 2020, the member states agreed on regulations for achieving the short-term target of 40%. However, the regulations do not contain sanctions for failing to carry out the corrective actions needed to reduce the emissions from ships. Carbon dioxide emissions from maritime transport are measured and monitored separately for each ship and the results are reported to the European Commission. IMO's global emission measurement obligation entered into force in 2019. Finland is committed to the IMO targets for reducing emissions from maritime transport.

Four per thousand initiative

The Paris Climate Conference in December 2015 also launched a “four per thousand” initiative that seeks to increase the concentration of carbon in soil (4 per 1000; UN 2015b). The initiative aims to increase the quantity of carbon contained in soils by 4‰ each year. The sequestration of atmospheric carbon in soils will contribute to limiting the temperature increase to 1.5–2 °C. It will also increase the productivity of soil and improve food security.

Thirty-nine countries and hundreds of organisations have committed to the initiative. Finland was among the first signatories of the initiative and is committed to promoting it also in Prime Minister Sanna Marin’s Government Programme. The initiative consists of a common action plan for governments and stakeholders to increase soil carbon sequestration and a programme for international research and scientific collaboration.

Finland is investigating its carbon sequestration potential in the Climate Plan for the Land Use Sector that is currently being prepared and in several ongoing research and development projects.

Coalition of Finance Ministers for Climate Action

The Coalition of Finance Ministers for Climate Action brings together fiscal and economic policymakers from around the world and seeks to ensure fiscal and economic planning is part of the global response to climate change. The aim is to harness the expertise and fiscal and economic policy tools of the finance ministries of member countries in combating climate change. These tools include taxation, budgeting, financing and public procurement. The coalition is presided by Finland and Indonesia.

The Coalition of Finance Ministers for Climate Action was launched in Washington in April 2019 on Finland’s initiative. The coalition consists of 65 member countries that are committed to the so-called Helsinki Principles. The member countries together account for about 63% of the world’s gross domestic product (GDP) and about 39% of the world’s greenhouse gas emissions.

The objectives of the Coalition’s work are set out in the six Helsinki Principles:

- Align policies and practices with the Paris Agreement commitments;
- Share experience and expertise with each other in order to provide mutual encouragement and promote collective understanding of policies and practices for climate action;
- Work towards measures that result in effective carbon pricing;

- Take climate change into account in macroeconomic policy, fiscal planning, budgeting, public investment management, and procurement practices;
- Mobilise private sources of climate finance by facilitating investments and the development of a financial sector which supports climate mitigation and adaptation;
- Engage actively in the domestic preparation and implementation of Nationally Determined Contributions (NDCs) submitted under the Paris Agreement.

1.3 International cooperation

Arctic Council

The Arctic Council is an intergovernmental forum that promotes co-operation between the arctic states and indigenous peoples, in particular on issues of sustainable development and environmental protection. The Council's working groups regularly publish information on the effects of and adaptation to climate change in the Arctic. According to an estimate published by the AMAP working group of the Arctic Council in 2021, the Arctic is warming three times faster than the Earth on average.

The Arctic Council has worked for approximately a decade with black carbon, methane and other SLCP emissions. The work with black carbon and methane is inspired by the fact that the speed of climate change can be slowed down by taking global action against SLCPs in addition to CO₂ emissions. The efforts are guided by a framework document drawn up in 2015 (Arctic Council 2015), with the member states reporting every two years their national emission trends of black carbon and methane in the medium-term and their actions to reduce their emissions. The national reports are used as input for a summary and progress report for the ministerial meeting of the Arctic Council that convenes every two years.

Black carbon absorbs thermal radiation and amplifies Arctic warming. The highest relative impact comes from airborne emissions that originate from the nearby regions and settle on Arctic ice. The member states of the Arctic Council only emit 6% of global black carbon, but their emissions increase Arctic warming by about 33%. Black carbon is produced by incomplete combustion, for example, in power and industrial plants using outdated technology, in small-scale burning of wood, diesel vehicles, flaring of excess methane at oil drilling sites, incineration of organic waste and controlled burning of agricultural land.

In 2017, the member states adopted a collective goal of reducing black carbon emissions by 25–33% from the 2013 level by 2025. Progress towards the goal is monitored at

the Arctic Council level, but it might require actions in Finland as well. The Finnish Environment Institute estimates that in 2025, Finland will emit 39% less black carbon than in 2013.

The framework document and the emissions reduction target are expressions of political will, and do not bind the member states under international law. The observer states of the Arctic Council have also been invited to participate in the efforts stated in the framework document, and many of these countries are now active participants.

OECD

Established in 1961, the Organisation for Economic Co-operation and Development (OECD) is an international organisation that currently consists of 37 member countries. Finland joined the OECD in 1969. The OECD's task is to monitor and compare the development of its member countries and to issue policy recommendations. The OECD offers external expert views on how the present policies or structures in different sectors should be developed. For Finland, the OECD is also a source of opinions outside the EU.

The OECD engages in wide-ranging efforts to mitigate climate change and execute climate agreements with the goal of supporting international climate negotiations and the states' efforts to execute their national and international climate commitments. Most of this work is done under the OECD Environment Policy Committee which has a separate working group that coordinates climate work. However, projects on climate change are also going on in many other committees and between committees.

IPCC

The Intergovernmental Panel on Climate Change (IPCC) collects and analyses scientific data on climate change and options for adaptation and mitigation to support political decision-making. The collected data is published as comprehensive Assessment Reports that are authored by hundreds of researchers across the world. The IPCC also publishes Special Reports on specific themes and methodology guidelines on the reporting of GHG emissions to support the execution of the climate agreement. The IPCC reports undergo a scientific peer review and a government review before they are published. The reports are approved in the IPCC general meetings.

In 2018–2019, the IPCC published three special reports: Special Report on the impacts of global warming of 1.5°C (IPCC 2018), Special Report on land use (IPCC 2019a) and the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC 2019b) and the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2019c).

The IPCC is currently preparing the main sections of the Sixth Assessment Report (AR6). The first one that concerns the physical science basis of climate change (Working Group I contribution: The physical science basis) was published in August 2021. The second main section that deals with adaptation to climate change (Working Group II contribution: Impacts, adaptation and vulnerability) was published in February 2022. Scheduled for approval in 2022 are the third main section on the mitigation of climate change (Working Group III contribution: Mitigation of climate change) and a report summarising the entire 6th cycle (Synthesis Report).

The Ministry of the Environment has established a national IPCC working group that supports Finland's participation in the IPCC and enables participants to cooperate with the IPCC nationally and internationally in themes that support the climate policy. Finland's IPCC Focal Point (a national contact point) is the Finnish Meteorological Institute.

2 EU climate policy

2.1 Objectives and policy packages

The EU climate policy steers joint EU actions and the Member States' own actions in climate change mitigation and adaptation. The policy is based on the UN climate agreement, its supplementary Kyoto Protocol and the Paris Agreement. The core of the climate policy consists of emissions trading, national obligations for sectors that fall outside the emissions trading system (also known as 'effort sharing') and the EU adaptation strategy. The EU's long-term target is to achieve carbon neutrality by 2050, which means that emissions must be reduced until the total amount of emissions equals the removal by sinks.

In December 2020, by the decision of the European Council on the EU Climate Law, the European Union committed to reducing net greenhouse gas emissions by at least 55% from 1990 levels by 2030. The European Climate Law (EU 2021b) entered into force in summer 2021. It makes the carbon neutrality target by 2050 and the emissions reduction target for 2030 legally binding. In the calculation of net emissions, the law caps the share of removals in the Union's 2030 climate target to 225 million tonnes of CO₂ equivalent.

Raising the general EU target for 2030 from 40% to at least 55% aims to ensure that the goal of climate neutrality by 2050 can be reached. As a result of this increase, the obligations in both the emissions trading and effort sharing sector will become stricter and targets will be set for net removals in the land use sector. The EU Climate Law Regulation contains climate targets for 2030 and 2050. The Climate Change Regulation will be updated with the EU climate target for 2040. At the same time, the Commission will publish in a separate report the projected indicative Union greenhouse gas budget for the 2030–2050 period.

In July 2021, the European Commission published a package of climate and energy legislative proposals with the aim of ensuring a 55% reduction in emissions in the Union by 2030 (the Fit for 55 package). The climate package (EU 2021a) contains several legislative proposals on amending the current directives and regulations on climate policy and establishing new ones. The proposals contain many elements that would affect the Medium-term Climate Change Policy Plan, but the exact content of the legislation is not completely known yet. The proposals will be processed in negotiations between the European Parliament and the Council of the European Union that consists of ministers of the Member States. The Commission's proposal tightens the emissions reduction

obligation of Finland's effort sharing sector from 39% to 50%. In addition, the Commission proposes a new emissions trading mechanism for road transport and building-specific heating, although these sectors would still remain as part of the effort sharing sector.

The EU Climate Law and the Commission's Climate Package are a part of the European Green Deal. The programme aims to transform the EU into a modern, resource-efficient and competitive economy, where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use, without leaving any person or region behind.

2.2 EU emissions trading system

The EU Emissions Trading System (ETS; Emissions Trading Directive 2018/410) covers currently approximately 40% of the Union's greenhouse gas emissions. The scope of the ETS covers large industrial installations and energy production plants with a thermal input of more than 20 MW. Aviation has been included in the system since the beginning of 2012, but the scope of the ETS is currently limited to flights within the EU.

The ETS does not set separate obligations for each Member State, since it operates on the EU level and the obligations in it apply to all operators that fall under the scope of the system. Since 2013, a single EU-wide emissions ceiling has been set for all sectors covered by the ETS. The emissions ceiling, i.e. the amount of emission allowances issued falls linearly every year so that the emissions reduction obligation of the sector is met. The ETS also contains a market stability reserve that reduces the system's susceptibility to disturbances.

The Commission's new climate package proposes that the ETS emissions reduction target be increased from 43% to 61% in 2005–2030. This would be achieved by increasing the linear reduction coefficient of emission allowances from 2.2% to 4.2% and by making a one-off cut in the emission ceiling. The Commission also proposes that maritime transport be included in the ETS and that the free emission allowances in some sectors be cut during the transition period.

2.3 Effort sharing legislation

The EU's Effort Sharing Decision (406/2009) specifies emissions reduction obligations to sectors outside the ETS, except for the land use sector. The primary sectors covered by the Effort Sharing Decision are transport, building-specific heating, agriculture, waste management, non-road mobile machinery and fluorinated greenhouse gases.

The EU's joint emissions reduction obligation for the effort sharing sector is divided between the Member States primarily based on GDP. In addition, the national targets of some countries have been adjusted based on cost-efficiency and fairness. The Commission's climate package published in July 2021 proposes the tightening of both the overall target of the effort sharing sector and the obligations of each Member State. The EU-wide emissions reduction target would tighten from 30% to 40% in 2005–2030. The current Member State specific emissions reduction obligations range from 0 to 40%, but in the Commission's proposal they would range from 10 to 50% in the future. The proposal would increase Finland's current emissions reduction obligation of 39% to 50% in the effort sharing sector.

The Effort Sharing Regulation (ESR) states that emissions must be reduced linearly every year in accordance with annual emission allocation in 2021–2030 (Effort Sharing Regulation 2018/842). To make it easier to meet the obligations, the Member States have a range of flexibility mechanisms at their disposal. Between 2021 and 2030, the Member States have been able to use temporal flexibilities, which means that they can bank and borrow emissions between individual years. Temporary flexibilities enable extra units to be saved for future years and borrowed from the following year under certain conditions. The Member States can also trade emission units between each other. This means that Member States can purchase emission units from other Member States in order to meet their emissions reduction obligation. From 2021 onwards, international emission units purchased from outside the EU may no longer be used for this purpose. Two new flexibility mechanisms are available for the 2021–2030 period: a one-off flexibility mechanism that allows a limited amount of emission allowances to be transferred from the ETS side to cover the emissions of the effort sharing sector, and a very limited amount of surplus emission units from the land use sector may be used for meeting the obligation of the effort sharing sector.

The Commission's climate package proposes that the current flexibilities be retained. The current country-specific flexibility in the land use sector would be limited to two five-year periods. In order to use the flexibility to cover the obligation of the effort sharing sector, the land use sector must exceed its obligation. The proposal suggests that when calculating whether the obligation that entitles to the flexibility has been exceeded, all land use categories of the land use sector may be included in the calculations, unlike at present.

The Commission also proposes a new flexibility method: a voluntary EU-level additional reserve that is based on a potential EU-level surplus generated in the land use sector and using this surplus to meet the obligations of the effort sharing sector on the condition that certain criteria are met. Joining this system would be voluntary for the Member States.

The Commission's climate package proposes a separate emissions trading system for two key sectors in the effort sharing sector, which are road transport and heating. In spite of emissions trading, these would remain within the effort sharing sector at least until 2030. The new ETS would target fuel distributors and fossil fuels used in residential, service and public buildings or in small heating plants producing heat for them while not falling within the scope of the current ETS, and fossil fuels used in road transport, excluding the use of agricultural machinery on paved roads. According to the Commission's proposal, actual auctions of emission allowances would begin in 2026. The emissions ceiling would reduce annually as dictated by the linear emissions reduction factor by 5.15% in 2026–2027 and 5.43% in 2028–2030. The purpose of the new ETS is to mitigate these emissions in concert with the other proposals in the climate package by 43% by 2030 compared to the 2005 level.

2.4 Land use sector

According to the current regulation (2018/841), the land use sector consists of the greenhouse gas emissions and removals caused by land use, land use change and forestry (LULUCF). At the EU level, the LULUCF sector absorbs more greenhouse gas emissions than it produces. The average magnitude of removals by carbon sinks in 1990–2019 was 6% (approximately 300 million tons CO₂-eq, including Great Britain) of the annual emissions from all other sectors.

Forest carbon sinks vary annually for reasons like natural disasters and variations in roundwood removal levels. Forests are by far the largest carbon sink in the EU land use sector, and most of the emissions are caused by deforestation as forests are cleared to make way for infrastructure, such as new roads and buildings and agricultural land (EEA 2021). Member States vary widely in terms of the size of their carbon sinks and the significance of land use categories.

In Finland, forests are an important carbon sink, while other categories are mainly sources of emissions. A particularly significant source of emissions are peatland fields and forests on drained peatlands. On the whole the Finnish land use sector has acted as a significant net carbon sink in the period that starts from 1990, binding on average 30% of the emissions from other sectors.

The currently valid LULUCF Regulation obliges the Member States to keep greenhouse gas removals in the land use sector, calculated in accordance with the rules laid down the Regulation, at least at the calculated level of the sector's emissions during the 2021–2030 period. The calculation rules used for monitoring emissions and removals depend on the land use category. For the period 2021–2025, the role of forests as a sink or emission

source can be determined by comparing the actual removals for the commitment period to the set reference level. The reference level of forests is a forecast for the commitment period calculated from the removals by forest land and harvested wood products or emission trends, provided that the Member State follows the same forest management practices as in the period 2000–2009. The reference level for Finnish forests was calculated by the Natural Resources Institute Finland under the direction of the Ministry of Agriculture and Forestry (Ministry of Agriculture and Forestry 2019). The compliance of the calculation with the Commission's guidelines was verified by technical inspections arranged by the Commission.

The flexibilities laid down in the Regulation apply to intrasectoral and intersectoral flexibilities and transfers of emission units of the land use sector between Member States. Removals by forest land and harvested wood products that exceed the reference level may also be used to compensate the emissions from other categories of land use in the land use sector; the maximum amount of such compensation is 3.5% of the emissions of the Member State's base year. For Finland, the maximum amount of this flexibility is 2.5 Mt CO₂-eq per year.

As the Finnish land use sector is a net sink, its removals can compensate emissions from the effort sharing sector by a maximum of 0.45 Mt CO₂-eq per year in 2021–2030. However, if the calculations indicate that the land use sector is a source of emissions, Finland may have to compensate for the emissions with additional emissions reductions from the effort sharing sector. Emission units can also be procured from Member States whose total removals exceed their total emissions.

The Commission's climate package proposes that the current LULUCF Regulation remain in force for the period 2021–2025, but for the next period, the calculation and accounting system would change significantly. For the land use sector, the package proposes that the EU net sink be increased from the present level to 310 million tonnes of CO₂ equivalent by 2030. Finland's prorated share of the 2030 target would be 17.8 million tonnes of CO₂ equivalent.

Based on the proposal for amendment of the LULUCF Regulation, the Commission will issue an Implementing Regulation in 2025, which specifies the trajectory for Member State specific obligations for 2026–2029 so that the target set in the proposal for 2030 is met. The trajectory will be based on confirmed emissions and removals in 2021–2023. To simplify implementation and compliance, the accounting rules for land use specified in the Kyoto Protocol will no longer be applied after 2025. Instead, the calculation will be based on emissions and removals reported in the greenhouse gas inventories.

A major revision proposed by the Commission is that from 2031 onwards, emissions from agriculture would be considered a part of the land use sector, instead of the effort sharing sector like at present. The resulting new sector, AFOLU (agriculture, forestry and other land-use), should be climate-neutral in 2035, and should strive towards carbon negativity from that point on. A more detailed legislative proposal on the AFOLU sector would be submitted in 2025.

2.5 Governance Regulation of the Energy Union

The EU's Governance Regulation of the Energy Union (2018/1999) was approved in December 2018. The Governance Regulation of the Energy Union is a monitoring system for the EU's climate and energy policy that controls the Energy Union's targets and the achievement of emissions reduction targets. The Energy Union covers five dimensions: energy security; the internal energy market; energy efficiency; decarbonisation; and research, innovation and competitiveness. The key elements of the governance model are National Energy and Climate Plans (NECP) and Long Term Strategies (LTS). The Governance Regulation contains provisions on the monitoring of both the energy sector and greenhouse gas emissions.

The Member States had to submit their NECPs by the end of 2019 and from there on, an updated or a new plan every five years. In a NECP, a Member State describes its contribution to the EU's common energy and climate targets for 2030. The execution of the NECP must be reported to the Commission every other year from 2023 onwards. Finland's NECP for 2019 (Ministry of Economic Affairs and Employment 2019) is based on the latest national energy and climate strategy published in 2016 and the Medium-term Climate Change Policy Plan published in 2017. The entries on energy and climate policy in Prime Minister Sanna Marin's Government Programme are included in the NECP.

According to the Governance Regulation, LTSs that reach up to 2050 have to cover total reductions in greenhouse gases, the removals by sinks and the increases in the removals. Emissions reductions and removals must also be reviewed in different sectors, such as energy production, industry, construction, agriculture, waste management and the LULUCF sector. Other LTS content specified in the Governance Regulation includes the expected progress towards low-carbon economy, greenhouse gas intensity, strategies for research, development and innovations and links to other national long-term plans. Finland submitted its LTS in April 2020 (Ministry of Economic Affairs and Employment 2020).

2.6 Energy regulations

The EU's energy policy and its objectives are directed by a package that consists of several EU directives. The most important regulations from a climate perspective are the Renewable Energy Directive, the Energy Efficiency Directive and the Directive on Energy Performance of Buildings. The Commission's climate package unveiled in July 2021 contains several proposals for updating these regulations.

2.6.1 Renewable energy

The Renewable Energy Directive (RED II 2018/2001) was approved at the end of 2018 and had to be implemented in the Member States by 30 June 2021. The actions in RED II seek to increase the share of renewable energy in electricity generation, transport and heating and cooling. The directive does not specify national targets. Instead, each Member State proposes a target for itself in its NECP and the means for achieving the target. The Member States ensure jointly that the proportion of renewable energy of final energy consumption is at least 32% in the EU by 2030.

In its 2019 NECP, Finland reported that its target for renewable energy is 51% by 2030. For transport, the proportion of renewable energy must be 14% in each Member State by 2030. Finland's Distribution Obligation Act will increase the share of biofuels in transport from 18% to 30% in 2021–2029.

The Commission's climate package proposes an increase in the proportion of renewable energy to 40% of final energy consumption by 2030. The Commission also proposes that the indicative annual increase obligation in renewable energy sources in the heating sector be turned into a minimum requirement (1.1 or 1.5 percentage points if waste heat is utilised) and that the increase obligation of renewables in district heat production be increased from one percentage point to 2.1 percentage points per year. Likewise, the use of renewable energy in the industry would be subject to a new indicative annual increase obligation of 1 percentage point. For buildings, the proposed indicative target for renewable energy sources is 49% in the entire EU level by 2030. The minimum obligation of renewable fuels in transport is turned into an emissions reduction obligation of 13%.

The RED II directive defines binding EU-level sustainability criteria for biofuels in transport, bioliquids and solid and gaseous biomass fuels used for electricity generation and heat production. The sustainability criteria seek to ensure that the increasing use of bioenergy will reduce greenhouse gas emissions significantly compared to the use of fossil fuels. The Commission's proposal tightens the sustainability criteria and broadens their scope of application.

2.6.2 Energy efficiency

Pursuant to the Energy Efficiency Directive (2018/2002), the general EU-level target for energy efficiency is -32.5%, which specifies a ceiling for the end use of energy and total energy consumption in the EU. The Finnish NECP sets Finland's Member State specific obligation for the end use of energy at 290 TWh in 2030. In addition, the binding energy saving obligation of 0.8% for 2021–2030 requires that Finland report to the Commission annual energy savings of 2.4 TWh, which Finland plans to achieve primarily by actions that improve energy efficiency. In addition, the Energy Efficiency Directive contains many other obligations for improving energy efficiency.

The Commission unveiled a proposal for a new Energy Efficiency Directive along with the climate package. The proposal suggests that the EU-level general energy efficiency target for 2030 be made binding and the target be tightened significantly so that energy consumption must fall by 36–39% compared to the baseline scenario. The EU-level target is prorated to the Member States by applying a formula issued by the Commission. For Finland, the end use of energy must be at 255 TWh in 2030. The proposal increases the energy saving obligation from 0.8 to 1.5% at the beginning of 2024, which means that Finland must report annual energy savings of approximately 4.5 TWh to the Commission in the period 2024–2030. In addition, the Commission proposes for the public sector a binding reduction obligation of 1.7% in the end use of energy.

The Energy Efficiency Directive in force contains a limited obligation to renovate the building stock owned and used by the central government. The Commission's proposal for a climate package now extends the 3% renovation obligation to the building stock owned by the entire public sector. The proposal sets the requirement levels for renovation almost to the zero-energy level applicable to new buildings. The Commission also proposes new obligations for increasing the proportion of renewable energy in district heating and cooling systems and utilising waste heat in them.

2.6.3 Energy performance of buildings

The Directive on Energy Performance of Buildings (2018/844) seeks to improve the energy efficiency of buildings and thereby mitigate climate change. The Commission states that overall, buildings are responsible for about 40% of the EU's total energy consumption, and for 36% of its greenhouse gas emissions from energy (EU 2020a).

The energy performance of buildings is regulated by the Directive on Energy Performance of Buildings, which was last updated in 2018. The revised Directive seeks to promote cost-effective energy solutions in renovations and the use of smart technology in

buildings. The new regulations increase possibilities for charging electric cars and promote the development of automation for monitoring building heating and air conditioning in buildings. Amendments to the Directive in 2018 mostly apply to large non-residential buildings.

The Directive on Energy Performance of Buildings already contains provisions on setting minimum standards for energy efficiency in new construction and renovation, nearly zero-energy buildings, energy certificates for buildings and inspections of heating and air conditioning systems or alternative actions that achieve the same savings as the inspections.

The Commission published a proposal for amending the Directive on Energy Performance of Buildings in December 2021. The proposal complements the Commission's Fit for 55 package published in July.

2.6.4 Energy taxation

Energy taxes in the EU are harmonised taxes that are regulated by a Council Directive (2003/96). The Directive provides for minimum tax rates and the structure of taxation. Finland has in place some exceptions allowed by the directive on the basic tax structure. The Commission's Fit for 55 package proposed a revision to the directive.

The proposed revised directive would stagger the taxation and minimum tax rates of fuels and electricity into tax categories. The Member States would have to set uniform tax rates within the categories in relation to the energy content, which would make taxation uniform for e.g. gasoline, diesel and, after a transition period, natural gas. After the transition period, all fossil fuels, non-sustainable bio-derived fuels and sustainable food- and feed-crop-based bio-derived fuels would be taxed at the highest tax category. The tax rate of electricity would be bound to the lowest tax category, which would also be applied to advanced bio-derived fuels and renewable non-bio-derived fuels. The medium tax category would include sustainable bio-derived fuels (excluding sustainable fuels derived from food and feed crops) and low-carbon fuels.

The Commission's proposal would extend energy taxes to solid biomass and hydrogen, among others. The tax exemption of fuels in intra-EU maritime transport would be discontinued. The tax exemption of fuels in intra-EU air transport (other than cargo transport) would be phased out over a transition period. Fuels for heating and non-road mobile machinery could still be taxed at a lower rate than in transport. The proposal harmonises the taxation of households and businesses, although some targeted tax reliefs

would still be possible for the heating fuels and electricity consumed by energy-intensive businesses, but the criteria would be stricter.

The minimum tax rates in the Commission's proposal are very low. The Commission's assessment report on the current Directive states that the minimum tax rates were already low when the Directive entered into force in 2003, and have not been adjusted since. The Commission's proposal uses these rates as the baseline and proposes inflation adjustments to them starting from 2018.

2.7 Circular economy

A circular economy offers solutions for reducing greenhouse gas emissions and mitigating other environmental effects of consumption and production. 'Circular economy' is generally used to refer to an operating model that minimises natural resources extracted for the economy by changing production methods so as to be based on circularity and by shifting consumption patterns from products to services, renting, recycling and sharing.

In March 2020, the EU Commission published a new Circular Economy Action Plan entitled 'For a cleaner and more competitive Europe' as part of the European Green Deal (EU 2020b). The previous EU Circular Economy Action Plan was from 2015 and it was implemented between 2015 and 2018. The new Action Plan aims to promote a circular economy and bring about a systemic shift towards sustainable production and consumption patterns. The plan focuses on product policy and sustainable product design. The measures focus on resource-intensive sectors, which include, for example, electronics and ICT, batteries and vehicles, packaging, plastics, textiles and furniture, constructions and buildings and food, water and nutrients. Some measures also target intermediary products that have a high impact, such as steel, cement and chemicals.

The sustainable product policy measures presented in the plan target the entire value chain from materials and production methods to service concepts, consumption and safe recycling. The plan recognises the significant impact product design has for the lifecycle emissions of a product.

The Circular Economy Action Plan links in many ways with the EU's new Industrial Strategy that seeks to support the transition to a green and digital economy, improve the worldwide competitiveness of the EU's industry and increase Europe's open strategic independence. Both plans share some initiatives, for example on battery regulations, recyclability of electronics, EU textile strategy and empowering consumers.

2.8 Bioeconomy

The Commission communication 'A Clean Planet for All' (EU 2018a) stated that sustainably produced biomass plays an important role in carbon-neutral economy. Biomass-derived solutions can substitute for carbon intensive materials, particularly in the building sector but also through new and sustainable bio-based products for example in textiles, bioplastics and composites.

The EU published an updated Bioeconomy Strategy in 2018 (2018b). The strategy is based on the fact that bioeconomy offers opportunities for sustainable growth throughout the EU, both in urban and rural areas. The priorities of the strategy are:

- Strengthening and promoting growth in bio-derived industries in order to leverage the opportunities afforded by bioeconomy in the modernisation of European economy and industry to achieve long-term and sustainable wealth by bringing bio-derived innovations closer to the market, for example.
- Rapid adoption of bioeconomies throughout Europe. Member States and regions, particularly in Central and Eastern Europe, have a large underused biomass and waste potential. This can be supported by promoting the preparation of bioeconomy strategies
- Protecting ecosystems and understanding the ecological limitations of the bioeconomy

The Bioeconomy Strategy and the associated sustainable value chains of bio-derived resources are closely linked to the EU's industrial policy and green growth. Bioeconomy solutions are a part of the strategic toolkit towards a carbon-neutral economy, and the possibilities of bioeconomy, such as bio-based materials, will be investigated widely in industrial ecosystems and should be utilised widely therein. Sustainable bioeconomy can offer competitive, innovative and high-value added solutions and services. Bio-based products and solutions contribute to the EU's transition towards a sustainable, climate-neutral economy.

2.9 Climate funding

The EU's finance support to the Member States' climate actions is channelled through EU budget programmes and separate action plans and mechanisms. In December 2020, the European Council approved the long-term EU budget 2021–2027, which consists of a multiannual financial framework of 1,074 billion euro and a temporary recovery package of 750 billion euro titled NextGenerationEU (EU 2020c). The expenditures in the multiannual financial framework and the recovery package must be in line with the EU's

climate targets for 2030 and 2050 and the Paris Agreement. Thirty per cent of the total expenditure in the financial framework and the recovery package will be allocated to climate programmes.

The EU budget supports climate actions via the Modernisation Fund and LIFE programme, for example. Finland is not eligible for support from the Modernisation Fund, since it targets climate actions in low-income EU countries. The EU LIFE programme is the only EU funding that focuses solely on the environment, climate and nature conservation. The multi-year work programme for 2021–2024 was completed in July 2021 (EU 2021c). In Finland, LIFE funding is allocated by the Ministry of the Environment.

The NextGenerationEU funds climate actions directly and indirectly through the Recovery and Resilience Facility (RRF) and through the Just Transition Fund (JTF). Not all funding through the RRF and JTF goes to climate action, but all funded projects must pass a Do No Significant Harm (DNSH) review. Research and innovations are funded via the Horizon Europe programme that focuses on research and innovations associated with climate and energy.

The RRF provides Member States an opportunity to support climate actions as part of their national COVID-19 recovery and resilience plan. Finland uses funding from the RRF to implement a national Sustainable Growth Programme. The programme consists of four pillars, the financially largest of which solely supports green transformation and economic restructuring towards a carbon-neutral welfare state. The other pillars of the programme can also be considered to have an indirect effect on climate change mitigation. The Sustainable Growth Programme is being prepared by the Ministry of Finance. By national decision, fifty per cent of the funding for the programme will be allocated towards green transition. The Council of the European Union approved the programme in October 2021.

The JTF is being prepared on a national level by the Ministry of Economic Affairs and Employment. The JTF's primary purpose is to support areas that are most impacted by the transformation to climate neutrality and prevent an increase in regional disparities. The fund supports projects like clean energy technology, emissions reductions and employee re-skilling.

The Commission proposes the establishment of a new climate fund as part of the Fit for 55 package published in July 2021. The fund would be used to counter the negative effects that might be incurred to the most vulnerable households and micro-enterprises when the emissions trading system is introduced in building heating and transport. The size of the fund would be EUR 72.2 billion. The fund would operate in 2025–2032 and would span two financial framework periods. According to the Commission's proposal for amending the Emissions Trading Directive, a part of the income from the new emissions

trading auctions for road transport and heating of buildings would be channelled to the EU's own resource from 2026 onwards. The size of the fund would be 25% of the forecasted income from the proposed new emissions trading scheme for road transport and heating of buildings. However, the fund would start operating already in 2025, before the new emissions trading scheme is launched.

3 Finnish climate policy

3.1 Overview

Finland's national climate policy is guided by the climate and energy policies in the Government Programmes, the targets and obligations of Finnish and EU Climate Change Acts, EU regulations and directives on climate, the environment and energy, and international agreements, such as the Paris Agreement made in 2015. The execution of the international and national climate policy targets and obligations is coordinated by national plans and strategies.

Finland's national climate policy has traditionally been based on government programmes and plans. Climate and energy strategies have been drawn up since 2001; the first Medium-term Climate Change Policy Plan that concerns sectors outside emissions trading, i.e. the so-called effort sharing sector, was completed in 2017 (Ministry of the Environment 2017). Finnish climate policy has also been planned in sector-specific climate programmes and action plans created in ministries. Long-term climate targets and actions were processed in the Report on the Future of Climate and Energy Policy in 2009 (Prime Minister's Office 2009) and the Energy and Climate Roadmap 2050 published in 2014 (Ministry of Economic Affairs and Employment 2014a).

From 2015 onwards, the Climate and Energy Strategy has been prepared in parallel with the Medium-term Climate Change Policy Plan required by the Climate Change Act. The Climate and Energy Strategy covers the GHG emissions from the emissions trading sector, effort sharing and land use sectors, sinks of the land use sector as well as adaptation to climate change. The strategy applies to the entire field of energy policy, including energy production, operation of the energy markets, security of supply and operational reliability. The strategy is created once per government term by co-operation between ministries under the leadership of the Ministry of Economic Affairs and Employment. The most recent National Energy and Climate Strategy was published in 2016 (Ministry of Economic Affairs and Employment 2016a). The strategy specifies how Finland can reach the essential climate and energy targets and obligations set by the EU for 2030.

The new climate and energy strategy has been prepared simultaneously with this Medium-term Climate Change Policy Plan and it will be issued as a report to the Parliament in summer 2022. The creation of the strategy and Medium-term Climate Change Policy Plan use the same knowledge base whose central component is known as the baseline scenario (see Chapter 5.1).

A part of the overall climate policy is the National Climate Change Adaptation Plan. Published in 2014, the National Climate Change Adaptation Plan 2022 (Ministry of Agriculture and Forestry 2014a) replaced the original Climate Change Adaptation Plan published in 2005. A mid-term review of the adaptation plan was published in April 2019 (Mäkinen et al. 2019) The process of updating the adaptation plan was launched in 2021.

The Climate Plan for the Land Use Sector that will be completed in spring 2022 will complement the Finnish climate policy by stating the measures necessary for meeting the climate objectives of the land use sector and the plans for executing and monitoring the measures.

Climate policy operators

In Finland, the government is responsible for the general frameworks of climate policy and setting the targets therein. In practice, the obligations laid down in the Climate Change Act apply to the government and its organisations that are in charge of the planning system and associated obligations prescribed by the Act. The state is also responsible for Finland's commitments in international climate policy, such as the Kyoto Protocol and Paris Agreement. The government also implements the EU climate law and monitors it.

When preparing and implementing climate policy, the government engages in active dialogue with other parties involved in climate policy. This diverse engagement ensures that the opinions, rights and interests of different stakeholders are taken into account in the climate policy. The government also strives to ensure that the decision-making in climate policy is based on a robust knowledge base.

Companies have adopted an increasingly active role in climate policy in recent years. Companies are also increasingly targeted by measures that steer them towards emission reductions. A large proportion of industry, in particular, comes under the emissions trading system, while energy taxation also puts a price on companies' emissions. Companies want to be assured that the climate policy guidelines will remain in force also in the long term, because it helps them to plan investments systematically. The operating environment of companies must support the execution of the necessary investments.

For emissions-intensive companies, the tightening climate policy might mean extra costs in the short term, but it will also offer significant business opportunities in the longer term in the development of new solutions and technologies. Some companies have also independently started cooperating in various climate initiatives to reduce emissions. The contents of these initiatives and pledges vary, but in general, they are based on the Paris Agreement and its targets.

An increasing number of companies seek to achieve carbon neutrality as part of their sustainable operations. Companies also consider and monitor their carbon footprint to an increasing extent and report it to their stakeholders. In addition to individual companies, many interest groups that represent various companies have included climate policy in their programmes in recent years.

Municipalities and regions are important entities in attaining Finland's carbon neutrality target (see Chapter 6.3.1). Within their own municipality, local governments are responsible for zoning, land use, transport planning, ownership steering of energy companies, and partly also for the options for heating systems for buildings. Local governments can also enable and promote climate actions between the residents, businesses, farmers and other stakeholders. Municipalities are eager and willing to commit to promoting local and regional climate actions. The government supports municipal and regional climate actions by funding municipal climate actions, regional energy advisory services and the adoption of energy efficient technology in municipalities.

Traditionally, many interest groups, such as employer and employee organisations, and environmental organisations have contributed to climate policy by publishing their views on topical climate policy issues. Now that the social importance of climate policy has increased, the NGO sector as a whole has taken a more active stand towards climate policy. This is a sign that organisations wish to ensure the sustainability of their operations, are increasingly concerned about the climate crisis and wish to do their share to mitigate it. In general, the organisations are very adept in using participation channels associated with climate policy. Campaign-oriented organisations that only concentrate on climate policy have recently sprung up alongside traditional environmental organisations that operate with a larger scope.

3.2 Government Programme

Prime Minister Sanna Marin's Government Programme titled 'Inclusive and competent Finland – a socially, economically and ecologically sustainable society' (Prime Minister's Office 2019) states that Finland seeks to be carbon-neutral in 2035 and carbon-negative soon after that. This means that, in 2035, emissions should stand at or below the level of sinks, which should subsequently exceed emissions. This will be achieved by accelerating emissions reduction measures and strengthening carbon sinks.

The Medium-term Climate Change Policy Plan and the Climate and Energy Strategy will be updated to correspond to the emissions reduction trajectory that is in line with the carbon neutrality target. The Climate Change Act will also be reformed and its role as a policy instrument will be strengthened. The Government Programme states that the carbon

neutrality target will be reached in a way that is fair from a social and regional perspective and that involves all sectors of society.

Carbon neutrality will require larger emissions reductions in the effort sharing sector by 2030 than those set out in the previous Medium-term Climate Change Policy Plan. New measures are also planned for the post-2030 period. In addition, significant emissions reductions in the emissions trading sector and a considerable net sink in the land use sector will be required to achieve carbon neutrality.

The carbon neutrality target is a general objective that guides other climate-related parts of the Government Programme, including their execution. Other significant climate targets in the environmental, climate and housing package of the Government Programme are the goal of becoming world's first fossil-free welfare state, strengthening carbon sinks and pools in the short and long term and reducing the carbon footprint of housing.

In keeping with the Government Programme, electricity and heat production must be made nearly emissions-free by 2030 while also taking into account the perspectives of security of supply and servicing. Among the tools for achieving this is an energy taxation reform which was specified further in the Vuosaari Climate Meeting in 2020. The execution of the sink strengthening target will be based on the climate programme for the land use sector. The reform of the Climate Change Act will also add the sink strengthening target in the Act. The target concerning housing and construction will be implemented by a package of measures that focuses on housing and the building stock. The purpose is to reduce the carbon footprint of housing, improve the energy efficiency of the existing building stock and support the transition to zero-emission heating.

The transport subset in the package for regional policy, transport and agriculture contains measures that promote a functional, resource-wise and low-emission transport system. For agriculture, one of the objectives in the Government Programme is a climate-friendly and environmentally wise food system.

In addition to the targets and objectives above, the Government Programme contains many packages that are not considered separate sectors, but rather a part of most or all sectors. These cross-sectional packages in the Medium-term Climate Change Policy Plan are municipal and regional climate efforts, public procurement, consumer carbon footprint and circular economy.

The Government Programme also contains an entry on the creation of sector-specific low-carbon roadmaps. A total of 13 sectors have already created their low-carbon roadmaps, some of which will also have an impact on the emissions from the effort sharing sector

(Paloneva & Takamäki 2020). Important sectors for the effort sharing sector include transport and logistics, agriculture, property owners and developers.

3.3 Climate Change Act

The Climate Change Act (609/2015) provides for the planning and monitoring of climate policy and sets objectives for the national climate policy. The objective of the Act is to be a framework for national actions that reduce anthropogenic greenhouse gas emissions, mitigate climate change and adapt to it. The Climate Change Act sets a long-term target of at least an 80% reduction in emissions by 2050 compared to the 1990 level. The Climate Change Act is a goal-oriented framework act that applies to state authorities but does not contain substantive legislation on different sectors. The Act provides for a climate policy planning system that comprises three parts: a long-term and a medium-term plan for climate change policy and an adaptation plan. By virtue of the Act, the long-term climate policy plan and adaptation plan must be created once every ten years. The Medium-term Climate Change Policy Plan is drawn up once per government term.

The Climate Change Act seeks to strengthen the Parliament's and the general public's right of inclusion and access to information on the climate policy. The Parliament monitors the climate policy plans from Government reports and the Annual Climate Report. The Annual Climate Report reports the progress towards the climate targets and the impact of the ongoing actions. The inclusion of the general public and their access to information will contribute to broad-based and high-quality preparation of decisions and thus the acceptability of climate policy decisions. The Climate Panel, operating under the Climate Change Act, promotes a dialogue between political decision-making and scientific knowledge.

The Government Programme states that the reform of the Climate Change Act will record a carbon neutrality target for 2035 in the Act, as well as corresponding emissions reduction targets for 2030 and 2040 and an updated target for 2050. The reformed Climate Change Act will also include the targets for the land use sector and strengthening of carbon sinks laid out in the Government Programme. In terms of scale, the reform is substantial and will expand the Act's scope of application and specify its targets in further detail. Nevertheless, the reformed Act will remain a framework act, laying down provisions on the planning system for climate change policy.

The Government's proposal for a new Climate Change Act was issued on 3 March 2022. In support of the drafting process of the proposal, a working group was set up in early 2020, comprised of representatives from the relevant key ministries. The term of the working group ended at the end of March 2021. The Ministry of the Environment

continues to prepare the proposal based on the working group's deliverables. When circulated for comments, the proposal received a lot of positive feedback. In particular, the science-based emissions reduction targets and the 2035 carbon neutrality target were widely praised. On the other hand, the proposals for municipal obligation to promote climate actions and regulations for appeal were criticised. Based on the comments, the Government decided to remove the municipal obligations from the proposal and transfer them for further preparation. The regulations for appeal were also transferred for further preparation.

In autumn 2021, the Government budget session decided to add an obligation in the legislation concerning the creation of a climate plan at the municipal, county or regional level. The intention is to add the obligation in the Climate Change Act. Since the municipal obligation will require thorough preparation, it will be prepared in its entirety in another proposal that will supplement the reform of the Climate Change Act scheduled for early 2022. The need for setting a municipal obligation to promote climate actions will also be assessed during the preparation. The new regulations on appeals will also be included in the proposal. The completed proposal on municipal obligations and appeals will be presented to the Parliament in autumn 2022.

3.4 Climate policy planning system

Finnish climate policy is planned using a three-tiered system in which the medium- and long-term plans deal with the mitigation of climate change. Pursuant to the Climate Change Act, the medium- and long-term plans have to include a report on the actual greenhouse gas emissions, an estimate of the future emission trends and an assessment on how climate policy is developing worldwide and in the EU. The risks and adaptation to climate change are discussed in an adaptation plan.

The plans provide a basis and direction for the detailed preparation of climate policies in various branches of administration. The plans will be reviewed at intervals defined by the Climate Change Act (once per electoral term or ten years), which enables emerging needs and new information on climate change to be flexibly taken into account in the plans. If necessary, it will be possible to review the plans more frequently and put additional measures in place to attain the emissions reduction targets in time.

Under the act, climate change policy plans must be prepared in an open manner and in consultation with various parties. The policy plans are prepared as a collaborative effort among the relevant ministries, and they are approved by the Government. For each plan, one ministry will have overall responsibility, compiling and coordinating the work of others. The plans under the planning system must be integrated in pertinent parts.

In addition, the creation of the plans must be integrated with other climate and energy policy plans, such as the climate and energy strategy.

The Long-term Climate Change Policy Plan extends to 2050 and contains the key long-term actions in the emissions trading sector and the effort sharing sector. The plan prepared at least once in ten years and the preparation is coordinated by the Ministry of Economic Affairs and Employment. The first Long-term Climate Change Policy Plan under the Climate Change Act has not been created yet. The latest corresponding plans are the national Energy and Climate Roadmap 2050 (Ministry of Economic Affairs and Employment 2014a) which was completed in 2014 and Finland's long-term strategy (LTS) pursuant to the EU Governance Regulation which was published in April 2020 (Ministry of Economic Affairs and Employment 2020).

By virtue of the Climate Change Act, a Medium-term Climate Change Policy Plan is drawn up once per government term. The preparation of the plan is coordinated by the Ministry of the Environment. The plan contains an action plan for emissions reduction in the effort sharing sector, which is the sector outside emissions trading. The effort sharing sector comprises the emissions from transport, agriculture, building-specific heating, non-road mobile machinery, waste management and F-gas emissions. In addition, the sector also covers emissions from district heating production and small-scale industries outside the scope of the emissions trading system and a small number of other emission sources. The actions in the Medium-term Climate Change Policy Plan implement the Government Programme's objectives on energy and climate policy in conjunction with Finland's climate and energy strategy. Finland's first Medium-term Plan completed in 2017 (Ministry of the Environment 2017).

The adaptation plan is created at least once in ten years. It is prepared by the Ministry of Agriculture and Forestry. The adaptation plan deals with the risks caused by climate change and contains plans for adaptation. The adaptation plan must include a risk and vulnerability review, as well as action plans on adaptations specific to each administrative branch, if necessary.

3.5 Other sector-specific legislation

Actions outside the emissions trading sector, also known as the effort sharing sector, are regulated by several national laws that have an effect on the greenhouse gas emissions of the operations. Regulation on transport, land use and construction, agriculture and forestry, waste sector and environmental protection can have an effect on climate change mitigation and adaptation. For example, the Land Use and Building Act (132/1999) and the regulations issued pursuant to it are essential regulations that govern land use and

construction. The reformed Act will take the climate impact of operations into account to a greater extent. Also the Energy Efficiency Act (1429/2014) contains provisions on energy efficiency. In the transport sector, the key regulations include the Act on Promoting the Use of Biofuels for Transport (446/2007; 419/2019) and Act on Excise Duty on Liquid Fuel (1472/1994). The Waste Act (646/2011) lays down provisions on the recycling of waste and the Act on the Promotion of Biofuel Oil (418/2019) contains provisions on the obligation to distribute biofuel oil.

3.6 Reporting and monitoring

The data reported on the implementation of climate policy serves both the monitoring of the meeting of the obligations and national political decision-making. The reporting allows the government to determine whether its policy actions are sufficient with relation to the targets and launch of new policy actions and national plans as necessary. Additionally, ex-post assessments of the efficiency and impact of policy actions provide input for future resource allocation.

As a party to the UN Climate Agreement and an EU Member State, Finland must report its actions related to climate change mitigation and adaptation in many reports. Among the data to be reported are annual trends in GHG emissions, estimates of future emission trends and implemented and upcoming policy actions.

Among the most important reports are the annual greenhouse gas inventory sent to the EU and the UNFCCC secretariat and the Policies and Measures (PAMS) report submitted to the Commission that discusses climate policies and their implementation. In addition, Finland reports to the UNFCCC secretariat a National Communication that describes the national implementation of the Climate Agreement and the Biennial Report that tracks the progress towards the emissions reduction targets.

The monitoring of the EU's greenhouse gas emissions is based on the EU's Monitoring Mechanism Regulation (MMR) (525/2013) until the end of 2021, after which the reporting will be subject to the EU Governance Regulation (2018/1999). In spite of this change between regulations, the reporting system will remain essentially the same from 2021 onwards.

On a national level, the monitoring of emissions and climate actions is based on the Annual Climate Report drawn up pursuant to the Climate Change Act. The Annual Climate Report focuses on the emissions reduction trend in the effort sharing sector in particular and on the actions under the Medium-term Climate Change Policy Plan. However, the report has been developed further on the basis of Parliament's opinions about it, and

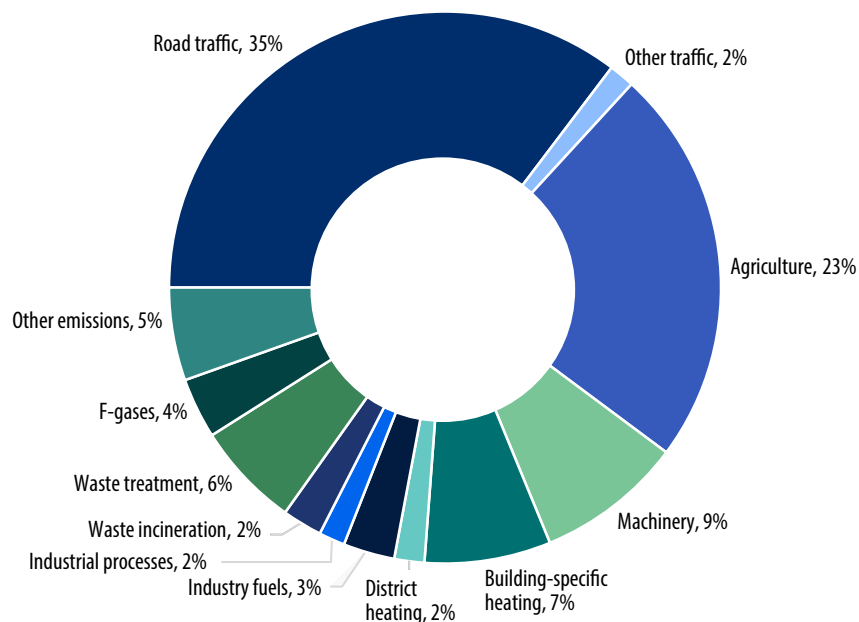
it now provides a comprehensive outlook on the trends in Finland's total emissions compared to the targets. The reporting associated with the Medium-term Climate Change Policy Plan is discussed in more detail in Chapter 11.

4 Emissions reduction targets in the effort sharing sector

The effort sharing sector covers all of the greenhouse gas emissions not included in the emissions trading system and the land use sector that are reported in the national emissions inventory. Carbon dioxide emissions from domestic aviation based on the greenhouse gas inventory are not included in the effort sharing sector. The primary sources of emissions in the effort sharing sector include transport and agriculture, heating of buildings, non-road mobile machinery, waste treatment and F-gases.

The effort sharing sector further covers emissions from fuel use in small-scale industries and the defence forces, other unspecified fuel uses, as well as non-CO₂ emissions from energy use in the emissions trading sector. Waste incineration is also mostly included in the effort sharing sector. Figure 1 shows the breakdown of emissions in the effort sharing sector in 2020.

Figure 1. Breakdown of GHG emissions by source in the effort sharing sector in 2020. (Statistics Finland 2022)



4.1 Finland's target for 2030

The targets in the Medium-term Climate Change Policy Plan are set on the basis of the EU Commission's proposal for an Effort Sharing Regulation (EU 2021d) published in July 2021. The proposal sets the emissions reduction obligation for Finland's effort sharing sector in 2030 to 50% compared to the 2005 level. The reference figure calculated by the Commission for Finland's emissions in 2005 is 34.4 Mt CO₂-eq, which means that the **corresponding emissions level for Finland for 2030 is 17.2 Mt CO₂-eq**. The proposal increases Finland's obligation by 3.8 million tonnes compared to the emissions reduction obligation of 39% set in the legislation currently in force. The proposal will be processed by the Council and the European Parliament next. The final decisions will be made in 2022 at the earliest. The 50% emissions reduction obligation proposed to Finland by the Commission is extremely ambitious.

In the Commission's proposal, the emissions reduction obligation for 2021–2030 consists of annual emission allocations that form an emissions reduction trajectory which ends at the 2030 obligation. The calculation of emission allocations is divided into three periods.

- 2021–2022: no changes to the allocations in the current Implementing Decision on the Effort Sharing Regulation (2020/2126). The emissions reduction trajectory starts from the average of emissions in 2016–2018 and ends in the current target for 2030, which is 20.9 Mt CO₂-eq. The allocations for 2021–2022 are 28.8 and 28.0 Mt CO₂-eq.
- 2023–2025: the emissions reduction trajectory would start from the emissions allocation allocated for 2022 and would end in the updated target for 2030, which is 17.2 Mt CO₂-eq. The allocations for 2023–2025 are 26.6, 25.3 and 23.9 Mt CO₂-eq.
- 2026–2029: the emissions reduction trajectory would start from the average of the actual emissions in 2021–2023 and would end in the updated target for 2030, which is 17.2 Mt CO₂-eq. The starting point would be 2024.

Therefore, the stricter new target for 2030 would create a kink in the current linear reduction trajectory in 2023. Another possible time for the kink is after 2025 when the emission allocations for the remaining period are recalculated. According to the Commission's proposal, the allocations for 2026–2029 would be finalised in 2025, when the 2021–2023 emissions are confirmed.

Flexibilities

Many different flexibilities can be used in order to meet the emissions reduction obligation of the effort sharing sector. The flexibilities remain mostly as is in the Commission's proposal for an Effort Sharing Regulation: temporary flexibilities, transfers between member countries, one-off flexibility in the emissions trading sector and a LULUCF flexibility. The importance of flexibilities will increase due to the ambitious emissions reduction obligation proposed for Finland.

Temporary flexibilities enable the annual emission allocations to be exceeded in some years as long as the cumulative emissions remain within the total emission allocation. The Member States may also trade emission units between each other. Finland has not used this possibility so far.

The one-off flexibility laid down in the currently valid Regulation (2018/842) will be available in the future as well. One-off flexibility means that emission allowances may be invalidated in emissions trading while creating corresponding units in the effort sharing sector. For Finland, the maximum flexibility is 2% of the 2005 emissions of the effort sharing sector. This represents 0.69 Mt CO₂-eq at an annual level and approximately 6.9 CO₂-eq in the whole period. The Government has already decided to utilise the one-off flexibility to the maximum extent.

The flexibility mechanisms are used in order to improve the cost efficiency of reduction measures in the effort sharing sector. When a one-off flexibility is used, the state loses income from emission allowance auctions, but for each reduced tonne of emissions, this currently seems to be less costly than implementing a similar reduction in the effort sharing sector. On the other hand, the use of flexibilities depends on the emissions trends and the need to reduce emissions annually and cumulatively throughout the entire period.

In addition to temporal flexibility and one-off flexibility, the Member States have a possibility to use flexibility between the effort sharing sector and land use sector. If the net sink of Finland's land use sector exceeds the target in the proposed LULUCF regulation, the removal units may be utilised in the effort sharing sector. The amount of this flexibility is limited, and to meet the obligations of the effort sharing sector, Finland can use removal units of up to 4.5 million tonnes of carbon dioxide equivalent between 2021 and 2030. The Commission's new proposal keeps the amount of flexibility unchanged, but divides its use into two five-year periods. The proposal suggests that when calculating whether the land use sector's sink target that entitles to the flexibility has been exceeded, all land use categories may be included in the calculations, unlike at present. In addition, accounting rules specified in the Kyoto Protocol would no longer be applied after 2025 in

the calculation of the land use sector's emissions balance. Instead, the calculation would be based on emissions and removals reported in the greenhouse gas inventories.

The Commission's new proposal for an Effort Sharing Regulation also contains a new flexibility associated with the sinks in the land use sector. If the emissions reduction target of 55% pursuant to the EU Climate Law has been achieved in 2030 at a net sink level of 225 million tonnes, any emission reductions that exceed 225 Mt CO₂-eq. would be collected into an additional reserve that could be used in the effort sharing sector. The Member States can then apply for emissions reduction units from this reserve, if their obligation is not met in 2025–2030 and they have used up all other flexibilities. Joining this additional reserve arrangement is voluntary and it contains a lot of uncertainties. Therefore, the Medium-term Climate Change Policy Plan does not prepare for using the reserve flexibility.

Flexibilities provide a good opportunity for managing the risks associated with the efforts to meet the obligation. Even though national emission reduction measures are planned and assessed on the basis of the best available information, there will always be a certain level of uncertainty about their effectiveness and implementation. Flexibilities can offer rapidly adoptable ways of bridging gaps. The Member States must be ready to utilise the available flexibilities.

4.2 The effort sharing sector's share in reaching carbon neutrality

According to Prime Minister Marin's Government Programme, Finland aims to be carbon-neutral by 2035 and carbon negative shortly thereafter. A key factor of carbon neutrality is the expected number of carbon sinks in 2035, which determines the magnitude of the required emissions reductions. The WEM scenario created in the HII SI project (VTT Technical Research Centre of Finland 2021a) calculated the net sink of the land use sector as 18 Mt CO₂-eq in 2035. When the 3 million tonnes of additional sinks outlined by the Government is added to this figure, the result is a carbon sink of 21 million tonnes that serves as the basis of the carbon neutrality target. This means that the aggregate emissions in the Finnish emissions trading and effort sharing sectors in 2035 should amount to no more than 21 Mt CO₂-eq, i.e. 70% below 1990 levels. Should the land use sector's net sink fall short of the level presented above, more emissions reductions will be required in other sectors.

The WAM scenario, also known as the policy scenario that implements the climate targets of the HII SI project models the distribution of emissions between the emissions trading

and effort sharing sector in 2035. According to an analysis made with the TIMES model, the emissions of the emissions trading sector will be 6.5 Mt CO₂-eq and the emissions of the effort sharing sector will be 14.5 Mt CO₂-eq in 2035. These estimates have been used to assess the sufficiency of the measures to reach the carbon neutrality target. Compared to the 2020 emissions level of the effort sharing sector, this represents a reduction of almost 50% in fifteen years.

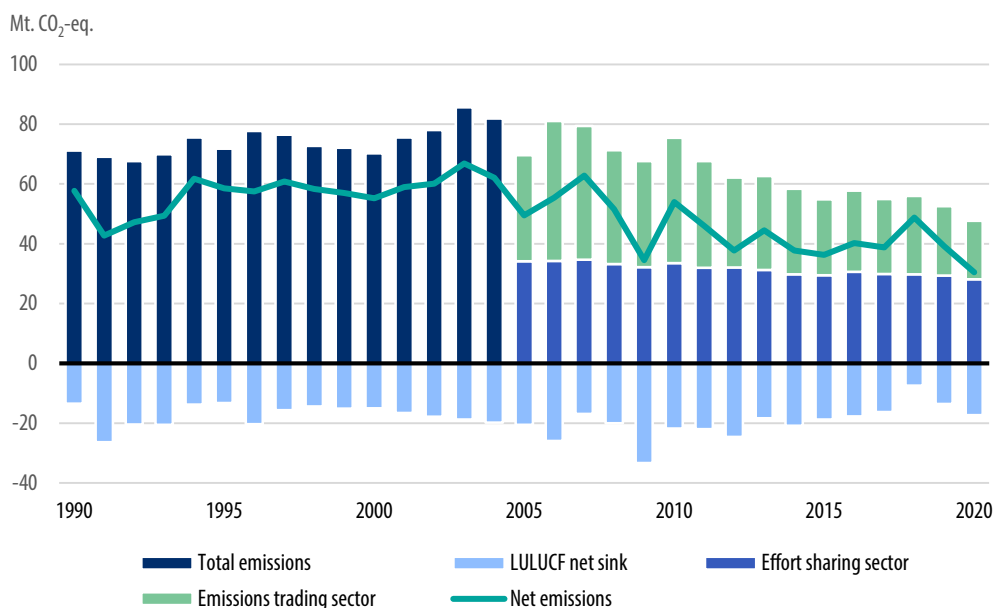
It may still be possible to achieve carbon neutrality in 2035 even if the effort sharing sector's emissions are larger than the ones presented here. This would require a higher than forecasted reduction in the emissions of the emissions trading sector or a higher than forecasted increase of the net sink of the land use sector. On the other hand, an opposite trend in these sectors would mean an even higher need to reduce emissions in the effort sharing sector. The proposed new emissions reduction obligation of 50% by 2030 is nevertheless a clear starting point for achieving carbon neutrality five years later. The EU legislation does not set an emissions target for Finland's effort sharing sector by 2035.

5 Current status of the effort sharing sector

5.1 Emission trends in 1990–2020

Finland's total emissions without the LULUCF-sector, i.e. the sum of the emissions trading and effort sharing sectors' total emissions were 47.8 Mt CO₂-eq in 2020 (Figure 2). In 2020, the emissions decreased 5.0 Mt CO₂-eq, which is a decrease of 9% from the previous year. Reduced use of coal and peat has affected the emission reduction. In 2020, the emissions decreased as a result of a warm winter, recent changes in electricity production structures and decreased transport performance. The impact of Covid-pandemic on the emission reduction cannot be separated directly from the inventory information of Statistics Finland, because the decrease was also affected by weather conditions and business cycles in industry. However, the impact of the pandemic could be seen especially in the emission reductions from transport. After 2010, the total emissions have decreased on average 4% yearly. During the last two years, the emissions have decreased 8% in a year. During 2005–2020, the total emissions have decreased 22.2 Mt CO₂-eq, which is a decrease of 32%. In comparison to the year 1990, the drop is -33%.

Figure 2. The total emission trends in 1990–2020 (Statistics Finland 2022). The negative values are representing the net sink of the land use sector. From 2005 onwards, the total emissions have been separated between the effort sharing sector and the emissions trading sector.

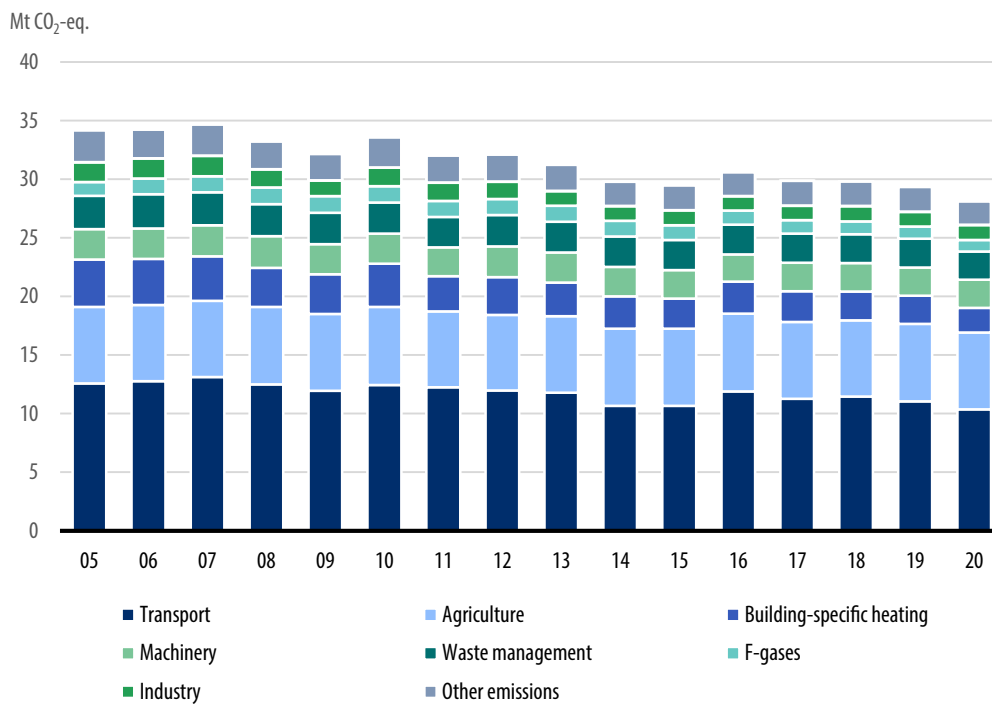


The net emission trends are essential considering climate change mitigation. Net emissions are calculated by subtracting the net sink of land use sector from the total emissions. To reach the government's carbon neutrality target, the net emissions should be zero by 2035 and negative after that. In 2020, the net emissions were 30.5 Mt CO₂-eq. The reduction in net emissions was affected by the decrease in emissions and increase in carbon sinks. During 2005–2020, the net emissions have decreased by 19 Mt CO₂-eq, which is a decrease of 38%. The change is -47% compared to the year 1990.

The EU emissions trading system covers big industrial and energy production installations, and commercial aviation within the European Economic Area. Finland's total emission trends without the land use sector have been affected by the significant reduction in emission trading sector's emissions in recent years. In 2020, the emissions of Finnish installations belonging to the emissions trading system were in total 19.6 Mt CO₂-eq. The emissions decreased 3.7 Mt CO₂-eq from the previous year, which was a decrease of 16%. Behind this decrease was reduced use of coal and peat compared to the previous year. After 2010, emissions have decreased approximately 7% yearly on average. Compared to the year 2005, the emissions from the emissions trading sector have decreased 15.9 Mt CO₂-eq, which is a decrease of 45%.

Greenhouse gas emissions have decreased more slowly in the effort sharing sector than in the emissions trading sector. Emissions in the effort sharing sector amounted to 29.3 Mt CO₂-eq in 2019 and 28.1 Mt CO₂-eq in 2020 (Statistics Finland 2022). Emissions were 0.5 Mt CO₂-eq lower in 2019 than the year before, declining by another 1.2 Mt CO₂-eq in 2020 (Figure 3). In 2019, emissions from road transport declined by 4%, while those from heating of buildings and non-ETS industrial processes were slightly lower than the year before. Conversely, emissions from agriculture increased. According to Statistics Finland, transport emissions continued to decline in 2020, while agricultural emissions remained almost unchanged. Reductions were achieved in building heating and landfills, among other sources.

Figure 3. GHG emissions in the effort sharing sector in 2005–2020. (Statistics Finland 2022). Industrial emissions include fuel use and industrial processes. Waste management emissions include waste incineration. Other emissions cover emissions from small-scale heating plants, unspecified energy-related emissions and solvent and product use. Fugitive emissions from fuels and indirect CO₂ emissions are likewise included in other emissions. Non-CO₂ emissions from energy use in the emissions trading sector are divided into industrial and other emissions.



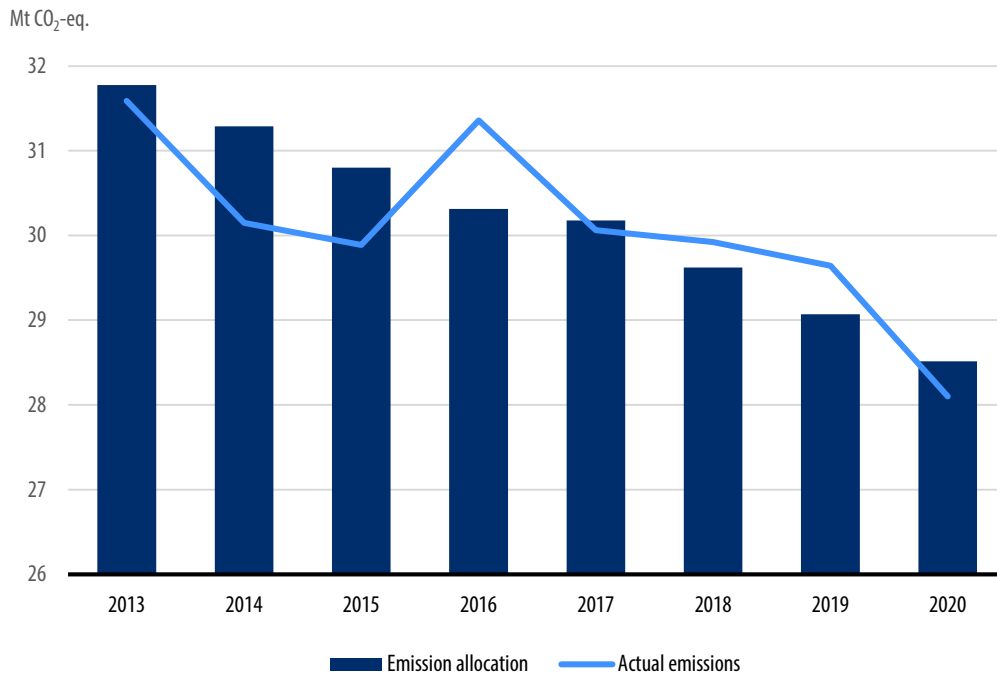
Since 2005, emissions have decreased in all sectors with the exception of agriculture. In total, the effort sharing sector's emissions in 2020 stood at about 18% below 2005 levels. Emissions from transport (excluding domestic aviation) have decreased by about 2.2 million tonnes CO₂-eq, while the heating of buildings shows a decline of about 2.0 million tonnes CO₂-eq. Likewise, current emissions from waste treatment and from industry falling within the effort sharing sector are clearly below 2005 levels (Table 2).

Table 2. Emissions in the effort sharing sector in 2005–2020 and change compared to 2005. (Statistics Finland 2022)

	2005	2019	2020	Change 05–20 (Mt CO ₂ -eq)	Change 05–20 (%)
Transport	12.6	11.0	10.4	-2.2	-18%
Agriculture	6.5	6.6	6.6	0.04	0.6%
Building-specific heating	4.0	2.4	2.1	-1.9	-48%
Non-road mobile machinery	2.6	2.4	2.4	-0.2	-7%
Waste treatment	2.8	2.5	2.4	-0.4	-15%
F-gases	1.2	1.0	1.0	-0.2	-16%
Industry	1.7	1.3	1.3	-0.4	-24%
Other emissions	2.7	2.1	2.0	-0.7	-26%
Total	34.2	29.3	28.1	-6.1	-18%

Finland's obligation under EU law has been to reduce the effort sharing sector's emissions by 16% of 2005 levels by 2020. Its fulfilment is specifically assessed by means of the annual emission allocation set for each year within the 2013–2020 period. Emissions in the Finnish effort sharing sector in 2013–2015 and 2017 fell below the emission allocations for these years. The 2020 emissions were also lower than the quota. Conversely, emission allocations were exceeded in 2016 and 2018–2019 (Figure 4).

Figure 4. Emission allocations of the effort sharing sector (EU 2013; EU 2017) and actual greenhouse gas emissions in 2013–2020 (Statistics Finland 2022).



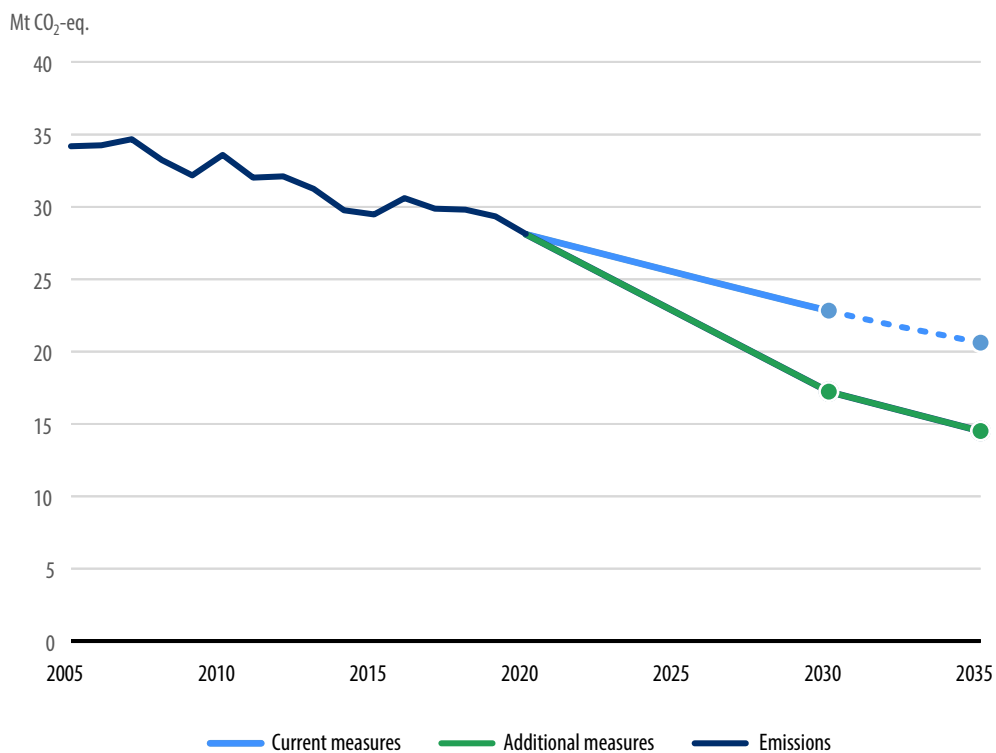
When assessing whether the emissions reduction obligation for the effort sharing sector is being met, it is necessary to compare the total emissions in 2013–2020 with the sum total of all annual emission allocations set for these years, as units can be transferred between years. Should emissions in a certain year fall below the allocation, the surplus units can be used to fulfil the obligations in subsequent years. Finland used the surplus units from 2013–2015 to offset the excess emissions in 2016. The exceeded quotas in 2018 and 2019 were offset by extra units accumulated in the previous years. Furthermore, Finland has access to international units if required and it can also purchase emission units from other Member States where necessary.

According to the 2020 inventory data, Finland is on track to meet its emissions reduction obligation for the entire 2013–2020 period without the need to make use of international emission units. Based on this data, Finland would have 0.8 Mt CO₂-eq in surplus units calculated cumulatively for the entire 2013–2020 period. Fulfilment of the emissions reduction obligation will be verified after the EU review of the inventory data. No surpluses remaining from 2013–2020 can be banked for the 2021–2030 period.

5.2 Adequacy of existing measures for reaching the targets

The adequacy of the current climate actions is assessed by comparing the GHG emission targets of the effort sharing sector to the WEM (With Existing Measures) scenario. The baseline scenario created in the HIISI project in spring 2021 describes the impact of policy measures decided by the end of 2019 on Finland's greenhouse gas emissions. The modelling made use of the assumptions recommended by the European Commission for trends in fuel import and emission allowance prices. The assessment on the emission trends achievable by current operations was also affected by factors such as trends in different industry sectors and the population projection. The scenario was updated in August 2021 with new data on transport. The emissions of the transport sector in the Medium-term Climate Change Policy Plan were not calculated by HIISI modelling, but by separately calculated WEM emissions. Likewise, the emission scenarios for agriculture and F-gases are sector-specific, and deviate a little from the figures calculated in the HIISI project with the TIMES model.

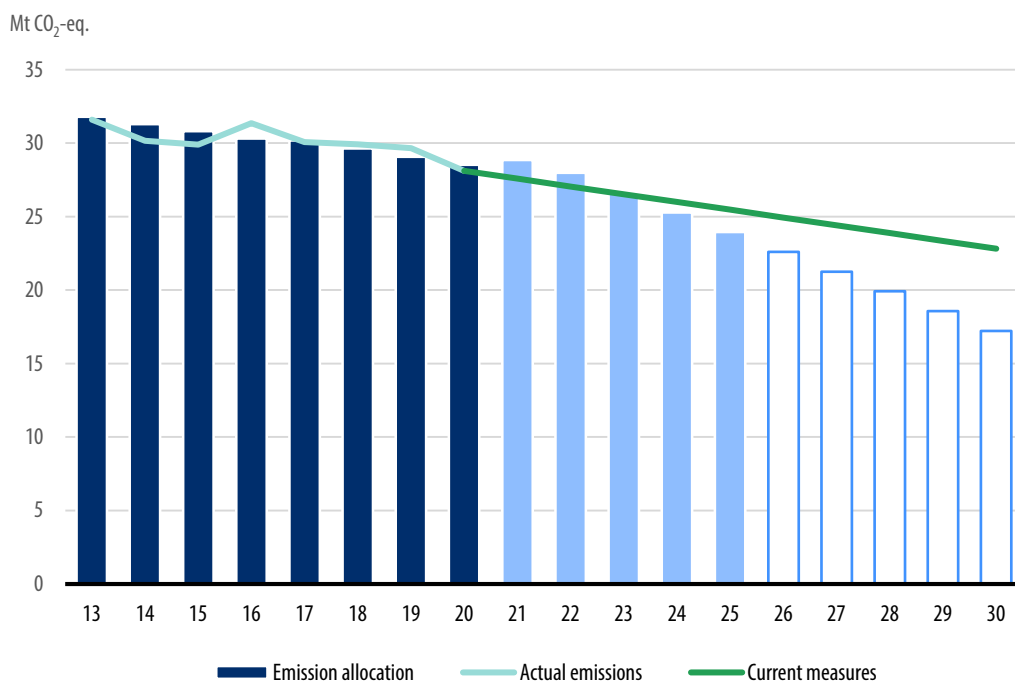
Figure 5. Emissions from the effort sharing sector in 2005–2020 (Statistics Finland 2022) and the WEM emission trends (VTT Technical Research Centre of Finland 2021a; Ministry of Transport and Communications 2021a; Maanavilja et al. 2021; Forsberg 2021) and the target trajectory for 2020–2035.



According to the baseline scenario, the emissions of the effort sharing sector will fall to 22.8 million tonnes CO₂-eq in 2030 and then further to 20.6 million tonnes in 2035 (Figure 5). To be in line with the -50% obligation proposed by the Commission for Finland, the emissions should be 17.2 Mt CO₂-eq. in 2030, **which leaves a gap of 5.6 Mt between the current measures and the obligation in 2030**. This gap in emissions reduction will be bridged by additional measures that form the action plan which will implement the emissions obligation of the effort sharing sector (see Chapter 7).

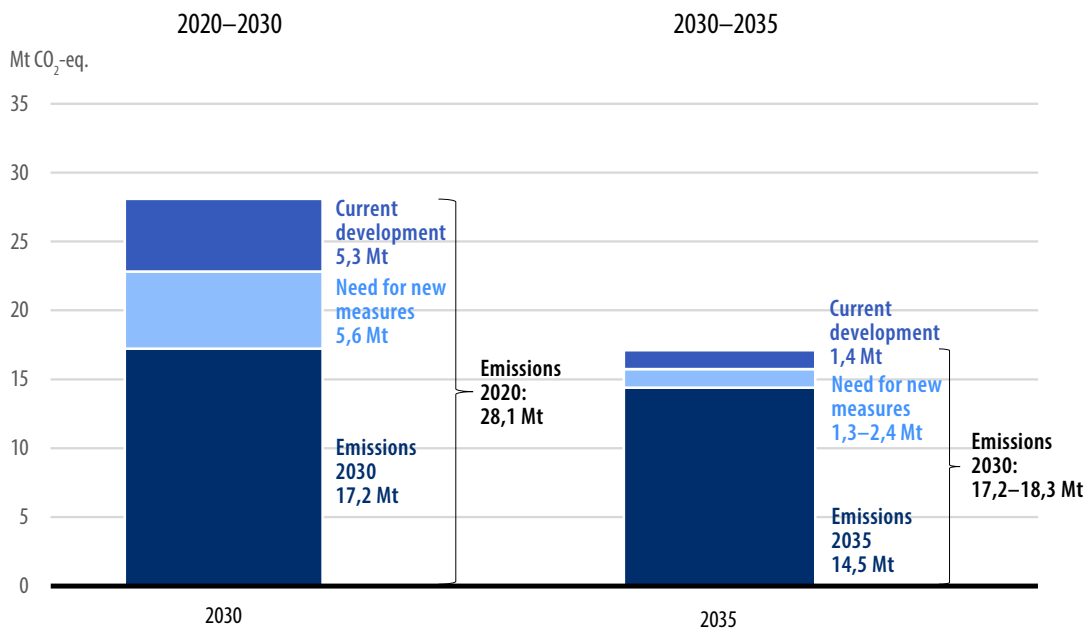
Figure 6 shows the actual emissions of the effort sharing sector and the emission trends calculated on the basis of current measures and their relationship to the annual emission allocations set by the EU. The need for emissions reductions increases towards the end of the 2020s. However, the emission trends forecast that is based on the existing measures does not contain annual figures and it does not take into account the potential increase in emissions caused by the recovery from the COVID-19 pandemic. In addition, the 2026–2030 allocations will be confirmed later, based on the actual emissions from 2021–2023 (see Chapter 4.1).

Figure 6. Emission allocations for the effort sharing sector in 2013–2030 (EU 2013; EU 2017; EU 2021d), actual greenhouse gas emissions 2013–2020 (Statistics Finland 2022) and WEM emission trends (VTT Technical Research Centre of Finland 2021a; Ministry of Transport and Communications 2021a; Maanvilja et al. 2021; Forsberg 2021). The emission allocations for 2026–2030 will be confirmed in 2025; in the figure, they have been calculated linearly on the basis of the Commission’s proposed target for Finland for 2030.



In the situation for 2035, there is a 6.1 Mt CO₂-eq gap between the baseline scenario of the effort sharing sector and the expected 14.5 Mt CO₂-eq emissions level (see Chapter 4.2). However, the starting point of the Climate Change Policy Plan is to speed up the emissions reductions so that the emissions of the effort sharing sector will be at the new target level in 2030. As a result, the need for additional measures in 2030–2035 will have to be assessed separately, and it will not be possible to use the baseline scenario as the basis for calculations anymore. The difference between the target for 2030 and the assumed target level for 2035 is 2.7 Mt CO₂-eq, which can be partially covered by the current actions and partially with new political actions. **Calculated this way, the need for additional emission reductions in 2030–2035 is thus 1.3 Mt CO₂-eq.** (Figure 7). If Finland utilizes the flexibilities in full (1.1 Mt) to reach the effort sharing sector’s obligation for 2030, the need for additional emission reductions in 2030–2035 is 2.4 Mt. If the 2030 obligation is met by using flexibilities from other sectors, the need for additional measures will grow for 2035. By contrast, if the emissions are lower than the target in 2030, there will be less need for additional measures in 2030–2035.

Figure 7. The emissions reductions achievable with the current development and existing measures and the additional measures in relation to the needed emission reductions in 2020–2030 and 2030–2035. The need for additional emission reductions in 2030–2035 depends on whether flexibilities are used to reach the obligation for 2030.



5.3 Assumptions behind the baseline scenario calculations

The baseline scenario (WEM) of the Carbon-neutral Finland 2035 project was created by VTT with its TIMES model. The baseline scenario is based on the current national policy measures (decided by the end of 2019) and the premises of the EU's climate and energy policy. The basic premise of the EU's climate and energy policy is the 40% emissions reduction target by 2030 compared to the emissions level in 1990, which was in force before the new European Climate Law was approved. The baseline scenario also uses sector-specific low-carbon roadmaps for some businesses and industrial sectors. The baseline scenario is used as the reference for the policy scenario, which is also known as the WAM (With Additional Measures) scenario. The scenario was updated in August 2021 with new data on transport.

The emissions of the transport sector in the Medium-term Climate Change Policy Plan were not calculated with HIISSI modelling, but by separately calculated WEM emissions (Ministry of Transport and Communications 2021a). Calculations made by VTT Technical Research Centre of Finland for the Ministry of Transport and Communications indicate that the emissions from domestic transport in 2030 and 2035 are slightly higher than those calculated with the TIMES model. The interpretation of the baseline projection for transport takes into account the emissions from fishing vessels and the additional approximately one per cent increase in emissions resulting from methane and nitrous oxide emissions, which are categorised in the effort sharing sector under 'other energy-based emissions'.

In the Medium-term Climate Change Policy Plan, the agricultural WEM emissions are not based on the TIMES model, but a sector-specific estimate produced by the Natural Resources Institute Finland in the HIISSI project (Maanavilja et al. 2021). Similarly, F-gas emissions are based on emissions scenarios calculated by the Finnish Environment Institute (Forsberg 2021).

The TIMES model describes the energy systems in Finland, the Nordic countries and the rest of Europe. The input assumptions of the model contain detailed descriptions of the current system of energy production and consumption and future technology options. The model covers all greenhouse gas emissions subject to the Kyoto Protocol.

The energy consumption and emissions trajectories calculated by the TIMES model depend on several types of input data. Key input data for the trajectories are the trends in different sectors of the economy, the production trends in energy-intensive industries, the existing fleet of cars and other vehicles and trends in mobility and transport needs by mode of transport, the existing building stock and trends in inhabitable surface area by type of building, the existing control measures for energy and climate policy and the

quantitative attrition of the plant and equipment base in the current energy system and the assumed development of available technological options in all sectors.

The energy system modelling of the TIMES system outputs a trajectory for energy procurement and end use in which the demand for net energy can be satisfied as cost-effectively as possible while taking into account the assumed trajectories of the sectors and the control measures applied to different operators. The model generates a comprehensive description of the material and emissions flows for different energy commodities for each year. The material and emission flows cover the lifecycle of each energy commodity, from production, import and storage to end use, final disposal or recycling. The results indicate the greenhouse gas emissions by sector, emission type and, if necessary, by process.

Fuel price trends have been taken into account in the lifecycle review of energy commodities. However, the prices can be calibrated to conform to price trend forecasts created by other methods. The fossil fuel prices in the model are in line with the guidelines on fuel import prices and emission allowance trends published by the European Commission (EU 2020d).

The trends in population and national economy are based on Statistics Finland's population projection made in 2019. According to the projection, Finland's population will grow slowly up to 2030 and will then start to decline.

Below is a summary of the key assumptions on policy measures in the baseline scenario calculated with the TIMES model in the HIISS project (Lehtilä et al. 2021):

- The EU emissions trading system is in force throughout the reviewed period and the division between the EU emissions trading and effort sharing sectors is based on the existing division;
- The excise tax rates in force in 2019 are expected to remain unchanged (in real terms). The subsequent changes to the tax rates that are in force at present are not included in the baseline scenario;
- Discontinuing coal in the production of electricity and heat no later than 2029 (Act on Prohibiting the Use of Coal in Energy Production (416/2019));
- Cutting back the use of peat at least by half by 2030; However, this was not included as an input assumption in the modelling, since the attainment of the target was investigated from the results of the modelling;
- The share of biofuels in the total energy content of road transport fuels in 2020 is 13.5% and will grow stepwise to 30% by 2030 in accordance with the Act on Promoting the Use of Biofuels in Transport (419/2019). A 10% bioliquid blending obligation for light fuel oil used in building-specific heating and for

diesel oil used in non-road mobile machinery, with linear growth between 2020 and 2030 in accordance with the Act on the Promotion of the Use of Biofuel Oil (418/2019);

- New construction in Finland is almost completely zero-energy construction in accordance with the EU's common targets (Directive on Energy Performance of Buildings (EPBD) 2010/31);
- The requirements for energy performance of renovations (Ministry of the Environment 2013) and the estimated impact of the subsidy for energy efficiency renovations distributed via the Housing Finance and Development Centre of Finland (ARA) on specific consumption;
- Replacing F-gases with other substances in accordance with the EU F-gas Regulation (517/2014);
- A national waste management plan that contains the targets of waste prevention and waste management and the actions to reach these targets;
- A 38% minimum share of renewable energy in final energy consumption in 2020 and, correspondingly, a 51% minimum target for renewable energy in 2030. However, the proportion of renewable energy in final energy consumption is not fixed in the input data of the model, but is one of the outputs of the model.

The results of the scenarios modelled by HII SI are reported as tonnes of carbon dioxide equivalent calculated using the Global Warming Potential (GWP) values stated in the IPCC's 5th Assessment Report (AR 5; IPCC 2013); other greenhouse gases are converted into a quantity of carbon dioxide that corresponds to their heating potential. This differs from the present calculation of the greenhouse gas emissions inventory, which still uses the GWP values of the previous Assessment Report (AR4; IPCC 2007). The differences lie mostly in the emissions from waste management, for which the AR5 values give higher results than the ones in AR4, and emissions from agriculture, which are slightly lower with the AR5 values. Also the F-gas emissions calculated as carbon dioxide equivalent are slightly smaller when calculated with the AR5 values. The differences in emissions from energy consumption are marginal and as a whole, the current emissions from Finland's effort sharing sector look very similar regardless of the GWP values used. When reviewing scenarios and assessing the adequacy of climate measures, it is essential to use the same calculation method in the WEM and WAM scenarios.

5.4 Sector-specific emission trends and existing measures

5.4.1 Transport

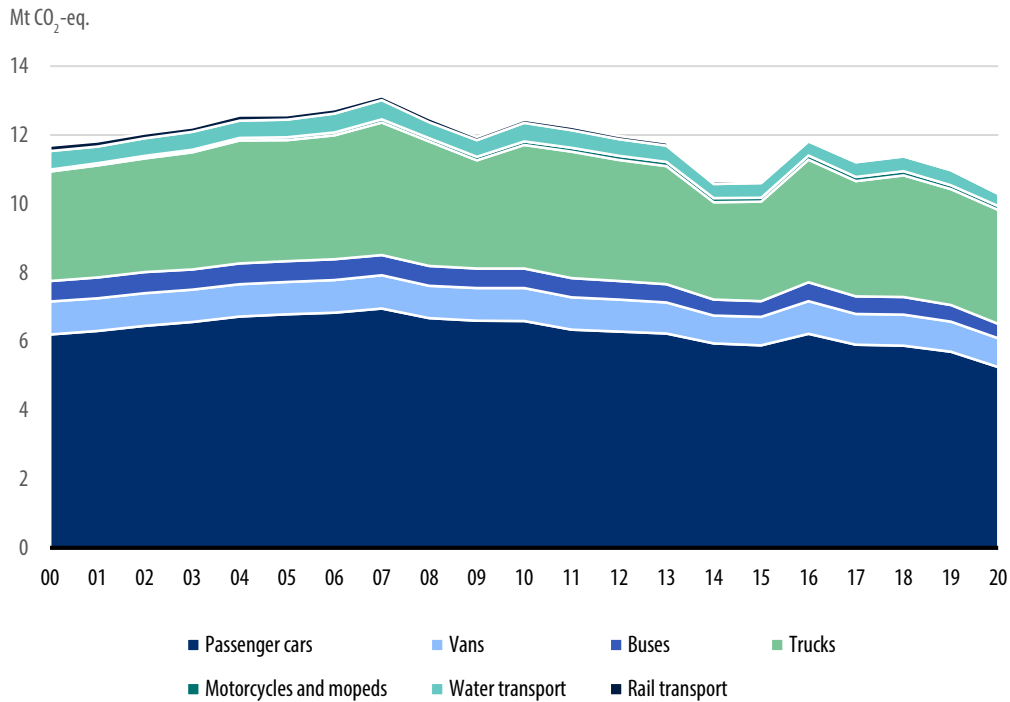
The greenhouse gas emissions from domestic transport (excluding domestic air transport) are calculated as part of the effort sharing sector. Domestic transport emissions consist of emissions from road transport, diesel-powered rail transport and domestic waterborne transport except for fishing vessels. The emission from electric rail, road and waterborne transport are calculated as part of emissions from electricity generation in the emissions trading sector and the emissions from domestic air transport are treated as a separate source of emissions. Emissions from fuels consumed by fishing vessels are reported as part of other energy-related emissions of the effort sharing sector.

Emission trends

In 2019, domestic transport emissions excluding aviation stood at 11.0 Mt CO₂-eq, accounting for 21% of total emissions and 37% of emissions in the effort sharing sector. Emissions decreased by more than 3% year on year. Based on data from Statistics Finland, emissions amounted to 10.4 Mt CO₂-eq in 2020, which is equivalent to a further drop of just over 6% as a result of a reduction in traffic performance, especially due to the COVID-19 pandemic (Figure 8; Statistics Finland 2022).

In 2020, about 95% of greenhouse gas emissions from domestic transport were generated in road transport, of which passenger cars accounted for about 53%. The figures for rail transport and domestic waterborne transport stood at less than 1% and about 3%, respectively. Aviation only accounted for about 1% of domestic transport emissions in 2020. However, aviation emissions are not counted towards the effort sharing sector.

Transport emissions showed an almost linear growth up until 2007, at which point the trend took a downward turn from 2008 to 2020, with the exception of some isolated growth years. The increased share of biofuels in road transport fuels and improved energy efficiency of new cars have contributed to the reduction in emissions. However, the reduction of emissions has been very slow, and current measures do not reduce transport emissions in line with the targets set.

Figure 8. GHG emissions in domestic transport in 2000–2020. (Statistics Finland 2022)

Existing measures

The measures included in the first Medium-term Climate Change Policy Plan (Ministry of the Environment 2017) for reducing emissions from transport have mostly been or are currently being implemented. The measures yet to be implemented are especially geared towards halting the growth in the traffic performance of passenger cars and speeding up the vehicle replacement rate.

Government resolution (Ministry of Transport and Communications/2021/62) on the reduction of greenhouse gas emissions in domestic transport, i.e. the Roadmap to fossil-free transport, was completed in May 2021. It formed the basis for planning and sizing the emissions reduction measures for transport in the new Medium-term Climate Change Policy Plan. The plan considers all measures decided before 2020 as ‘existing measures’.

The most important existing measures for reducing greenhouse gas emissions from transport are the Act on Promoting the Use of Biofuels in Transport (Distribution Obligation Act) and the binding CO₂ limits set by the EU to vehicle manufacturers. The estimated total impact of these measures in 2030 is almost 3 million tonnes in emissions reduction.

Other existing measures include subsidies for public recharging and fuelling, a recharging subsidy for housing companies, procurement support for all-electric cars and conversion subsidies for old cars, traffic system plans in urban areas, subsidies for public transport in major and mid-sized urban areas and an investment programme for walking and cycling. In total, emissions from transport have fallen by 2.2 Mt CO₂-eq in the period 2005–2020 and are expected to fall by approximately 3.6 Mt CO₂-eq by 2030 with the existing measures in force.

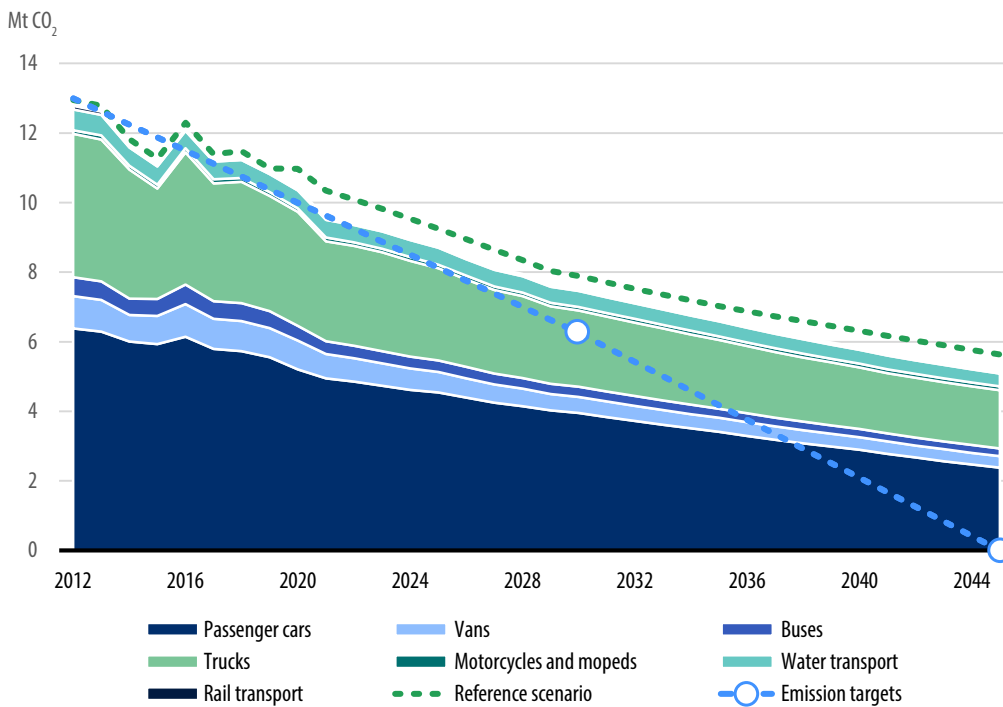
Baseline projection of greenhouse gas emissions from transport

The baseline projection of greenhouse gas emissions from transport was originally completed in April 2020. It made use of the Finnish Transport Infrastructure Agency's national transport performance forecast made in 2018. However, the forecast's assumptions on GDP and demographic trends differed significantly from more recent estimates. Therefore, the Government decided to update the baseline projection during spring and summer 2021. At the same time, the trend in the fleet of electric cars was also updated up to 2030. The original number of electric cars in the baseline projection (350,000) was increased to 600,000. This update reflects the actual sales of electric cars and the car manufacturers' reports on the types of cars they will introduce in the next few years.

The updated baseline projection was completed in August 2021. The updated baseline projection states that the CO₂ emissions from transport in 2030 are approximately 7.3 Mt CO₂-eq (7.9 Mt CO₂-eq in the April 2020 forecast) and that an additional reduction of approximately 1.0 Mt CO₂-eq is needed in order to halve the emissions from transport. These figures formed the basis for the Government's budget negotiations in September.

However, an error was discovered in the updated baseline projection concerning the calculation of the energy efficiency of new cars also in September. According to the updated and corrected baseline projection (Ministry of Transport and Communications, 2021b), emissions from transport are 7.5 Mt CO₂-eq in 2030 (Figure 9). In the Medium-term Climate Change Policy Plan, emissions from fishing vessels are subtracted from the baseline projection's emissions of domestic transport and the emissions are calculated as carbon dioxide equivalent, which in practice yields the same emissions level of approximately 7.5 million tonnes.

Figure 9. Updated and corrected baseline projection for greenhouse gas emissions of domestic traffic (Ministry of Transport and Communications 2021a). Note: the emissions are carbon dioxide emissions and waterborne transport also contains fishing vessels.



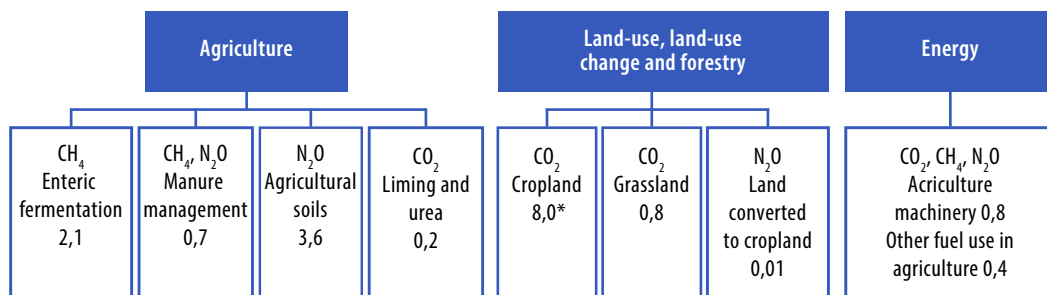
The key factors in the baseline projection for greenhouse gas emissions from transport are the forecasted trends of transport performance, vehicle motive power options and energy efficiency of the car fleet. In the baseline projection, the traffic performance of passenger cars increases at about 1% per year, while the traffic performance of heavy-duty vehicles increases slower, at approximately 0.5% per year up to 2030. The performance projection contains the tax increase of transport fuels in August 2020 and the gradual elimination of tax subsidy for paraffinic diesel in 2021–2023. The performance projection assumes that the tax rates of transport fuels will increase from 2025 onwards in line with the rate of inflation. The projection forecasts that the number of electric vehicles will increase to 600,000 and the share of biofuels among the fuels to 30% in 2029 and 2030.

5.4.2 Agriculture

Greenhouse gas emissions from agriculture are reported in several reporting sectors (Figure 10). The effort sharing sector covers methane and nitrous oxide emissions reported in the agriculture sector which mostly originate from livestock, manure and soil, as well as carbon dioxide emissions from liming. Small amounts of emissions are also generated

by urea fertilisation and field burning of agricultural residues. Carbon dioxide emissions from cropland and grassland are reported in the land use sector (LULUCF). Furthermore, emissions from the use of fuels in agricultural non-road mobile machinery, building-specific heating and grain dryers are reported in the effort sharing sector. In the Medium-term Climate Change Policy Plan, these emissions are included in the figures of mobile machinery and building-specific heating.

Figure 10. Reporting of emissions from agriculture in accordance with the UNFCCC. The figures are emissions from 2020 (Mt CO₂-eq). The emissions from cropland also include CO₂-eq emissions from clearing of land for cultivation. (Statistics Finland 2021b)



The emissions reduction measures performed in the agriculture sector also have an impact on the LULUCF sector. The Climate Change Policy Plan seeks to convey the impacts on both sectors. As a rule, it is easier to find emissions reduction measures in the LULUCF sector than in the agriculture sector. The measures in the agriculture sector should concentrate on the digestion and manure of domestic animals and emissions associated with the fertilisation of fields. It might be challenging to carry out these measures without a decrease in production.

Emission trends

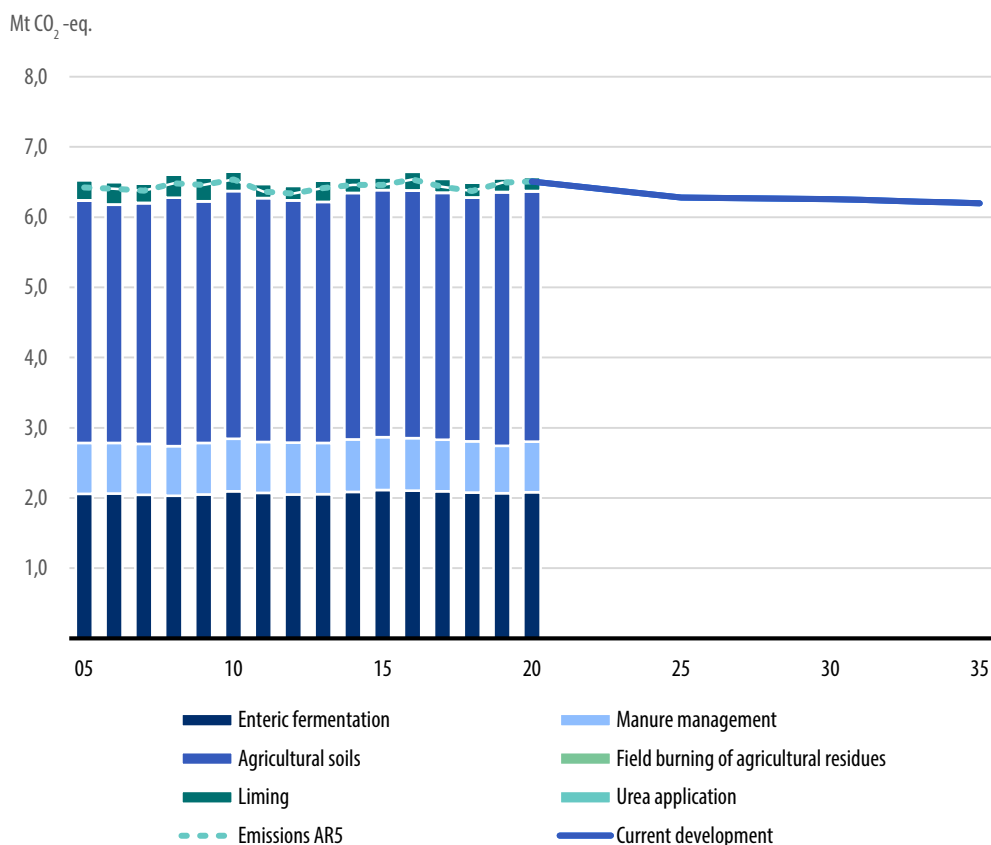
Emissions from agriculture counted towards the effort sharing sector – equivalent to emissions from the agriculture sector in the greenhouse gas inventory – have remained relatively stable over the last few years. Agricultural emissions represent approximately 12% of the total emissions of Finland (excluding the land use sector) and roughly 20% of the emissions from the effort sharing sector.

In 2019, agricultural emissions stood at 6.6 Mt CO₂-eq, representing a 1% increase relative to 2018 levels (Statistics Finland 2022). The increase mostly resulted from the larger amounts of agricultural residues due to a good crop year and from growth in the sales of

synthetic fertilisers. Livestock numbers continued declining, which decreased emissions from enteric fermentation relative to previous years. In 2020, the emissions remained at the previous year's level, i.e. at 6.6 Mt CO₂-eq. The current measures included in the Medium-term Climate Change Policy Plan are expected to lead to a slight downward trend in agricultural emissions (Figure 11).

In 2020, the emissions consisted of nitrous oxide emissions (54%), methane emissions from the digestion of domestic animals (32%), nitrous oxide and methane emissions from manure processing (11%) and carbon dioxide emissions from liming and urea fertilisation (3%). Emissions from controlled burning of fields are marginal in Finland. Emissions from burning of straw and stubble fields have practically disappeared due to the ban on burning that entered into force in 2021.

Figure 11. Emissions from agriculture in the effort sharing sector in 1990–2020 and an estimate of the emission trends achievable in 2021–2035 with existing measures. Actual emissions in keeping with the national emission inventory were calculated using GWP values in the IPCC AR4 while AR5 values were used to calculate the emissions scenario by 2035. AR5-based actual emissions are indicated by a broken line to facilitate comparison. (Statistics Finland 2022; Maanavilja et al. 2021).



Existing measures

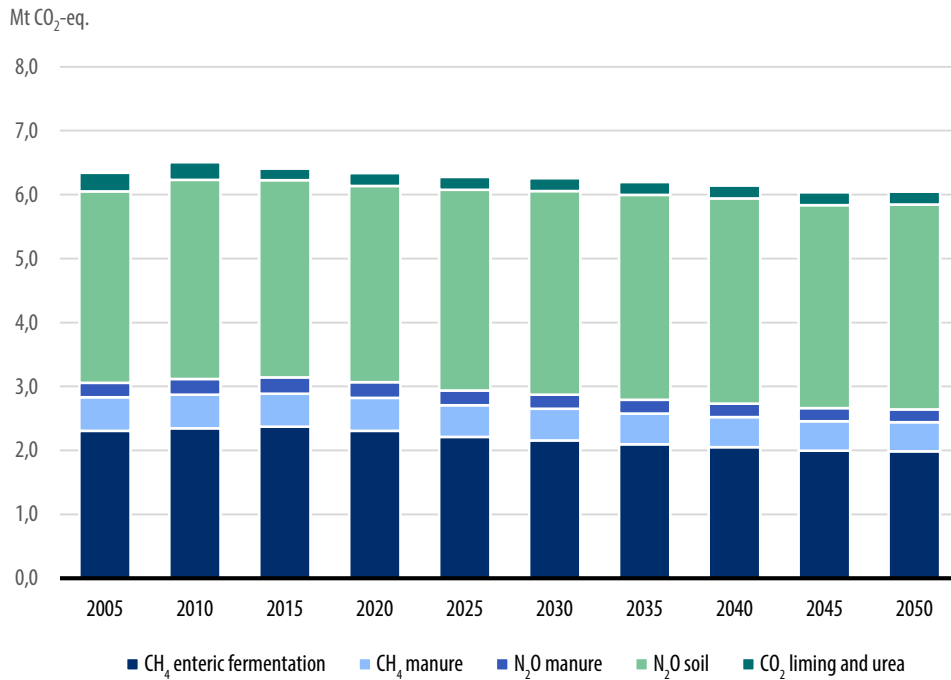
The first Medium-term Climate Change Policy Plan created in 2017 contained the following measures for the agriculture sector, all of which have already been implemented or are currently being implemented:

- Perennial cultivation of organic soil without soil preparation (environmental compensation for perennial grasses on peatlands and humus soils, Rural Development Programme for Mainland Finland, 2014–2020; Ministry of Agriculture and Forestry 2014b).
- Raising the groundwater level with controlled subsurface drainage (investment subsidy and management fee for controlled subsurface drainage, Rural Development Programme for Mainland Finland, 2014–2020).
- Promotion of biogas production (investment subsidy for biogas plants, Rural Development Programme for Mainland Finland, 2014–2020).
- Afforesting organic soil and wetlands (Act on Temporary Subsidy for Afforestation (1114/2020)).
- Promoting the increased sequestration and storage of carbon in soil and the implementation of the 4per1000 initiative (UN 2015b) through research projects and experiments
- The associated measures in the EU's Common Agricultural Policy (CAP) are environmental compensations (planting winter cover crops, recycling nutrients and organic matter, catch crops, grass for environmental management, green fertiliser grasses, using organic mulch on garden plants and renovation plants), greening subsidy (permanent grass actions), a ban on burning stubble fields and the requirement that fallow lands be stubble or plant-covered.
- Food-consumption-related measures highlighted in the Medium-term Climate Change Policy Plan include reducing food waste (halving food waste by 2030; a national monitoring system for food waste, a roadmap) and eating according to nutrition recommendations (such as The RuokaMinimi project established by the government's analysis, assessment and research activities).

Baseline scenario for the agriculture sector

According to the WEM scenario in the Carbon-neutral Finland 2035 project (HIISI), the emissions of the agriculture sector calculated with the AR5 coefficients will fall from the 2019 figure of 6.40 Mt to 6.20 Mt CO₂-eq by 2035, after which the emissions will fall further to 6.04 Mt by 2050 (Figure 12; Maanavilja et al. 2021)

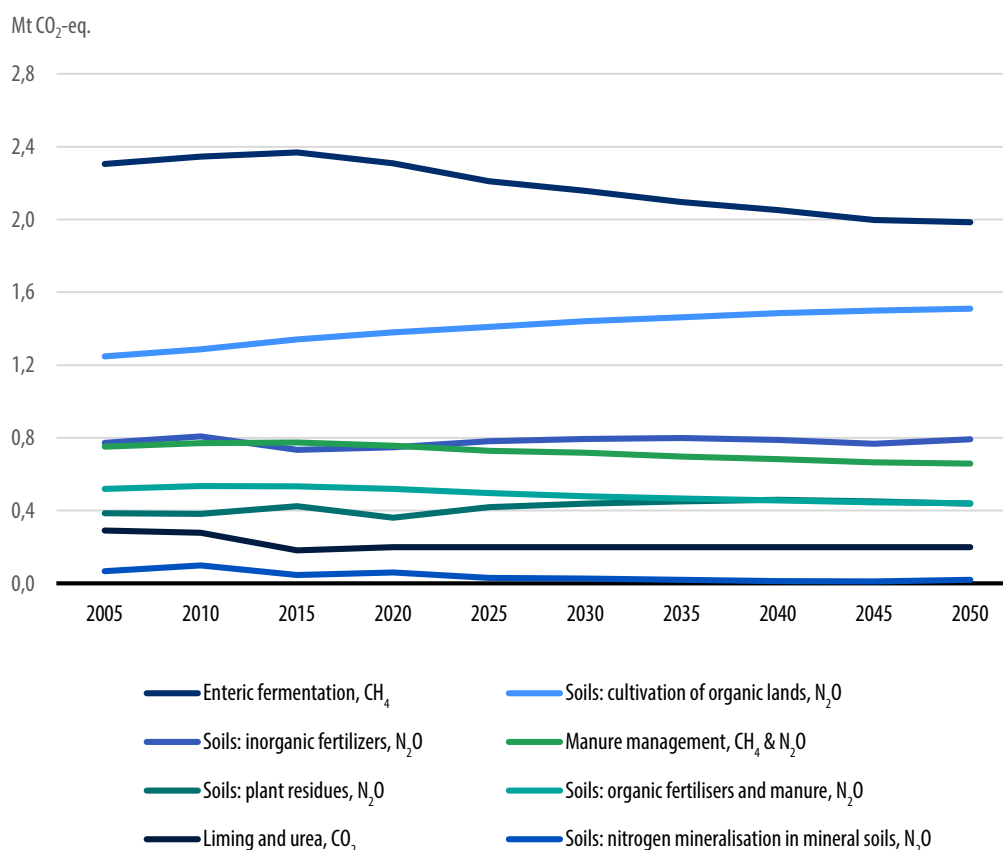
Figure 12. Actual emissions of the agriculture sector in 2005–2020 and emission trends in the WEM scenario (Maanavilja et al. 2021).



In the baseline scenario, the reduction in the number of bovine animals 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 (Figure 11).

Emissions from agricultural lands are expected to grow, since the cultivation of organic soils will increase in line with the trend of the previous years. Emissions from the use of synthetic fertilisers remain as is in the scenario. Emissions from manure spreading and manure on pastures are expected to fall a little due to the reduction in the number of animals. An increase in grass areas and the continuous use of catch crops similar to the present situation will increase emissions from agricultural residues but reduce the emissions from nitrogen mineralisation from mineral soils, which keeps the net effect small (Figure 13).

Figure 13. Emissions from the agriculture sector in the WEM scenario, emissions from agricultural lands stated separately (Maanavilja et al. 2021)



The baseline scenario for the agriculture sector is based on a calculation by the Natural Resources Institute Finland that shares some common assumptions with the HII SI scenarios, for example in the trends of energy prices and demographics. The baseline scenario also leverages data from the OECD-FAO's (2020) estimates on the prices of agricultural products and production inputs in 2020–2029. The WEM scenario assumes that product prices will remain unchanged after 2029.

The WEM scenario assumes that agricultural policy will be the same as during the 2014–2020 period. No potential changes in EU aid have been taken into account beyond 2020. Food consumption per capita is assumed to remain at 2019 levels over the 2019–2050 period.

In the WEM scenario, a total of 300,000 hectares of field area used for cereal and grass cultivation will be discontinued from cultivation. Most of this area will become fallow in the WEM scenario and will therefore remain agricultural land within the scope of subsidies.

5.4.3 Building-specific heating

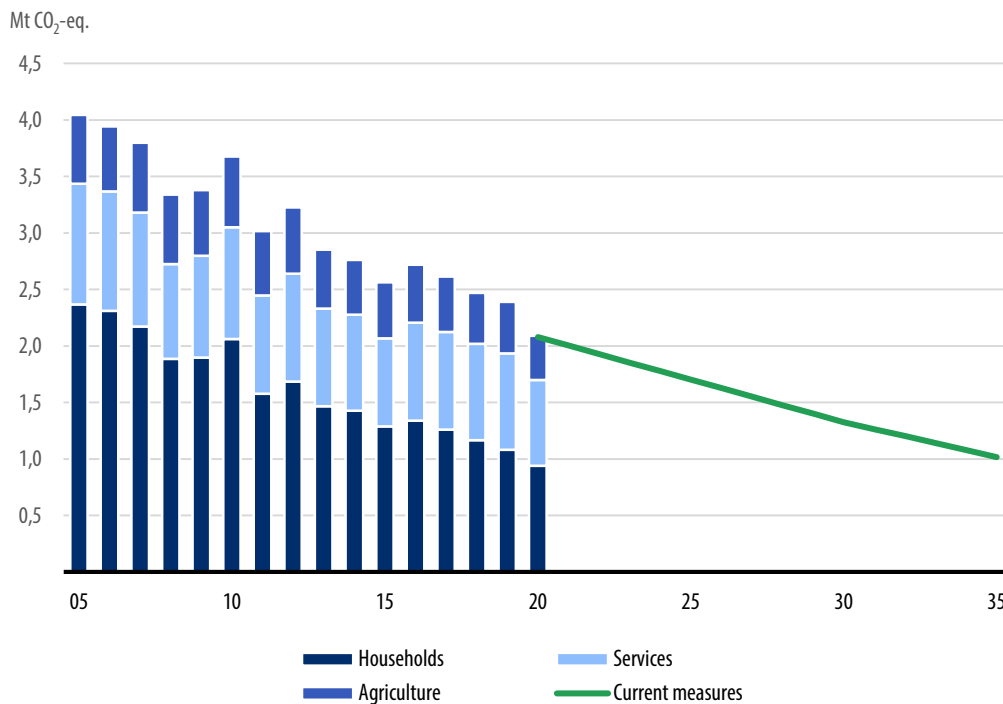
Emissions from building-specific heating are caused by using fuels in building-specific heating of residential, business and service buildings, public buildings and agricultural production buildings and dryers. Most of the fuels are light fuel oil, but some emissions in this category are caused by peat, natural gas and heavy fuel oil. In addition, the emissions include methane and nitrous oxide emissions from small-scale combustion of wood.

Emission trends

While emissions from building-specific heating have seen a downward trend in recent years, there is annual variation due to reasons such as the weather. By way of example, 2015 was a notably warm year, which is why the level of emissions remained below that of 2016, which recorded clearly more heating degree days.

The downward trend in building-specific heating emissions is due to a decline in oil heating and the improved energy efficiency of buildings. Emissions from individual buildings are mainly caused by oil heating. In 2019, emissions from building-specific heating amounted to 2.4 Mt CO₂-eq., which is just over 3% below the previous year (Statistics Finland 2022). Data from Statistics Finland indicates that the emissions in 2020 were about 2.1 Mt CO₂-eq. There was less need for heating, since the winter was warmer than the preceding one. Emissions from building-specific heating have nearly halved from 2005 levels, and according to the estimate based on the baseline scenario (VTT Technical Research Centre of Finland 2021a), they will halve again by 2035 (Figure 14).

Figure 14. Greenhouse gas emissions from building-specific heating in 2005–2020 and an estimate of the emission trends achievable in 2021–2035 with existing measures. (Statistics Finland 2022; VTT Technical Research Centre of Finland 2021a)



Existing measures

According to Prime Minister Marin's Government Programme, the use of fossil fuel oil in heating will be phased out by the start of the 2030s. Oil heating is due to be abandoned in state-owned and municipal buildings by 2024. A separate action plan (Ministry of the Environment 2021a) will be adopted to encourage oil-heated properties to switch to other forms of heating during the 2020s. The action plan will also apply to state-owned and municipal buildings.

The oil sector and the central government have signed an Energy Efficiency Agreement on the Distribution of Liquid Heating Fuels (Höylä IV; Ministry of Economic Affairs and Employment 2016b), which aims to improve energy efficiency in oil-heated buildings and promote renewable energy sources in oil heating. The agreement covers the period from 2017 to 2025.

In the baseline scenario, emissions are expected to continue decreasing as a result of the renewal and renovation of the building stock and changes to heating systems. The obligation to distribute biofuel oil and substitution of fossil oil heating with other forms of heating will result in a significant reduction in emissions. The Act on the Promotion of

Biofuel Oil (418/2019) entered into force in April 2019. The Act sets the share of biofuel oil at 3% in 2021, increasing it gradually to 10% by 2028.

Newly introduced grants will be used to promote phasing out oil use in residential properties. Greenhouse gas emissions from oil heating in residential buildings amounted to 0.8 Mt CO₂-eq in 2019. About 80%–90% of this amount comes from detached and semi-detached houses. About 40% of all of these emissions, in turn, are caused by oil heating. A 2019 study on Finnish housing ('Suomi Asuu 2019') indicates that 133,000 detached and semi-detached houses used an oil boiler in 2019. According to the study, an average oil-heated house consumed about 2,220 litres of oil per year. Overall, only about 5% of energy sector oil products are consumed by households.

A grant is available for detached and semi-detached houses in full-time residential use to cover costs arising from removing an oil heating system from such a house and converting it into other heating systems. The amount of subsidy is EUR 4,000 per oil heating system in a detached or semi-detached house when the system is removed and replaced with district heating or a geothermal or air-to-water heat pump system, or EUR 2,500 per oil heating system in a detached or semi-detached house when the system is removed and replaced with a non-fossil-based heating system.

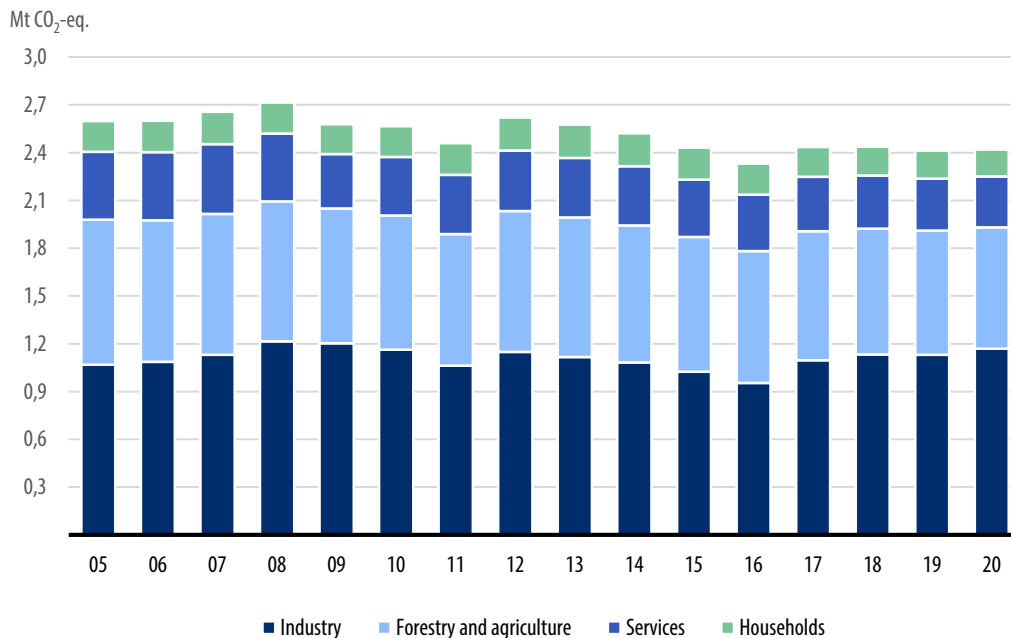
In order to reduce emissions from the heating of agricultural buildings, the Ministry of Agriculture and Forestry grants investment subsidies for agricultural heating plants and driers that use renewable energy.

5.4.4 Non-road mobile machinery

Emission trends

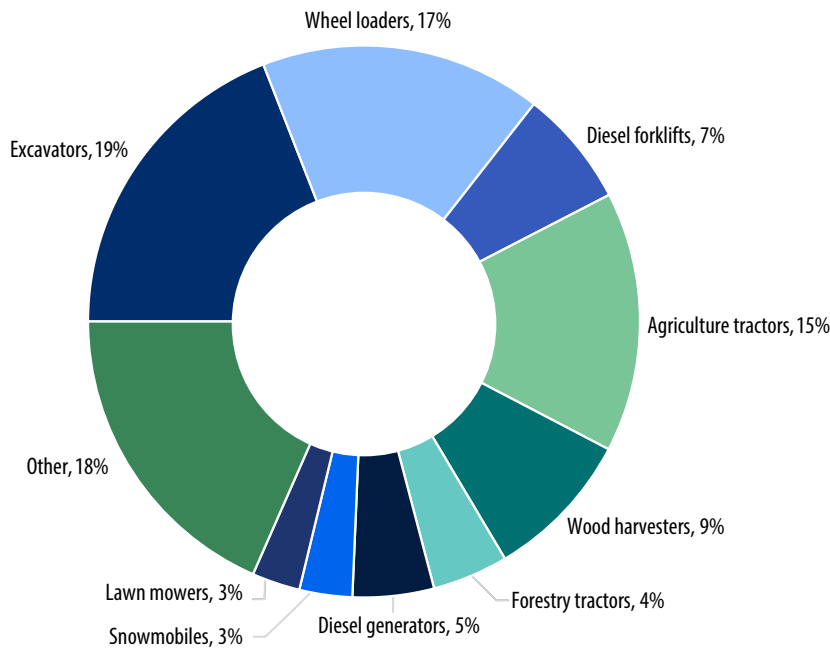
In 2020, emissions from non-road mobile machinery stood at 2.4 Mt CO₂-eq, accounting for about 5% of Finland's total emissions and 9% of emissions in the effort sharing sector (Statistics Finland 2022). Emissions from non-road mobile machinery have remained more or less unchanged in recent years (Figure 15).

Figure 15. GHG emissions from non-road mobile machinery in 2005–2020. (Statistics Finland 2022)



Non-road mobile machinery includes equipment intended for a wide variety of applications, ranging from sturdy excavators, road graders and agricultural and forestry machinery to forklift trucks, ATVs and lawnmowers. Emissions from non-road mobile machinery vary from year to year, depending on factors such as the business cycles in the manufacturing and construction industries. Emission calculations are based on the calculation model for non-road mobile machinery (TYKO; VTT Technical Research Centre of Finland 2021b) developed by VTT Technical Research Centre of Finland. Figure 16 shows the breakdown of greenhouse gas emissions from non-road mobile machinery into the main machinery categories in 2020.

Figure 16. Breakdown of GHG emissions from non-road mobile machinery in 2020 (VTT Technical Research Centre of Finland 2021b).



Non-road mobile machinery is still almost exclusively powered by internal combustion engines. Diesel or light fuel oil accounts for almost 90% of emissions from non-road mobile machinery fuels. Petrol-fuelled non-road mobile machinery mainly comprises different types of light-duty machines. Machinery age varies significantly in Finland and a considerable number of very old machines are still in operation, although non-road mobile machinery with high utilisation rates are clearly more recent than those with low rates.

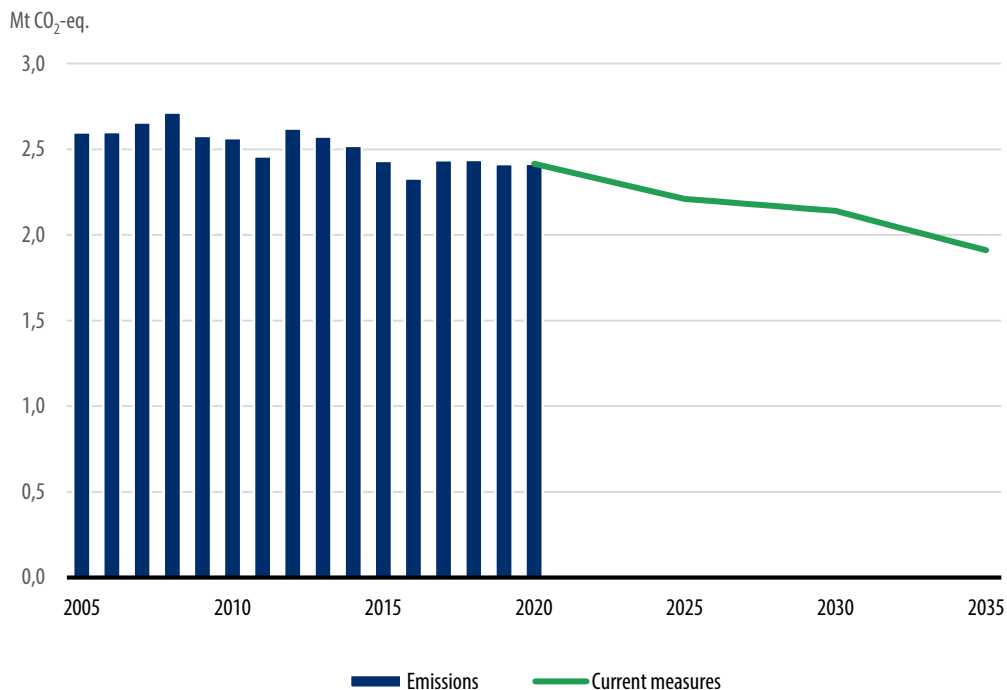
Most of the environmental impacts of non-road mobile machinery are caused during operation. The environmental burden caused during operation depends, in particular, on the characteristics of machinery but also on how it is operated and how different work stages are planned. The most important environmental impacts caused during operation include CO₂ emissions and exhaust emissions that are harmful to human health. Exhaust emissions from non-road mobile machinery are typically much greater than those of cars. Non-road mobile machinery also generates noise. The role of harmful exhaust emissions and noise is more significant in areas of high population density.

Existing measures

The first Medium-term Climate Change Policy Plan estimated that the measures on non-road mobile machinery would reduce emissions by 0.35–0.55 Mt CO₂-eq relative to the baseline trajectory, which would amount to about 1.9 Mt CO₂-eq in the target year 2030. Based on the latest projection (VTT Technical Research Centre of Finland 2021a) created in the HIISSI project, the current trajectory will lead to about 2.1 Mt CO₂-eq emissions in 2030, which means that the target of the previous Climate Change Policy Plan cannot be achieved with the emissions reduction measures implemented to date. On the other hand, the calculation model for non-road mobile machinery (TYKO) does not recognise the impact of all of the implemented policy measures on emissions.

The baseline projection indicates that greenhouse gas emissions in the non-road mobile machinery sector will fall about 20% below current levels in the 2035 target year for carbon neutrality. Figure 17 shows the actual trend in the emission performance of non-road mobile machinery and projections by 2035 based on different scenarios.

Figure 17. The emission trends in non-road mobile machinery in 2005–2020 and the baseline scenario estimate of the emissions trend achievable in 2021–2035 with existing measures (Statistics Finland 2022; VTT Technical Research Centre of Finland 2021a)



Several measures are currently being used to reduce CO₂ emissions from non-road mobile machinery. Under the Act 418/2019 that entered into force in 2019, the biofuel distribution obligation for light fuel oil stands at 3% in 2021 and will rise to 10% by 2028, at which point its impact on annual emissions will amount to approximately 0.2 Mt CO₂-eq.

The accounting criteria for taxation on heating fuel were revised at the beginning of 2019 to include fuel life-cycle emissions in carbon dioxide emissions. At the same time, tax on light fuel oil was raised by about 2%. As of the beginning of 2021, the tax was raised further to EUR 2.7 per megawatt-hour, which is an increase of nearly 11%. The tax increases will affect the price of – and, consequently, demand for – machinery fuels.

In October 2019, the Ministry of the Environment and the Association of Finnish Technical Traders signed a Green Deal on non-road mobile machinery in order to increase the percentage of low-emission machinery through public procurement. 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. As part of the agreement, the Ministry of the Environment has worked with Motiva and the Association of Finnish Technical Traders to design a training programme on energy-efficient use of non-road mobile machinery. In September 2020, the Ministry of the Environment, Senate Properties and the Cities of Espoo, Helsinki, Turku and Vantaa signed a voluntary Green Deal to reduce emissions at construction sites.

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 use biogas are eligible for subsidy as environmental improvement measures. The subsidy covers 35% of eligible costs, including costs of purchase and installation of new equipment.

Steps have been taken to improve the knowledge base on machinery emissions by developing the quality of the baseline data used in the TYKO model developed by VTT Technical Research Centre of Finland. For this purpose, the Ministry of the Environment funded a project carried out by VTT, which was completed in May 2019. TYKO model development will continue as part of the overall development of the LIPASTO calculation system. The model's current challenges include its limited ability to take account of the effects of different measures on emissions. Emission estimates do not take changes to machinery power sources or applications sufficiently into account; nor can trends be linked to financial steering mechanisms, for example.

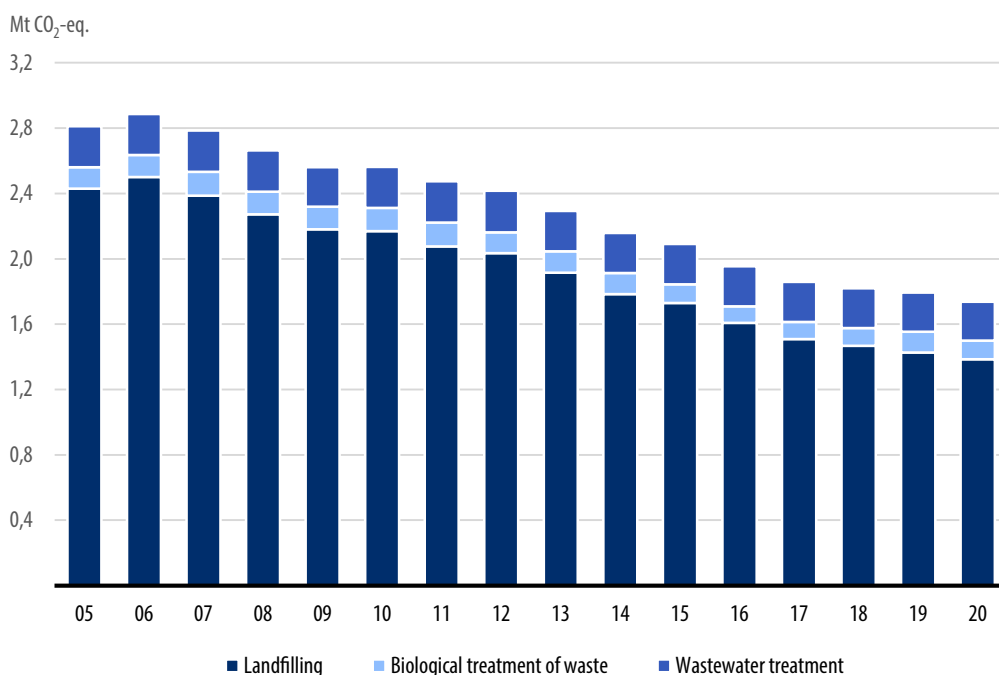
5.4.5 Waste management

Emission trends

Greenhouse gas emissions from waste treatment amounted to 1.8 Mt CO₂-eq in 2019 and 1.7 Mt CO₂-eq in 2020 (Figure 18; Statistics Finland 2022). This accounts for about 6% of emissions in the Finnish effort sharing sector. Waste treatment emissions have been decreasing steadily since the 1990s, plunging by as much as 38% since 2005. The change is -63% relative to 1990 levels. The main reason for this is the stricter energy legislation which has led to a decrease in the landfilling of municipal waste and increased use of waste for energy. Landfill gas recovery has also reduced emissions. Methane produced by landfills is the most significant source of emissions in waste treatment. Other sources include biological waste treatment, i.e. composting and anaerobic digestion, as well as wastewater treatment.

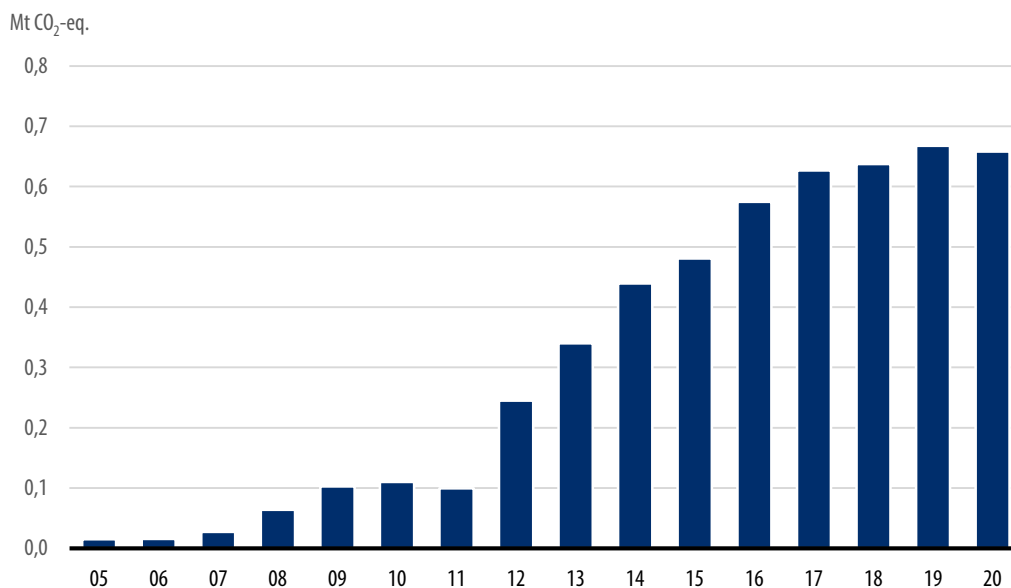
Since 2005, the greatest reductions have been achieved in methane emissions from landfills as organic waste landfilling has declined. The decreasing emissions trend is expected to continue in the near future, as the Government Decree on Landfills (960/2016) that restricts landfilling of organic waste, in force since 2016, will reduce greenhouse gas emissions from landfills even more and gas generation in old landfill sites will continue to decrease as a result. Methane emissions from anaerobic digestion have slightly increased as the method has become more prevalent, whereas greenhouse gas emissions from composting have correspondingly decreased as a result of its declining prevalence. The emission trends in wastewater treatment have been relatively stable.

Figure 18. GHG emissions from waste treatment in 2005–2020. (Statistics Finland 2022)



Emissions caused by energy recovery from waste, i.e. waste incineration, are reported in the energy sector, which belongs to the 'other emissions' category in the effort sharing sector. Therefore, they are not included in the data on emissions from waste treatment presented above. Emissions from municipal waste incineration plants are mainly counted towards the effort sharing sector, whereas co-incineration plants fall within the emissions trading sector. The effort sharing sector's emissions from waste incineration have risen very significantly since 2005 (Figure 19). This is due to increased energy recovery from municipal waste. About 58% of municipal waste generated in 2020 was recovered for energy, while only about 17% of municipal waste was incinerated in 2008. If no new policy measures are introduced, waste incineration emissions are expected to grow slightly in the next few years but stabilise thereafter.

Figure 19. The emission trends in waste incineration in the effort sharing sector in 2005–2020 (Statistics Finland 2022).

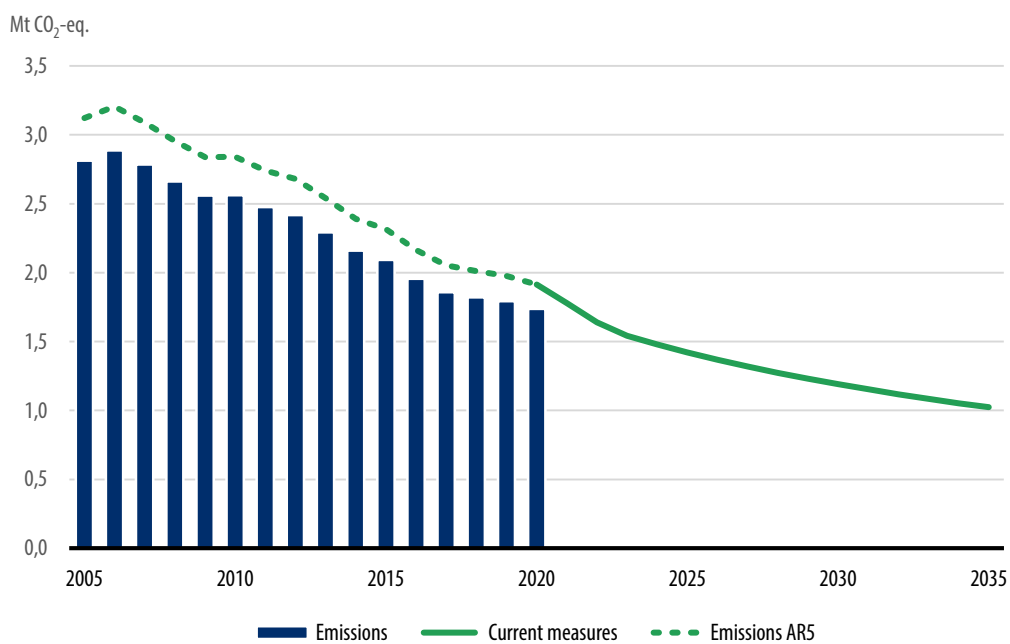


Existing measures

The restrictions on landfilling organic waste, effective since the beginning of 2016, have had a significant effect on the reduction in greenhouse gas emissions from landfills, to the extent that practically no municipal waste is being landfilled any longer. However, the reductions in emissions introduced by the Government Decree on Landfills have already been factored into the baseline scenario, while no actual new emissions reduction measures have been outlined. The disposal of waste by landfilling has been almost completely replaced by recycling and energy recovery from waste. Emissions from energy

recovery from waste will grow a little. Emissions from wastewater management are expected to remain more or less unchanged, Under the baseline scenario (VTT Technical Research Centre of Finland 2021a), waste treatment emissions will decrease by 40% of the 2019 levels by 2030, falling to almost half the current levels in 2035 (Figure 20).

Figure 20. The emissions trend in waste treatment in 2005–2020 and the baseline scenario estimate of the emission trends achievable over 2021–2035 with existing measures. The figure does not include greenhouse gas emissions from waste incineration. Actual emissions in keeping with the national emission inventory were calculated using GWP values in the IPCC AR4 while AR5 values were used to calculate the scenarios. AR5-based actual emissions are indicated by a broken line to facilitate comparison. (Statistics Finland 2022; VTT Technical Research Centre of Finland 2021a)



The Government Programme outlines that the Government will investigate the conditions for using a waste incineration tax to promote a circular economy. A study conducted during 2020 explored the possibilities offered by a tax on waste incineration and voluntary agreements on waste incineration – i.e. the Ministry of the Environment’s Green Deal – in terms of promoting a circular economy and reducing climate impact. With the tax levels analysed in the study, energy- and weight-based waste incineration taxes will not lead to any significant recycling and climate effects. Correspondingly, the effects of a Green Deal purely focusing on waste incineration may remain fairly modest, but the study suggests that a wider Green Deal covering the entire waste value chain could be more effective and lead to emissions reductions as well.

5.4.6 F-gases

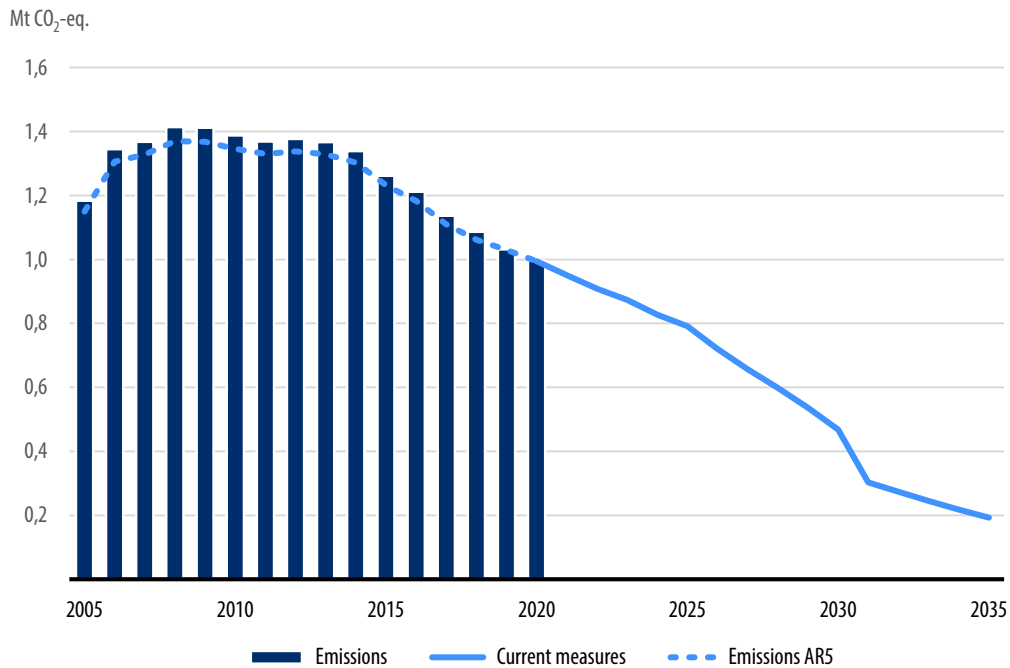
Emissions from the use of fluorinated greenhouse gases (F-gases) increased from the 1990s up until 2013 and have been slightly declining ever since (see Figure 21). F-gases are mainly used in refrigeration equipment, heat pumps, electrical switchgear, fire-fighting, foam blowing, and as aerosols and solvents. The most significant reason for the increase in F-gas emissions since the 1990s is the replacement of ozone-depleting compounds with F-gases in refrigeration and cooling equipment and other applications.

F-gas emissions decreased by almost 3% in 2020 relative to the previous year, and stood at 1.0 Mt CO₂-eq (Statistics Finland 2022). The emissions have declined by almost 30% from the 2008 peak, but they still remain almost twenty times higher than in 1990. In 2020, F-gas emissions decreased in almost all sources. The largest drops were seen in emissions from commercial and industrial refrigeration and cooling equipment and from vehicle air-conditioning systems.

F-gas emissions from commercial refrigeration equipment are being reduced by the ever-increasing use of carbon dioxide as a refrigerant in large-scale commercial installations. No new installations using high-GWP R-404A refrigerants have been introduced since 2018. R-404A emissions are also declining in industrial refrigeration and cooling equipment. F-gas emissions are likewise being reduced in the vehicle air-conditioning systems sector by an alternative to HFC refrigerants, which was first introduced for vehicle air-conditioning systems a few years ago. As of 2018, it is no longer permitted under EU law to register for use any new passenger cars and small vans equipped with air-conditioning systems using refrigerants with a GWP value exceeding 150.

The regulation of F-gases has increased at the EU level as a result of the Regulation on greenhouse gas emissions (517/2014), for example, which aims to gradually reduce the quantity of F-gases placed on the market. With existing measures, F-gas emissions are expected to decrease by about 60% by 2030 and by about 80% by 2035 relative to current levels.

Figure 21. F-gas emissions in 2005–2020 and emissions in ‘with existing measures’ scenario in 2021–2035. (Statistics Finland 2022; Forsberg 2021).



5.4.7 Industry

Energy-related and process emissions from industry are mainly covered by the ETS. The ETS covers power plants exceeding a certain capacity threshold and other combustion plants, oil refineries, coke plants, foundries and steel plants as well as the cement, glass, lime, brick, ceramic, pulp, paper and paperboard industries. The scope of emissions trading expanded in 2013 when the system was expanded to cover carbon dioxide originating from the emissions of certain petrochemicals and nitrous oxide originating from the production of nitric acid.

Industrial emissions that belong to the effort sharing sector originate from non-road mobile machinery (see Chapter 5.3.4) and from the energy use and processes of industrial plants outside the emissions trading system. In 2020, energy-related emissions from the industry were approximately 0.9 Mt CO₂-eq in the effort sharing sector, while 0.4 MT CO₂-eq came from processes. (Statistics Finland 2022). Most of the process emissions come from the manufacture of chemicals and chemical products. Approximately 20% of the energy-related industrial emissions that are calculated as part of the effort sharing sector are N₂O and CH₄ emissions that come mostly from the combustion of fossil and wood fuels in fluidised bed boilers that belong to the emissions trading system.

Existing measures

Emissions from industry outside the emissions trading system can be affected by energy taxation, energy efficiency measures, energy aid and a distribution obligation of light fuel oil. The Energy Authority manages and steers energy efficiency measures within the administrative branch of the Ministry of Economic Affairs and Employment, with the most important being energy efficiency agreements, energy audits, regional energy advisory services, as well as preparation of eco-design and energy labelling matters for specific product groups.

Energy efficiency agreements are a means jointly chosen by the central government and the participating sectors to meet the international energy efficiency obligations imposed on Finland. Energy efficiency agreements guide companies and organisations in improving their energy efficiency. The agreements cover more than 650 companies and their nearly 6,800 sites and nearly 120 municipalities and joint municipal authorities. Energy efficiency agreements have resulted in significant reductions in emissions. About 95% of the reductions are estimated to be generated in the emissions trading sector due to the large proportion of electricity and district heating in all energy savings.

The Energy Efficiency Act (1429/2014) obliges large enterprises to carry out an energy audit every four years. Energy audits are used to produce knowledge of the existing energy consumption profile of a company's units, identifying energy savings opportunities. Most of the emissions reductions resulting from a reduced consumption of electricity and district take place in the emissions trading sector.

A voluntary energy auditing programme has been developed for small and medium-sized enterprises (SMEs). Voluntary energy audits are comprehensive on-site surveys of energy consumption, identifying opportunities to save energy. The audits are conducted and reported according to separate instructions. The Ministry of Economic Affairs and Employment subsidises voluntary energy auditing by local authorities and SMEs. Carrying out an energy audit in accordance with relevant models and instructions is a precondition for energy aid. Motiva Ltd is responsible for all practical tasks relating to subsidised audits, such as instructions, monitoring, development, quality control, auditor training and advisory services.

The Ministry of Economic Affairs and Employment and Business Finland (BF), the Finnish funding agency for innovation, may allocate discretionary grants to innovative energy projects. Two types of grants are available:

- energy aid for investment projects and studies (Ministry of Economic Affairs and Employment/BF)
- investment grants for energy projects to replace coal (Ministry of Economic Affairs and Employment)

Energy aid is available for projects to promote renewable energy production or use, energy savings or energy efficiency, or conversion into a low-carbon energy system by other means. Investment grants for new energy technologies and large demonstration projects may be awarded to projects pursuing future energy solutions with a budget of more than EUR 5 million. The objective of the investment aid is to help achieve the national and EU-level targets set for future energy solutions by 2030. Most of the energy aid focuses on the effort sharing sector.

5.4.8 Other emissions

Smaller emissions lots under the effort sharing sector originate from small power plants and heat boilers outside the emissions trading system, methane and N₂O emissions from energy plants that belong to the emissions trading system, fuel evaporation, solvents and the use of other products, indirect carbon dioxide emissions and unspecified emissions from the energy sector. This category of emissions also includes emissions from fuels used by defence forces and fishing vessels.

In 2020, the other emissions category of the effort sharing sector totalled 2.2 Mt CO₂-eq of emissions. (Statistics Finland 2022). Approximately 1.0 Mt CO₂-eq of this figure came from emissions of unspecified fuel use, the most of which were unknown consumption lots of light and heavy fuel oil, LPG and natural gas. In practice, the consumed amounts are determined as the difference between total sales and known consumption. The subcategory also includes the fuels consumed by the Finnish Defence Forces, statistical adjustments and smaller emission sources, such as helicopters. The greenhouse gas inventory report states that the emissions in this subcategory contain uncertainties of up to ±10–50%, depending on the fuel.

In 2020, the emissions from small district and regional heating plants were approximately 0.5 Mt CO₂-eq, the N₂O and CH₄ emissions from the energy industry's emissions trading plants slightly less than 0.3 Mt CO₂-eq and emissions from the use of solvents and other products (such as lubricants, candles and the urea solution used in diesel engines for neutralising oxides of nitrogen) stood at 0.2 Mt CO₂-eq.

The share of fugitive emissions from fuels in Finland's total greenhouse gas emissions is approximately 0.2%. Fugitive emissions are generated in oil refining and petrochemistry and the processing, transmission and distribution of natural gas. The total amount of fugitive emissions stands at 0.1 Mt CO₂-eq, a third of which is in the effort sharing sector.

Indirect carbon dioxide emissions form in the atmosphere from the NMVOC and methane emissions that originate from industrial processes, use of products and fugitive emissions

of fuels. Indirect carbon dioxide emissions have fallen in recent years and stood at only 0.07 Mt CO₂-eq in 2020.

Existing measures

Emissions from energy can be affected by energy taxation, energy efficiency measures, energy subsidies and a distribution obligation of light fuel oil. The obligation to distribute biofuel oil (418/2019), enacted in 2019, does not only reduce emissions from non-road mobile machinery and oil heating of buildings but also from other activities using light fuel oil. In 2019, the amount of light fuel oil consumed in Finland was almost 19 TWh, with just over a fifth used for applications other than non-road mobile machinery and building-specific heating. Should consumption remain more or less at current levels, a 10% biofuel share in the late 2020s would reduce emissions from light fuel oil used for applications other than non-road mobile machinery and building-specific heating by a maximum of 0.1 Mt CO₂-eq.

6 The action plan to reach the targets

6.1 Principles for determining additional measures

The primary goal of the Medium-term Climate Change Policy Plan is to specify the measures that would enable Finland to reach its emissions reduction targets for 2030 and 2035. Therefore, the plan contains a sufficient number of new measures so that the required emissions reductions can be achieved. The plan has been prepared in a way that enables new policy measures to be determined for all sectors. 'New measures' or 'additional measures' refer to measures and the resulting reductions in emissions that are not considered in the baseline scenario outlined in Chapter 5. Some new measures are still awaiting final decisions, including decisions on their financing. The decisions on financing will be processed in the future state budgets and General Government Fiscal Plans. Some additional measures are currently expressed at a fairly general level, which means that their content must be specified in more detail in further processing.

Additional measures were determined separately for each sector. As a result, the parties in charge of preparing the plan could cooperate with researchers in the field and study the latest information on the emissions reduction possibilities in their sector. The purpose of this method was to identify a sufficient number of emissions reduction measures that, when implemented together, would enable Finland to achieve its emissions reduction targets. The emissions reduction targets themselves were not specified separately for each sector, except for the transport sector, that is obligated to halve its emissions by 2030.

The reduction measures were planned to be both cost-effective and acceptable. Cost-efficiency means the costs incurred by the measures in relation to the achieved reduction in emissions. Costs are viewed from the perspective of both the public sector and private sector. Acceptability is harder to assess, since it is closely linked to fairness. Here, the authors reviewed the impact of the measures especially in terms of income distribution and regional equality.

A wide range of stakeholder groups and citizens was heard during the preparation of the Climate Change Policy Plan. Opportunities for participation were provided especially in the earlier phases when no finalised measures were available as support for the discussion. As a result, the measures were discussed at a general level in the hearings. This plan is based on the principle that carbon neutrality should be achieved as cost-efficiently and fairly as possible. The hearings provided important information on the participants' opinions on the proposed climate measures, including measures that may

prove challenging to accept. The views presented in the hearings were taken into account in the preparation of the Medium-term Climate Change Policy Plan as applicable. For more information on the hearings and their content, see Chapter 9.

The emissions reductions of the additional measures are expressed as million tonnes of carbon dioxide equivalent (Mt CO₂-eq). The figure for 2030 describes the impact of the measures compared to the baseline scenario (WEM). The 2035 figure is an additional reduction that the measures will bring in 2030–2035.

6.2 Sector-specific additional measures

6.2.1 Transport

In May 2021, the Government approved the resolution (Ministry of Transport and Communications/2021/62) on the reduction of greenhouse gas emissions in domestic transport, i.e. the Roadmap to fossil-free transport. The purpose of the roadmap is to halve the greenhouse gas emissions of domestic transport from the 2005 level by 2030 and eliminate the emissions completely by 2045. The measures target road transport in particular. According to the roadmap, achieving the 2030 target would require additional emissions reductions of approximately 1.65 Mt CO₂-eq compared to the basic trajectory estimated in April 2020. However, the baseline projection was updated in summer 2021, since the underlying transport performance forecast from 2018 was considered obsolete. The updated baseline projection sets the need for additional measures to approximately 1.25 Mt CO₂-eq. The COVID-19 pandemic halted the growth of traffic performance and even turned it negative in some areas, while electrification of transport has proceeded quicker than anticipated. The impact of the COVID-19 pandemic is likely to be short-lived, however.

This roadmap sets out a three-phase process. The first phase consists of subsidies and incentives to mitigate emissions of transport. These include subsidies for purchasing electric and gas-powered cars, subsidies constructing the relevant distribution infrastructure and subsidies for walking, cycling and public transport. Most the costs of the first phase are incurred in 2022–2026. They are estimated to be approximately EUR 360 million in total. The decision to fund the first phase in 2022 was made in the September 2021 budget session. Future funding will be decided in the government discussions on spending limits. If the funding proposed in the roadmap is received for the phase 1 measures, the total emissions reduction brought about by these measures would be approximately 0.5 Mt CO₂-eq.

Phase 2 in summer 2021 investigated some additional measures or trends that are thought to have an impact on emissions from transport, but in May there was still insufficient data on the impact. These means or trends are an increase in telework, promotion of integrated transport services and traffic services. The studies completed in autumn 2021 indicate that these means or trends could reduce emissions by 0.2 Mt CO₂-eq in total.

A study carried out in autumn 2021 investigated whether the distribution obligation of biofuels could be increased from the present 30% and whether sustainably produced raw materials are available in sufficient quantities. The study on the distribution obligation was completed in November 2021. The results of the study indicate that increasing the distribution obligation to 34 or even up to 40% will increase the price of fuels, but the increase would be moderate compared to the price increase that is foreseeable due to the trends in global market prices and the existing distribution obligation. Increasing the obligation could achieve an additional emissions reduction of 0.3–1.0 Mt CO₂-eq in transport (Sipilä et al. 2021).

Phase 2 could also include the potential impact of some EU legislative initiatives published in summer 2021 on the emissions from road transport in Finland. Among these initiatives were emissions trading for road transport and buildings, stricter limits for CO₂ emissions from passenger cars and vans and an update to the distribution infrastructure. VTT Technical Research Centre of Finland estimates that these measures would reduce road transport emissions by 0.4–0.5 Mt CO₂-eq in 2030. Since the tightening of statutory emissions limits is already included in the estimated emissions reductions in phase 1, the impact of the other EU initiatives would be approximately 0.3–0.4 Mt CO₂-eq.

Phase 3 of the roadmap will start in spring 2022 after the emissions reduction impact of all of the measures, trends and EU initiatives has been assessed. The Government will evaluate and decide on any need for further national measures concerning transport in the third phase. To this end, the Government will continue to prepare the various alternative measures, including national emissions trading for fossil fuels and the transport tax model based on kilometres and road categories, in case other national measures and solutions at EU level together are insufficient.

Roadmap to fossil-free transport, phase 1

1. Replace fossil fuels with alternative transport fuels

Fossil fuels in transport can be replaced by alternative transport fuels, such as electricity and hydrogen, or various renewable fuels such as liquid biofuels, biogas or electrofuels. The amount of energy consumed by traffic each year is so high that it is not possible to replace the entire energy consumption with only one single driving force or fuel alternative. Both a reduction in the total energy consumption of transport and a number

of different transport fuel options are needed to replace fossil fuels. As a rule, the use of fossil fuels must be phased out in the long term. The only exceptions could be vintage and hobby vehicles and vehicles used in rescue operations and in exceptional circumstances. The transport fuel reform must also pay careful attention to security-of-supply issues.

In order to halve greenhouse gas emissions from transport by 2030, fossil fuel consumption should be halved in almost the same time. Fuel consumption can be reduced by reducing the kilometres driven or fuel consumed by individual vehicles. Fuel consumption can also be reduced by switching to electricity in transport. In 2030, thirty per cent of the remaining fuel consumption will be covered by renewable fuels, such as liquid biofuels, biogas and possibly also with hydrogen or electrofuels manufactured from hydrogen, all produced from sustainable raw materials.

Liquid biofuels and electrofuels can mostly be mixed with existing conventional fuels and distributed at traditional distribution stations. On the other hand, a new distribution infrastructure is needed for electricity and gas, so that people and companies can switch to these transport fuels everywhere in Finland. The aim is to have at least one public fast-charging station per 100 electric cars in Finland in 2030 and that a charging point can be found for each electric car also for overnight charging. In 2025, the number of CNG refuelling stations would be 100 and the number for liquefied gas would be approximately 40. In the longer term, the number of stations should at least double.

The traffic use of hydrogen in Finland has not progressed on market terms. If the situation were to change and there would be more demand for hydrogen in the future, the use of hydrogen in transport would also require a new distribution infrastructure. For this reason, the demand for hydrogen must be carefully monitored and possible measures must be taken in the event of a change in demand.

The Roadmap to fossil-free transport contains the following measures for replacing fossil fuels:

- Include biogas and electrofuels in the distribution obligation.
- Continue and increase support to public distribution infrastructure for transport electricity and gas.
- Continue and increase support for private charging infrastructure for housing companies. Expand the support to cover not only housing companies but also workplaces.
- Assess possible ways of implementing the obligation concerning charging points for service station chains
- Promote the fair and non-discriminatory sharing of charging services and roaming

In addition, the following measures were agreed on in the budget negotiations of autumn 2021:

- Determine the economic, environmental and energy policy impact of removing 100% biodiesel from the scope of the distribution obligation, taking into account the availability of sustainable raw materials and other biofuel targets.
- Cooperate with the operators in the sector to determine whether 100% biogas could be adopted in road transport by 2025; a potential avenue might be using the green deal process while ensuring compatibility with the distribution obligation.

The measures above will achieve a total emissions reduction of 0.1 Mt CO₂-eq in 2030.

It should be noted that adding biogas and electrofuels into the distribution obligation without increasing the percentage of the obligation will not reduce emissions from transport. Without such an increase, biogas as transport fuel will reduce the consumption of liquid fuels, resulting in a situation in which biogas will start replacing liquid biofuels instead of fossil fuels, unlike in the baseline projection. Therefore, transport sector emissions in the WAM scenario will grow compared to the baseline projection, unless the obligation percentage is increased by an amount that corresponds to the consumption of biogas.

The intention is to keep replacing fossil fuels, not liquid biofuels, with biogas. To ensure that this happens, the distribution obligation should be increased to match the estimated biogas consumption, which means an increase of approximately four percentage points to a total of 34% in 2030. This represents approximately 2.5 TWh of biogas consumed by the transport sector. To meet this target, Finland has to succeed in its efforts to influence the EU's proposal for limit values for passenger cars and vans so that gas-powered vehicles would still be manufactured in the EU in the 2020s.

2. Renewal of the vehicle fleet

A rapidly progressing global transformation of vehicle technologies is currently underway in transport. New technologies, especially electricity, are emerging alongside traditional internal combustion engines and also replacing them. The transformation of vehicle technology plays a critical role in reducing greenhouse gas emissions from transport.

Approximately 100,000–120,000 new cars are sold in Finland each year. In addition, approximately 45,000 used cars are imported to Finland each year from abroad. The majority of Finns never buy a new car, but instead acquire their cars from the second-hand

car market. The number of second-hand cars sold in Finland is approximately 600,000 each year. According to the estimate of the car industry, the average value of a car in the Finnish car fleet is approximately EUR 6,800, while the average price of a new car is approximately EUR 34,000.

Cars remain in use for approximately 20 years. It is therefore important to ensure that an increasing share of the new cars sold and the used cars imported is as low-emission as possible and increasingly made up of cars other than conventional diesel and petrol cars. When new cars with alternative motive powers end up in the used-car market, an increasing number of households can transition away from fossil fuels. The transition can be facilitated by state measures.

In addition to private citizens, municipalities and companies also play an important role in the renewal of the car fleet. Each year, municipalities and joint municipal authorities order various transport services for approximately EUR 880 million and, as contracting entities, they can influence the type of equipment used to carry out transports. The Act on environmental and energy efficiency requirements in vehicle and transport services procurement (740/2021) was enacted in 2021. Industrial and commercial operators also have the opportunity to influence the characteristics of the transport services they have ordered and the vehicles that produce them. Companies, on the other hand, are each responsible for their own fleet choices and are thus key players in the renewal of the car fleet.

The aim is to increase the share of zero-emission and low-emission new technologies in new passenger cars from the current 30% to as close as possible to 100% by 2030. The share of plug-in hybrids in the sales of new cars would be at its highest around 2026, but would then begin to decrease rapidly as the share of electric cars increases accordingly. It is estimated that the price of electric cars will reach the prices of conventional internal combustion engine cars in 2025.

The roadmap sets targets for the number of cars by motive power for 2021–2045. However, these targets have to be revised, since transport is becoming electrified more rapidly than estimated at the time the roadmap was created. Taking the new limit values into account, the target of the WAM scenario is to have approximately 750,000 electric passenger cars and approximately 40,000 electric vans in use in 2030, at least half of which fully electric. The number of gas-powered passenger cars and vans would be approximately 130,000. The number of electric trucks and buses would be around 8,000 and gas-powered trucks and buses around 7,400.

The Roadmap to fossil-free transport contains the following measures for renewing the vehicle fleet:

- Exert an influence in the EU on the preparation of CO₂ limit values for passenger cars and vans so that the legislation will bring maximum benefits for emissions reduction also in Finland. Prepare for similar influencing on the limit values for heavy-duty vehicles.
- Continue the existing purchase subsidy for fully electric cars.
- Continue the present conversion supports to convert petrol cars to ethanol or gas. Explore and implement measures to further promote conversion.
- Implement a scrapping premium campaign or campaigns.
- Introduce new purchase support for electric and gas-powered vans.
- Introduce a new procurement subsidy for electric trucks. Continue and increase the purchase subsidy for gas trucks.
- Start resolutely implementing the clean vehicle and service procurement directive in Finland.
- Launch an extensive research programme on vehicles and alternative transport fuels.

In addition, the following measures were agreed on in the budget negotiations of autumn 2020 and 2021:

- Starting from the beginning of 2021, carry out a tax reform on transport-related employee benefits that supports the transition to low-emission traffic. Lower the taxable value of electric vehicles used as a company car by EUR 170 per month for 2021–2025.
- Make charging of electric vehicles at the workplace or in public charging points tax-free for 2021–2025. The charger of a company car will be considered as part of the car's accessories
- Exempt fully electric cars from car tax and implement a corresponding increase in the base rate of their motor vehicle tax. The increase of the motor vehicle tax does not apply retroactively to fully electric vehicles already commissioned. The exemption from car tax applies to cars taxed after 1 October 2021.
- Reduce the taxable value of low-emission company cars by EUR 85 per month for 2022–2025. This change applies to low-emission hybrids and gas-powered company cars.

The measures above will achieve a total emissions reduction of 0.1 Mt CO₂ in 2030. The estimate includes the Commission's proposal on the new CO₂ limit values for passenger cars and vans. If implemented, the emissions trading system for road transport will have an impact on the attainment of the vehicle stock targets. This impact is assessed in more detail below.

3. Improving the efficiency of the transport system

Finland is a sparsely populated country, and a car is a vital means of transport for many people now and in the future. However, especially in urban areas and in interurban transport, there are also alternatives to cars, such as public transport, shared transport, walking and cycling. Through their own actions, the central government and municipalities can encourage people to increasingly shift to these sustainable modes of transport. Goods transport can also be made more efficient or moved from roads to rail or waterways. The vehicle kilometres will decrease as transports become more efficient and partly shift to more sustainable modes of transport. Sustainable mobility or transport usually means mobility that minimises environmental harm and the use of resources. In most cases, it is considered to include at least pedestrian, cycling and public transport as well as other transport services in passenger transport as well as water and rail freight transport.

In urban areas and interurban transport, a determined shift away from the current car-centric system must be made towards a sustainable mobility system. This is a significant systemic change in the way of managing the needs of mobility and transport. In a system of sustainable mobility, mobility and transport needs are managed by utilising and combining various transport modes and services. Digitalisation and transport-related information play a crucial role. Automation can also help achieve transport emissions reduction targets, if it can be used to improve, for example, the competitiveness and attractiveness of public transport.

Measures related to improving the efficiency of the transport system have been prepared in connection with the preparation of the National Transport System Plan. The National Transport System Plan will be adjusted and aligned with the General Government Fiscal Plan at the beginning of each government term pursuant to the Act on the Transport System and Highways. The Act also provides that the National Transport System Plan be adjusted as necessary when the General Government Fiscal Plan changes. The National Transport System Plan looks at the transport system as a whole, and its objectives are associated with sustainability, accessibility and efficiency.

The objective of the roadmap to fossil-free transport is that the vehicle-kilometres of passenger cars will no longer increase in the 2020s. If people's mobility needs continue to increase, the aim is that this growth in urban areas and interurban transport will be

directed towards sustainable modes of transport. This would mean an approximately 10% growth in the traffic performance of each sustainable mode of transport in 2030. For individual households in rural areas, car vehicle-kilometres may continue to increase, but as the population concentrates in urban areas, the combined vehicle-kilometres of households throughout the country will remain at the 2019 level.

The target for goods transport is that the rate of increase in the traffic performance of vans and trucks will slow down in the 2020s compared to the baseline scenario. The objective does not mean reducing freight transports or economic activity, but rather that goods are transported more efficiently in road transport or that transports are shifted to more sustainable modes of transport.

The Roadmap to fossil-free transport contains the following measures for improving the efficiency of the transport system:

- Promote, in cooperation with the state and municipalities, sustainable transport, such as walking and cycling, public transport and various transport services.
- Continue implementing the investment programme for walking and cycling and improving the conditions for walking and cycling along highways and at traffic nodes.
- Increase the level of the government grants for public transport in large and medium-sized urban areas
- Increase the level of the central government transfers for mobility management.
- Utilise in full the considerable lengths and masses for road transports permitted by law in Finland.
- Improve the maintenance of routes.
- Adopt the logistics digitalisation strategy and the government resolution to be prepared on the basis of the strategy.

In addition, the following measures were agreed on in the budget negotiations of autumn 2020 and 2021:

- The taxation of employee travel tickets will be simplified by setting the maximum tax exemption to EUR 3,400 while removing the component between EUR 300 and EUR750 that was considered taxable income. Company bicycles will be made a tax-free benefit up to EUR 1,200 per year. The tax-free part of the so-called mobility service package will be determined like other tax-free employee benefits.

- Regional public transport will be developed by finding out which regions are willing to arrange commuter train services and the capability to extend existing services.

The measures above will achieve a total emissions reduction of 0.3 Mt CO₂ in 2030. If implemented, the emissions trading system for road transport will have an impact on the attainment of the targets associated with the transport system. This impact is assessed in mode detail below.

The measures of phase 1 of the roadmap will be able to reduce carbon dioxide emissions from transport by approximately 0.4 Mt CO₂ in 2030, if the measures are granted funding as proposed in the roadmap.

Roadmap to fossil-free transport, phase 2

Phase 2 of the roadmap assessed some additional measures or trends that are likely to have an impact on emissions from transport, but whose exact impact was still unknown in May. These means or trends are an increase in telework, promotion of integrated transport services and traffic services. The roadmap also investigated the impact of increasing the distribution obligation. The investigations were completed in autumn 2021.

1. Increase of remote work

Approximately 357,000 employees in Finland worked remotely in 2019. During the COVID-19 pandemic in 2020, the number of remote workers was approximately 790,000. This is assumed to be the highest number possible with the current regional and employment structure. The traffic performance of passenger cars in 2020 was four per cent smaller than in 2019. This is indicative of the potential impact remote work might have if it gains popularity. However, many other factors in addition to remote work also contributed to the reduction in traffic in 2020, such as lay-offs, restrictions in leisure activities and other measures to restrict the spread of the pandemic.

According to a forecast made in the project, the number of remote workers will be 577,000 in 2030 and 582,000 in 2045. The maximum scenario forecasts the number of remote workers at 811,000 in 2045.

The increase in remote work would reduce the annual CO₂ emissions from passenger car traffic with the maximum reduction being approximately 0.125 Mt CO₂-eq in 2030. The most likely scenario states that remote work would reduce emissions by approximately 0.08 Mt CO₂-eq by 2030.

2. Promoting transport services

The emissions reduction potential of transport services was also studied in a range of scenarios. The scenarios varied the way different forms of servitisation of transport are adopted in different areas and how different courses of development would affect the supply of services and thereby the price, service level and car ownership in the area. According to the modelling used, the predicted provision of broader and more diverse transport services will decrease greenhouse gas emissions from transport by around 80,000 tonnes by 2030. In 2045, autonomous transport will have made the provision of transport services even broader and more diverse decreasing the annual greenhouse gas emissions by around 580,000 tonnes.

3. Combined transport

The report used statistics to estimate opportunities for combined transport (car or vehicle combination + train) and their impact on greenhouse gas emissions from transport. Depending on the volume of goods and the extent of transport areas, combined transport would reduce carbon dioxide emissions from transport, estimated on the basis of statistical transport potential, by 18,000 to 30,000 tonnes in 2030. The scenarios assumed that combined transport would be available in six rail links (Helsinki-Oulu, Turku-Oulu, Helsinki-Kuopio, Turku-Kuopio, Tampere-Oulu ja Tampere-Kuopio). In practice, a complete transition from the statistical transport potential to combined transport is not possible. It is likely that combined transport would only be operated on some of the road sections examined, in which case the reduction in carbon dioxide emissions would be smaller.

Starting combined transport will require investments in the rail network, terminals and new rolling stock in domestic transport. Regarding foreign transport, it is possible to launch combined transport with the current rolling stock. This also requires a committed operator that produces the service in an economically sustainable way that benefits both the transport customer and the operator. In addition to current tax subsidies, combined transport could be supported by environmentally based tax concessions. The report did not take a stand on the exact type of these concessions.

In total, the measures of phase 2 of the roadmap can reduce carbon dioxide emissions from transport by approximately 0.2 Mt CO₂ in 2030, if remote work and servitisation of transport proceed as desired and if the necessary additional measures are performed to promote combined transport. In addition, the distribution obligation of renewable transport fuels will be increased from the current 30% to 34% by 2030 and the measures in the biogas programme will be implemented to increase the production of biogas. The emissions reduction achieved by increasing the distribution obligation will be approximately 0.3 Mt CO₂ in 2030.

Legislative initiatives on transport in the EU Commission's climate package

1. Emissions trading for road transport and buildings

In June 2021, the European Commission published a large legislative package that proposes the establishment of a separate emissions trading system for emissions from road transport and for those emissions from building-specific heating that were previously outside the emissions trading system. The new emissions trading system would operate alongside the existing one. In Finland, the new emissions trading would cover the emissions from fossil fuels used in road transport and building-specific heating. The system might also cover small district and regional heating plants and non-road mobile machinery in the service sector and households which are currently outside emissions trading. According to an estimate by VTT, the new emissions trading would reduce emissions from road transport by 0.3–0.4 Mt CO₂ in 2030, if fuel prices increased in line with the Commission's estimate, i.e. by approximately 11 c/l for gasoline and 13 c/l for diesel.

2. Binding CO₂ limit values for passenger cars and vans

The Commission's climate package also proposes a tightening of the carbon dioxide emissions targets for new passenger cars and vans in the EU and the setting of new carbon dioxide emission targets. The proposal would tighten the car-manufacturer-specific limit values at the EU level so that starting from 2030, the limit value for passenger cars would be 55% less and for vans 50% less than the 2021 target. This would mean a significant tightening of the existing limit values for 2030, which for passenger cars stand at -37.5% and for vans -31% from the 2021 target. The Commission also proposes a new 100% reduction to the limit values of both passenger cars and vans starting from 2035. In practice, this would lead to a situation in which car manufacturers would only manufacture fully electric cars and hydrogen cars in 2035.

An estimate by VTT Technical Research Centre Finland says that the tightening of limit values would only have a moderate effect on emissions from transport in Finland, only 0.06 Mt CO₂ in 2030. This is due to the fact that the share of electric cars among cars registered for the first time is already growing rapidly, and the CO₂ emissions from new cars will fall to the proposed new level already in the baseline projection.

The tightening of limit values is included as a phase 1 measure in the roadmap, which means that its emissions-reducing impact is considered in the total emissions reductions achieved in phase 1.

3. Distribution Infrastructure Regulation

The Commission's climate package contains a proposal for repealing the directive on alternative fuels infrastructure and a proposal for a new regulation on the topic. The proposal contains binding national minimum requirements for the charging and refuelling

infrastructure for road transport vehicles, vessels and aircraft. The proposal concerns public infrastructure, i.e. charging and refuelling stations that are freely accessible by all. The proposal also lays down general technical requirements for the charging and refuelling points and requirements on the availability of information on the infrastructure and services, data transmission and payment methods. In addition, the proposal also contains provisions on the required content of the Member States' mandatory national plans for alternative fuel infrastructure and the reporting on the progress of the plans and the development of the infrastructure.

The proposal's impact on the carbon dioxide emissions from transport cannot be assessed directly with the current level of knowledge. Nevertheless, it is obvious that the popularity of electric cars and other vehicles powered by alternative power sources is tied to the availability of recharging or refuelling possibilities. Increasing the scope and density of recharging and distribution stations will have a positive effect on the actualisation of the electric vehicle forecasts. By contrast, if the consumers are uncertain about the availability of motive power, they are likely to favour traditional motive powers, since their availability is guaranteed.

4. Energy Taxation Directive

The Commission's directive proposal would base energy taxation on the energy content of the products, making it easier to compare the products. Furthermore, since the new tax would replace the existing quantity-based tax, it would eliminate the unfavourable tax treatment of some products, such as biofuels, compared to fossil fuels in some countries. There would be four tax categories. The highest category would consist of traditional fossil fuels, such as motor gasoline and diesel oil and so-called non-sustainable biofuels. The next category would include fossil fuels that are less harmful than the ones in the highest category and which would allow societies to decarbonise to some extent in the short and medium term. These fuels include natural gas, LPG and fossil hydrogen. Their minimum tax rate would be two thirds of the minimum tax rate of the highest category for a transition period of 10 years, after which the tax reduction would be discontinued. The next category would consist of sustainable biofuels whose minimum tax rate would be half of the minimum tax rate of the highest tax category. The lowest tax category would include electricity and advanced biofuels, bioliquids and biogas, low-carbon fuels and renewable products of non-biological origin.

Each tax category would be set a minimum rate that the Member States could exceed and that would be different for transport and heating applications. The Member States would have to keep the order of the categories and the order inside the categories the same in terms of the minimum tax rate. As is the case now, the minimum tax rates for transport applications would be higher than in other applications. The minimum tax rates for non-road mobile machinery applications and other special applications would be the same as

for heating applications as is the case now, which seeks to simplify taxation. A minimum tax rate would also be set for electricity. The minimum tax rates in the proposal are very low compared to Finland's current tax rates, and they would not be increased from the level set by the directive that entered into force in 2003, except for an inflation adjustment starting from 2018. However, some tax exemptions would be lifted and some new products would become subject to tax.

To ensure neutral tax treatment, the Member States should ensure that their taxation is uniform for products used for the same purpose in a given tax category. For example, the proposal would require that motor gasoline and diesel oil used as transport fuel be taxed under uniform tax criteria based on their energy content, which would prevent Finland from using the current energy taxation scheme where diesel oil is taxed at a lower rate than gasoline.

The impact of the proposed energy tax directive on emissions from transport in the effort sharing sector would depend significantly on how national taxation reacts to the proposed measures and how elastic the consumption of fuel is estimated to be in the future. Significant uncertainties exist concerning the national reactions to the energy tax directive and price elasticity of fuel consumption. If the tax rates of diesel and gas were made uniform with the current tax rate of gasoline and the power source tax of diesel- and gas-powered cars were discontinued, the resulting reduction in emissions in 2030 would be approximately 0.6 Mt CO₂-eq compared to the baseline projection, if the long-term price elasticity of diesel and gas consumption in vans, trucks and buses were -0.8 and in passenger cars -0.57 with the passenger car fleet remaining at the level stated in the baseline projection.

An increase in fuel tax rates causes concern in citizens

During the early stages of the drafting of the Climate Change Policy Plan, the authors requested opinions on typical climate actions from a wide range of citizens and other stakeholders. These hearings also identified measures which involve special challenges in terms of fairness. For example, an open citizen survey indicated that 83% of citizens consider a significant increase in fuel price somewhat unfair or very unfair. The citizens are generally concerned about the economic impact of the measures, although they would also like the government to take action against climate change, says the Citizens' Panel on Climate Actions. On the other hand, fuel taxation was considered a fairly powerful tool in both the citizen survey and in the stakeholder hearings.

A topic that often came up in the hearings was fairness, such as the impact of the measures on low-income citizens and people in sparsely populated areas. Equality workshops estimated that an increase in price will have proportionally the greatest effect on low-income citizens but quantitatively the greatest effect on high-income citizens, since their consumption levels are the highest. For example, the Sámi highlighted that an increase in fuel tax might have a negative effect on their livelihood. The Citizens' Panel on Climate Actions stated that any tax increases must focus on climate emissions and must be compensated by other means so that the total tax ration will not increase. The Panel says that an increase in fuel tax is not fair until used electric cars are available at the same price and quantity as used fossil-fuel cars.

Roadmap to fossil-free transport, phase 3

In phase 3 of the roadmap, the Government evaluates and decides on any need for further national measures concerning transport. Phase 3 of the roadmap will start in spring 2022 after the emissions reduction impact of all of the measures, trends and EU initiatives has been assessed.

To support climate actions in transport, the government will continue to prepare the various alternative measures, including national emissions trading for fossil fuels and the transport tax model based on kilometres and road categories, in case other national measures and solutions at the EU level are together insufficient. The need for additional

measures will be assessed in view of Finland's progress towards its climate targets in other sectors and by other measures, the cost-efficiency of the emissions reductions and their impact on competitiveness and regional and social fairness. Other factors that will be considered are fuel price trends and the detailed impact assessments created to support the overall assessment. Overall, the transport sector aims to reduce emissions by 1.25 million tonnes of carbon dioxide in 2030 compared to the baseline trajectory. The measures in phase 1 and 2 of the roadmap (without an increase in the distribution obligation) could reduce emissions by approximately 0.6 million tonnes and the increase in the distribution obligation by approximately 0.3 tonnes. Additionally, EU-level emissions trading in road transport would reduce emissions by approximately 0.3–0.4 Mt CO₂-eq.

Impact of transport policy actions on the emissions from the effort sharing sector: 1.3 Mt CO₂-eq in 2030 + 0.9 Mt CO₂-eq in 2035.

6.2.2 Agriculture

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 it can also bind atmospheric carbon to soil.

Measures designed to reduce agricultural greenhouse gas emissions must acknowledge the importance of food production to the entire society, so they cannot jeopardise national food security. The primary goal of Finnish agricultural and food policy is to guarantee national food security and good nutrition for people living in Finland. The global demand for food will increase in the future, which means that more attention needs to be paid on making production more effective, i.e. reducing the quantity of emissions per produced unit. It is important to investigate and ensure that any planned and executed climate measures become visible in Finland's national greenhouse gas inventory.

The primary measures to reduce agricultural emissions are the ones stated in the European Union's Common Agricultural Policy (CAP). The CAP is currently being reformed from the next funding period 2023–2027 and its emissions reduction measures are also being reviewed in the process. The policy reform places a particular emphasis on mitigating and adapting to climate change, safeguarding animal welfare and attracting new farmers to the sector. Other priorities include maintaining a viable income for farmers, developing rural areas and improving risk management.

Finland's CAP plan was submitted to the Commission in the latter half of 2021 and the implementation of the plan will start at the beginning of 2023. The current CAP measures

will continue as usual during the transitional period 2021–2022. Funds from the EU recovery facility are also available during these years. The CAP cannot implement all necessary mitigation or adaptation measures in agriculture, and it would not be sensible either, since national-level measures are also needed. The preparation of the WAM scenario for agricultural climate actions should pay attention to the fact that the CAP currently undergoing reform will be in force for 2023–2027, and a new CAP plan will be drawn up for the subsequent years.

Another document that is closely associated with the efforts to reduce of agricultural greenhouse gas emissions, increase carbon sequestration in agricultural land and maintenance of carbon pools is the Climate Plan for the Land Use Sector that is currently being prepared. 'Land use sector' refers to agricultural land, forestry and other land use. The plan lays down the means to reduce greenhouse gas emissions from the land use sector and strengthen carbon sinks and pools. The Climate Plan for the Land Use Sector covers the measures that focus on forests, changes in land use, climate wetlands and carbon dioxide emissions from agricultural lands. The plan will also contain an implementation plan and a plan for monitoring the measures and their impact.

The With Additional Measures (WAM) scenario for agricultural climate measures in the Medium-term Climate Change Policy Plan is based on scenarios created in the project Carbon-neutral Finland 2035 – measures and impacts of climate and energy policy (HIISSI; VTT Technical Research Centre of Finland 2021a) (Maanavilja et al. 2021).

Input data for the scenarios came from the draft national CAP plan, including the following propose measures: turning cleared areas permanently into grassland, catch crops, soil improvers and renovation plants, subsidies for grasslands and fallows (including grasses on peat fields), investments on controlled subsurface drainage and their management, establishing and managing wetlands (including climate wetlands). In addition to the CAP, the input data also contains financial support for afforestation of wastelands, effective from 2021 onwards, an estimate of the emissions reduction possibilities of the land use sector (Lehtonen et al. 2021) and a climate roadmap by the Central Union of Agricultural Producers and Forest Owners/Central Union of Swedish-speaking Agricultural Producers in Finland (Lehtonen et al. 2020).

The measures in the agricultural WAM scenario are associated with changes in land use, arable land use (cultivation of peatlands with elevated water levels, increasing carbon sequestration of mineral soils), precision farming and reducing methane emissions from dairy cows. These measures will reduce emissions not only in the agriculture sector, but also to a large extent in the land use sector.

Support for the production of climate-friendly food was requested at the hearings

During the early stages of the drafting of the Climate Change Policy Plan, the authors requested opinions on the impact and fairness of typical climate actions from a wide range of citizens and other stakeholders. For example, the Citizens' Panel on climate action requested support for the domestic production of plant protein and climate-friendly food. Furthermore, many stakeholders emphasised the significance of discontinuing the cultivation of peat fields and restoring them to their original state and the promotion of domestic plant proteins. The stakeholders wanted agricultural subsidies to take environmental and climate issues into account to a greater extent.

On the other hand, the stakeholders highlighted that the usefulness of the measures should be investigated comprehensively, taking climate, diversity, the economy and social and regional fairness into account. The Sámi Parliament considered local food security to be particularly important. The equality workshops concluded that major crop farms and livestock farms might be financially better equipped to adopt new technologies and production methods required by the climate measures.

In the baseline scenario, the arable area subject to agricultural subsidies remains almost unchanged, whereas the implementation of the WAM scenario will reduce the area by 64,000 hectares by 2030. Grain cultivation area will fall by approximately 10% but without a corresponding drop in total production, since the cultivation will concentrate on fields that produce the best yields. Field-specific crop rotation and the shift to new plant varieties will result in an increase of 2.5% in crop yields by 2035.

Nitrogen utilisation efficiency will grow, and by 2040, precision farming will have reduced the need for nitrogen fertilisation by 10% from the 2019 figure. At the same time, crop yields will increase by 5 percent by 2050, partly thanks to new plant varieties that are able to utilise nitrogen better than their predecessors. The improved crop yields are a major factor in the nationwide 1.5% increase in agricultural income in the WAM scenario compared to the baseline scenario in 2050.

The number of dairy cows in the WAM scenario will fall from 262,000 to 196,000 by 2050. The total production of milk will fall by 2%. In the baseline scenario, both the number

of dairy cows and milk production will fall more. The WAM scenario will bring further reductions to methane emissions from dairy cows by means of rapeseed cake, 3-nitrooxypropanol (3-NOP) and red seaweed additives in the feed of dairy cows.

The increase in fallow area will stop at around 300,000 hectares in the WAM scenario. Incentives for increasing fallow area include subsidies for green fertiliser grasses and renovation plants. The purpose of these subsidies is to improve the fertility of fields and increase carbon sequestration, but they will also improve the crop yields a little. The area of biogas grass cultivation will increase.

The changes in land use resulting from the additional measures are described in Table 3 and 4.

Table 3. Changes in land use that result from the additional measures in the WAM scenario: land from other land use categories will become agricultural land or agricultural land will be used for other purposes (Maanavilja et al. 2021).

Change in land use	Change in area in 2019 (hectares)	Change in area in 2023 (hectares)	Change in area in 2030 (hectares)	Change in area in 2040 (hectares)	Total 2023–40 (hectares)
Clearing of peat fields	2,112	1,177	294	50	5,639
Clearing of mineral soil fields	1,918	1,188	297	50	5,694
Afforestation of abandoned peat fields	183	650	650	650	11,716
Afforestation of abandoned mineral soil fields	204	2,286	2,285	2,285	41,127
Afforestation of peat fields	0	0	666	666	11,322
Afforestation of mineral soil fields	0	319	1,200	1,200	20,719
Peat fields to climate wetlands (water level at -5–10 cm)	0	556	556	556	10,000
Peat fields to water protection wetlands	23	10	10	10	180
Mineral soil fields to water protection wetlands	207	90	90	90	1620

Table 4. Arable land use created as a result of the additional measures in the WAM scenario, in hectares (Maanavilja et al. 2021)

Target areas, in hectares	2019	2023	2030	2040
Grass cultivation on peatlands with an elevated water level of -30 cm	0	0	17,500	42,500
Paludiculture of peatlands (reed canary grass, common reed)	0	0	5,833	13,333
Catch crops	122,775	300,000	620,000	620,000
Soil improver and renovation plants	3,098	100,000	100,000	100,000
Grass on peat fields (protective zones in peat soils on which an annual crop has been cultivated)	0	20,000	20,000	20,000
Green fertiliser grass on mineral soils	12,294	20,000	24,545	70,000
Biogas grass (mineral soils)	0	4,138	33,103	74,483

Measures in the agriculture sector's WAM scenario

1. Measures associated with land-use changes

- Restricting the clearing of fields.

Finland has tried to mitigate clearing of fields by excluding fields cleared after 2004 from compensatory allowances, and therefore no compensatory allowances have been paid for such fields. The payment of national subsidies is tied to the eligibility for compensatory allowances, which means that new cleared fields will not receive any national surface area subsidies either.

As regards limitations to clearing, the CAP's requirements for good agriculture and environment will reduce clearing by approximately 800 hectares per year on peatlands and the same amount on mineral soils, which is a total of 1,600 hectares per year starting from 2023. In addition to the measures in the CAP, Finland should also consider other means of restricting any clearing of forests for other land use. The WAM scenario assumes that acceptable and cost-efficient measures for this can be found so that from 2040 onwards, only 50 hectares per year would be cleared. Measures for restricting land use change are currently being investigated as part of the creation of the Climate Plan for the Land Use Sector.

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂-eq in 2030 + 0.02 Mt CO₂-eq in 2035. Impact on the emissions from the land use sector: 0.5 Mt CO₂-eq in 2030 + 0.2 Mt CO₂-eq in 2035.

- Restricting the transition of previous peat production areas to agricultural use.

The intention is that starting from 2023, if a farmer wants a full farmers' support package, areas released from peat production may only be used for agriculture if they are used for cultivating grasses. Other measures for restricting land use change are currently being investigated as part of the creation of the Climate Plan for the Land Use Sector.

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂-eq in 2030 + 0.01 Mt CO₂-eq in 2035. Impact on the emissions from the land use sector: 0.1 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.

- Afforestation.

Afforest wastelands, such as fields left outside agricultural use and former peat production areas pursuant to the Afforestation Subsidy Act (1114/2020) that entered into force in 2021. The subsidy system is intended for private landowners and will remain in force until the end of 2023. Work is underway to assess the conditions for continuing the afforestation subsidy post-2023 and potentially expanding the subsidy system to also cover fields in cultivation, such as small fields in agricultural use that produce poor yields and have a thick layer of peat, or other areas with high emissions.

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂-eq in 2030 + 0.02 Mt CO₂-eq in 2035. Impact on the emissions from the land use sector: 0.01 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.

- Agricultural land to climate wetlands.

The current CAP supports the establishment of wetlands as a non-productive investment. The investment has to be capable of promoting the reduction of agriculture's environmental burden on waters and/or increase the diversity of habitats in low-biodiversity agricultural areas. The emissions are reported in the land use sector in categories inland waters (wet wetlands) and other wetlands (climate wetlands)

Impact on the emissions from the effort sharing sector: 0.02 Mt CO₂-eq in 2030 + 0.01 Mt CO₂-eq in 2035. Impact on the emissions from the land use sector: 0.1 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.

2. Measures associated with arable land use and methane emissions from dairy cows

- Cultivation of wet peatlands (paludiculture).

Water level on peatlands will be increased and the cultivated plants are grass, reed canary grass or some other plant suitable for wetland cultivation. CAP contains provisions on investment and management subsidy for the increase and regulation of the water level (environmental compensations – management of runoff waters). The subsidy is also available for a more affordable means of increasing and regulating the water level: check weirs. A separate management agreement is needed for the monitoring of the water level. Farmers should be compensated for managing the regulator devices, regulating the water level and the risks caused by the increase in water level.

One of the challenges in increasing paludiculture in Finland is that there is currently no market for the cultivated products, i.e. no buyers or sales channels for the product/biomass coming from paludiculture. A working value chain must be in place before any larger-scale production can start in Finland.

The Government parties outlined in their September 2021 budget negotiations that they wish to promote paludiculture and wetland cultivation, where an increase on the water level decreases the breakdown of peat and emissions from soil. The target is to have at least 30,000 hectares in paludiculture by 2035. This means an increase of 20,000 hectares to the original 2035 target of the WAM scenario, which was 10,000 hectares.

Impact on the emissions from the effort sharing sector: 0.1 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035. Impact on the emissions from the land use sector: 0.7 Mt CO₂-eq in 2030 + 0.4 Mt CO₂-eq in 2035.

- Grassland instead of annual crops, more carbon into fields.

In the agricultural WAM scenario, the area of uncultivated but managed fields and fallows increases in accordance with the draft CAP plan (protective strips, protective zones, field grasses for nature management, green fertiliser grasses, biodiversity fields). The areas will remain high also after 2029.

The areas of catch crops, soil improver plants and renovation plants in 2023–2029 will mostly conform to the areas stated in the draft CAP plan. In 2030, the area of catch crop cultivation is expected to have doubled from the area in 2023.

The environmental compensations and greening subsidies in the ongoing CAP programme period contain measures associated with carbon-sequestering agriculture. In the environmental compensations, these include planting winter cover crops, recycling nutrients and organic matter, catch crops, green fertiliser grasses, using organic mulch on garden plants and renovation plants. The greening subsidies seek to promote carbon sequestration with permanent grass. The supplementary conditions that the subsidy-seeking farmers must follow in order to be eligible for full subsidy are a ban on burning stubble fields and the requirement that fallow lands be stubble or plant-covered. Developing a carbon sequestration market might promote reductions in emissions.

Impact on the emissions from the effort sharing sector: 0.04 Mt CO₂-eq and 0.4 Mt CO₂-eq in land use sector emissions in 2030.

- Precision farming.

The purpose of precision farming is to improve the utilisation rate of fertiliser nitrogen and thereby the consumption of nitrogen fertilisers.

The efficiency of fertilisation and the use of nutrients can be improved by precision farming and the associated digital systems and services. Global warming lengthens the growing season, and with suitable new plant varieties combined with precise farming and input use, crop yields will be higher and nitrogen utilisation will be better. Precision farming and improved fertility of fields will bring cost savings and a successful adaptation to climate change (taking into account the increased plant disease pressure), which would otherwise lead to a reduction in crop yield and quality.

The WAM scenarios in the HII SI programme assumed that nitrogen fertilisation would reduce by 5% by 2030 and by 10% by 2040. The proportion is calculated from all fertiliser nitrogen and the reduction from nitrogen in artificial fertilisers.

The reformed CAP will promote precision farming with a range of means, such as a farm-specific environmental compensation under the measure 'promoting a circular economy'. The reform also proposes support for investments that promote biodiversity and sustainable production methods; such investments might also include devices and equipment for precision farming.

Impact on the emissions from the effort sharing sector: 0.05 Mt CO₂-eq in 2030 + 0.02 Mt CO₂-eq in 2035.

- Reducing methane emissions from dairy cows through feeding methods. Studies (Maanavilja et al. 2021; Arndt et al. 2021) indicate that using rapeseed cake in the feeding of dairy cows might reduce methane emissions by approximately 10% per litre of milk if the cows are fed predominantly with roughage (grass). However, since more than 40% of the feed of dairy cows is concentrated feed, rapeseed cake would mostly replace the currently widely used rapeseed meal, and the actual reduction of methane emissions is likely to be 3 to 5% per cow. The economic viability of using rapeseed cake depends strongly on its price or the price of some other component of the feed.

A suitable goal is a 10% reduction of methane emissions from dairy cows by means of feeding that are currently being researched and developed, including new additives, which should be economically viable, profitable and suitable for the feeding processes of the farm.

Of the feed additives that reduce methane emissions from digestion, 3-NOP (3-nitroxypropanol) is the most intensively researched and has been applied for a feed additive for dairy cows. The European Food Safety Authority's assessment is scheduled to complete in autumn 2021. If the assessment is positive, the compound will be approved in 2022.

The Government parties outlined in their September 2021 budget negotiations that the proportion of climate-friendly feed will be increased by means of a blending obligation or tax incentives, for example. The parties also decided to allocate EUR 0.7 million in the 2022 budget for the development of feeds and the required studies.

Impact on the emissions from the effort sharing sector: 0.2 Mt CO₂-eq in 2030.

Other factors that affect emissions from agriculture

In addition to the measures of the WAM scenario referred to above, many other factors might contribute to a reduction in the greenhouse gas emissions from agriculture in 2035. The magnitude of these factors is still difficult to estimate, however.

- Real estate composition of fields. As stated in the Government Programme, the Ministry of Agriculture and Forestry will draw up a development programme for the real estate composition of fields, including the preparation and implementation of the associated measures in order to improve the competitiveness of agricultural production while also taking into account the impact on the environment, waters, the climate and biodiversity.

The real estate composition of fields can be markedly improved by parcel or land arrangements. The composition could also be affected by measures in the upcoming Common Agricultural Policy plan and matters associated with the ownership, renting systems and taxation of fields.

- Increasing organic production.

One of the ways mentioned in the Government Programme for reaching a climate and environmentally friendly food system is to increase food production, food processing, domestic consumption and export of domestic organic produce. The new organic farming programme, Luomu 2.0 (Ministry of Agriculture and Forestry 2021a) that was published in spring 2021 contains all these objectives. A more detailed implementation plan and its performance indicators is currently being prepared in cooperation with stakeholders in the organic farming sector.

Organic production is based on good soil management. The cultivation methods used promote the sequestration of organic matter and carbon in soil, which is a precondition for the fertility of fields. At the same time, these methods promote nutrient recycling, reduce dependence on fossil energy and increase the nutrient self-sufficiency of farms.

- Age range of cattle.

As the lifespan of cows is lengthened, replacement heifers will be needed less, which means that a higher proportion of calves will be reared for slaughter. As it takes longer to rear replacement heifers than beef cattle, the methane reductions will fall as the number of replacement heifers falls. The Agricultural Development Fund is funding a related programme on breeding dairy cows to be more resource-efficient and environmentally sustainable. No policy measures exist at present to control the age range of cattle.

- Sexed semen.

Sexed semen can affect the gender of calves. The goal is to reduce the number of male dairy calves and increase the share of faster-growing dairy-beef crossbreed calves among the dairy cattle. Sexed semen is a relatively new technology, so it needs more research on its use and effects. Nevertheless, the method is gaining popularity rapidly.

- Agroforestry.

Agroforestry is an old cultivation method that seeks to improve the conditions for agriculture by introducing trees and bushes into the traditional agricultural production methods. Agroforestry might improve field fertility, reduce erosion and nutrient leaching, increase biodiversity and sequester carbon both in soil and in vegetation.

- Improving carbon sequestration with various soil improvers.
The carbon pool of fields can be increased by a range of soil improvers and other organic additives used in fields. Most of the carbon in soil comes from plant residues, but carbon can also be increased by biological materials, such as manure, fibre and compost products or biocarbon.
- Recycling of nutrients and biogas.
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 in streamlining manure management and nutrient recycling. The purpose is to create the conditions for a well-functioning market of organic fertilisers and thereby ensure efficient recycling and use of nutrients. An experimental nutrient recirculation programme will run over the period 2020–2022 as a continuation of the programme that ran in 2016–2018.

The support scheme for biogas investments and new manure processing techniques set out in the Government Programme was launched in December 2020. Another subsidy scheme for the production of biogas based on nutrient cycles is also being prepared. The Government's coronavirus stimulus package increased the rates of agricultural investment subsidies and rural business financing for biogas investments to 50% for the period 2021–2022.

Finland will strengthen the implementation of the biogas programme and present additional measures that bring the production of biogas up to 4 TWh.

- Promoting carbon sequestration markets.
As decided in the budget session in autumn 2021, Finland will promote carbon sequestration markets and incentives for climate actions in agriculture. To strengthen carbon sequestration, Finland will promote the national and international efforts to create ecologically, economically and socially sustainable rules for carbon sequestration markets.

Finland is currently preparing an information service on carbon markets that will serve the providers of compensation and parties interested in procuring compensation units. The website of the service will contain research-based information on climate measures and their climate impact. The Ministry of Agriculture and Forestry is about to launch a pilot project on carbon markets and an assessment on the impact of carbon compensations on the economy as a whole.

- Nutrition recommendations.
Updated Nordic Nutrition Recommendations will be published in 2022. The new recommendations will clarify the interfaces between nutrition and sustainable development. Since the Finnish nutrition recommendations are based on the Nordic Nutrition Recommendations, the national recommendations will be revised after the Nordic recommendations are approved.

The results obtained in the RuokaMinimi project (Saarinen et al. 2019) that ended in 2019 indicate that the climate impact of a person's diet can be reduced by 30–40% by making changes to the diet and ensuring that fields retain their carbon pools. There are many ways of achieving a diet that produces climate benefits and conforms to nutrition recommendations. In all cases, however, it requires a reduction in the consumption of meat, even though the entire food system is working together to reduce the emissions generated in domestic meat production.

Increasing the share of fish in the diet will bring not only climate benefits, but also nutritional benefits and positive effects on bodies of water. The Government Programme contains a promotion programme for increasing the consumption of domestic fish, which was approved in July 2021. The programme aims towards increasing the fishing and consumption of less used species of fish for human nutrition, such as fish from the carp family.

A cost-benefit analysis indicates that the output and value added in food processing could remain at least at the current level if people's dietary habits shifted towards consuming less meat or none at all. The calculations cannot answer the question of whether Finnish agriculture would be able to produce significantly more protein-rich products to replace the reduction of domestic animal produce in people's diet.

A climate-friendly change in people's dietary habits would revolutionise agriculture and the food industry, but if the change took place in a controlled way, the financial value of food production might be preserved. However, a significant increase in the production of plant-based protein foods is difficult to achieve due to Finland's northern location, and the farmers' possibilities to increase such production foods vary depending on the region. A controlled change requires new value chains and financial investments. Public policy measures can support the change by setting strong strategic goals and effective combinations of financial and knowledge-based incentives.

- Food waste.

Food waste means food that is edible but not used as human nutrition, feed or another value component. When edible food is discarded, all energy and other production and labour inputs are wasted. The problem with discarded food is not so much the resulting biowaste or that discarded food ends up in mixed waste, but rather the unnecessary greenhouse gas emissions generated during food production and the emissions that eutrophise bodies of water. These emissions would reduce if food production and consumption were balanced better. The Government Programme sets a target of halving food loss and food waste by 2030.

While food waste is produced in all phases of the food system, most of it comes from households (33% of the total food waste in the food system). However, the results of the RuokaMinimi project indicate that food waste produced by consumers is only responsible for approximately 4% of the climate impact or eutrophication potential of a diet.

Reducing food waste reduces emissions by the simultaneous reduction of food waste, demand, production and import, which reduces the climate impact of food production both in the agriculture sector and land use sector.

The Natural Resources Institute Finland has coordinated work to develop a national monitoring system for food waste for Finland. The entire food system has drawn up a common roadmap (Natural Resources Institute Finland 2021) bringing together key means to reduce food waste and loss at all stages of the food chain: primary production, industry, shops, food services and households. The roadmap was published in mid-January 2021.

- National Climate Food Programme.

In line with the Government Programme, a national climate food programme (Ministry of Agriculture and Forestry 2021b) is being prepared with the goal of minimising the climate footprint of the food consumed in Finland and improving people's understanding of how food is produced. Another goal of the programme is to support society's transition towards a climate-sustainable food system that takes into account social, economic, cultural and ecological sustainability. Timeout discussions on sustainable food have been arranged as part of the programme. The purpose of the discussions is to increase constructive social debate on food. The climate food programme has also launched a national protein cluster that seeks to strengthen the value chain of plant proteins. To this end, the roadmap to sustainable funding also investigates funding needs and opportunities associated with the strengthening of the value chain of plant proteins. The climate food programme also promotes sustainable public procurement.

- Public procurement.

The Government Programme points out that public procurement and public food and catering services play a key role in improving the sustainability of the food system. The objective set for public procurement and public food and catering services is to increase the share of fish and vegetable-rich food, which is also included in official nutrition and meal recommendations. As for meat, eggs and milk, the municipalities are instructed to favour Finnish local and organic produce, which promotes the consumption of sustainably produced products of animal origin and supports the goal of a sustainable food system.

The recommendations for school meals state that everyone should be offered a vegetarian option every day or that a vegetarian food day should be included in the weekly menu. If implemented, the recommendations would reduce the climate impact of food in food and catering services. Many local authorities already follow these recommendations and are also considering increasing the choices of fish and vegetarian food on the menu in broader terms to achieve their own climate targets. Several years ago, Finland made a decision to increase the national subsidy for organic milk, fruit and vegetables in the EU school distribution system to a higher level than the subsidy for regular products.

The National Public Procurement Strategy includes an objective for food and catering services to promote an ecologically sustainable food system. The Ministry of Agriculture and Forestry has been implementing the objective by means such as updating a guide to responsible food procurement and organising events to support responsible food procurement in food and catering services. In December 2021, the Government published a procurement guide for sustainable food and catering services that discusses how food and catering services can be arranged sustainably.

- Cooperation between stakeholders in the food system.

Reducing greenhouse gas emissions is a task for the whole of society. Some emissions reductions in agriculture will happen on market terms by actions taken by the operators in the food system. In keeping with the Government Programme, many operators in the food system have created a sector-specific low-carbon roadmap and set targets for reaching carbon-neutrality. Often, the entire production chain cooperates to reach these goals on a scientific basis.

Finnish food companies have actively reduced their carbon footprint for a long time already, with special emphasis on reducing the climate impact the raw materials used. The Development Fund for Agriculture and Forestry (Makera) is currently developing a uniform, science-based and practical model for calculating the carbon

footprint and environmental footprint of foodstuffs. Uniform calculations enable more reliable comparisons between products and product families. The project is run by the Natural Resources Institute Finland and it brings together a large number of food industry operators throughout the food chain. The purpose of the project is not only to harmonise the calculation of the carbon footprint, but also include the eutrophic effects and water footprint of food production in the assessment of the environmental impact of foodstuffs. This would also carry over to communications and societal decision-making on foodstuffs.

The target is to reduce emissions from agriculture

During the latter half of 2021, the Government set a target for reducing greenhouse gas emissions from agriculture. The intention is to reduce the combined emissions from the effort sharing and land use sector and by 29% from the 2019 level by 2035. The Natural Resources Institute Finland is currently working on a programme for climate action and farm economy (HERO). When complete, HERO will outline how the 29% reduction in emissions can be achieved while strengthening the economy of farms. The agricultural climate and environmental measures are collected into a single measures package that specifies the emissions reduction trajectory in detail up to 2035. The measures in the agricultural WAM scenario are in line with the Climate Change Policy Plan and will promote the achievement of the target of a 29% reduction in emissions. Other emissions reduction measures are needed as well. The programme is scheduled to be completed by the end of March 2022.

The impact of the agricultural policy measures on the emissions of the effort sharing sector is a total of 0.6 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035. The impact on the emissions from the land use sector is at least 1.8 Mt CO₂-eq in 2030 + 0.9 Mt CO₂-eq in 2035.

6.2.3 Building-specific heating

One of the primary targets of the effort sharing sector is to replace oil heating with low-emissions forms of heating by 2030. This target applies to residential buildings and real estate in the service and public sector, and to attain it, the Ministry of the Environment has prepared an action plan for phasing out oil heating (Ministry of the Environment 2021a). The action plan in the Medium-term Climate Change Policy Plan assumes that 95% of the target is met.

The process of drafting the action plan was launched under the coordination of the Ministry of the Environment in early 2020 and the plan was sent out for consultation

in the spring of 2021. The drafting process involves the relevant ministries and experts from Statistics Finland and Motiva. The draft action plan puts forward 26 measures for encouraging private and public users of oil heating to switch to other forms of heating. The measures would extend and expand the grants and subsidies currently in place, specify future energy efficiency agreements, guide the criteria for public procurement, develop energy efficiency legislation applicable to new buildings and large-scale renovation projects, and enhance communications and advisory services.

Newly introduced grants will be used to promote phasing out oil use in residential properties. A grant is available for detached and semi-detached houses in full-time residential use to cover costs arising from removing an oil heating system from such a house and converting it into other heating systems. The amount of subsidy is EUR 4,000 per oil heating system in a detached or semi-detached house when the system is removed and replaced with district heating or a geothermal or air-to-water heat pump system, or EUR 2,500 per oil heating system in a detached or semi-detached house when the system is removed and replaced with a non-fossil-based heating system.

The total amount of appropriations granted by now for the subsidy system is approximately EUR 63.1 million. The 2022 Budget contains a subsidy appropriation of EUR 28.9 million for households. The grants for the phasing out of oil heating have stepped up heating system replacement rates to a considerable extent. A total of 17,200 applications were received by November 2021, whereas the number of replaced oil heating systems has usually stood at approximately 3,900 units per year. The estimated impact of the appropriations available on annual emissions of the effort sharing sector stands at about 0.08 Mt CO₂-eq.

Finland's Recovery and Resilience Plan that was submitted for confirmation to the Commission in May 2021 (Prime Minister's Office 2021a) contains a provision for additional funding of EUR 70 million for phasing out oil heating. The Commission published a favourable opinion on Finland's proposal in October, and at the end of October, the Council of the European Union approved the plan by a formal written procedure. In addition, the Government decided in its budget session that in order to help low-income households change their heating method, the Government will investigate the feasibility of establishing a programme that would be funded by the Housing Finance and Development Centre of Finland ARA, and extend up to 2030 and support the phasing out of fossil oil heating by means of loans or leasing.

The amended Land Use and Building Act that entered force in December 2021 now requires that a minimum of 38% of the heat and electricity purchased for a building must be renewable energy. What this means in practice is that municipal building supervision authorities will no longer grant permits for buildings whose primary energy source is fossil

energy, such as oil. The minimum requirement for renewable energy applies to all new buildings and buildings undergoing large-scale repairs (more than 25%). The amendment is associated with the national implementation of the EU Renewable Energy Directive.

The domestic help credit available in taxation is an alternative for owners of detached and semi-detached houses planning to renew their heating systems. In 2021, the maximum credit was EUR 2,250 per person, which means that the total amount available for couples is EUR 4,500. The domestic help credit can only be used to cover the share of work performance. At its budget session in September 2021, the Government outlined that heating method changes involving discontinuation of oil heating would be supported by raising the maximum domestic help credit from EUR 2,250 to EUR 3,500 and the compensation rate from 40% to 60%. The change is temporary and will be in force from 2022 to 2027.

Reductions in emissions from residential buildings are also sought by means of energy grants for projects aiming to improve energy efficiency. A total of EUR 100 million in funding has initially been earmarked for the period from 2020 to 2022. The estimated impact on annual emissions stands at about 0.14 Mt CO₂-eq. The impact will cover emissions from all residential buildings rather than just oil-heated properties. Some of the emissions reductions will take place in the emissions trading sector, but it is likely that support measures will also be needed the future for meeting the targets of building-specific heating.

Phasing out oil heating and switching to other forms of heating in municipally owned buildings has been expedited by grants since October 2020. Finland has about 9,300 buildings owned by municipalities and unincorporated municipal enterprises, including about 4,300 buildings in use and 5,000 vacated buildings. In many cases, even empty buildings have to be heated. The grant accounts for 20% of the eligible and actual investment costs approved in the grant decision. The grant will be increased by five percentage points for municipalities that have joined a voluntary energy efficiency agreement. An appropriation of about EUR 15 million has been reserved for the grants, aiming to achieve an annual emissions reduction of approximately 15 kt CO₂-eq in the effort sharing sector. In addition, the 2022 Budget allocates a total of EUR 4.9 million for municipalities, parishes and associations. The Government outlined in its budget session in September 2021 that the aid intensity of the support for phasing out oil heating will be increased to 30% for approved and actual costs for a fixed period of 2022–2024.

Communication and advisory services ensure that information about new subsidies for phasing out oil heating in residential and municipal buildings reaches the target groups effectively. In 2020–2021, nationwide communications concerning the support for residential buildings were handled by Motiva Oy as an assistant to the State aid

authorities. Motiva is also running the Energy-efficient Home programme that provides objective information for people building a detached or semi-detached house on choices that help construct a nearly zero-energy building. The programme has also produced information on HVAC engineering solutions that improve the energy efficiency of existing detached or semi-detached houses, such as changing the main form of heating. The key information distribution channel is the www.energiatehokaskoti.fi website.

Motiva coordinates a national energy advisory service for consumers that is funded by the Energy Authority and available in all regions in Finland. The current funding package of EUR 2.8 million for the regional energy advisory service will continue until spring 2023. The advisory service is provided free of charge and provides information on how to select or change a heating system, how to heat a building energy-efficiently and how to start using renewable energy. Furthermore, some of the projects funded by the Ministry of the Environment under the Municipal Climate Change Solutions Programme (2018–2023) are associated with the promotion of phasing out oil heating, for example by means of information operations.

In addition to subsidies, financial support and provision of information, other significant measures for reducing emissions from building-specific heating are a distribution obligation of biofuel oil and emissions trading for road transport and building proposed by the Commission. Under the Act 418/2019 that entered into force in 2019, the biofuel distribution obligation for light fuel oil stands at 3% in 2021 and will rise to 10% by 2028. A new policy will increase the proportion to 30% by 2030. This will help in keeping the emission reduction trajectory in line with the annual emission allocations granted to the Finnish effort sharing sector by the EU, but in the target year 2030, biofuel oil will only have a minor impact on emissions from building-specific heating, since oil heating has been phased out for the most part. The calculations assume that the increases in the proportion of biofuel oil in light fuel oil will be implemented linearly from 2026 onwards. The economic impact of the increase in the distribution obligation will be investigated in more detail during the preparation of the respective decision.

Finland's long-term renovation construction strategy (Ministry of the Environment 2020) contains an important package of measures on the digitalisation of properties and renovation. A combination of IT, telecommunications technology and traditional building technologies, especially building automation, could significantly improve the energy efficiency of buildings and reduce the greenhouse gas emissions from heating of buildings.

The Commission's climate package unveiled in July 2021 contains a proposal for amending the Emissions Trading Directive. The Commission proposes a separate emissions trading system for emissions from road transport and for those emissions from building-specific

heating that were previously outside the emissions trading system. The new emissions trading system would enter force in 2025 and would target fuel distributors. The system and other proposals in the climate package seek to achieve a 43% reduction in emissions by 2030 compared to the 2005 level. Emissions from road transport and heating of buildings would still remain as part of the effort sharing sector at least until 2030. Like with the distribution obligation, the impact of the new emissions trading on annual emissions falls as fossil fuels are phased out.

Incentives or sanctions?

During the early stages of the drafting of the Climate Change Policy Plan, the authors requested opinions on the impact and fairness of typical climate actions from a wide range of citizens and other stakeholders. These hearings also identified measures which involve special challenges in terms of fairness. For example, the price of electricity and heating were topics that were frequently brought up. Eighty-eight per cent of the respondents to the public citizen survey considered a significant increase in the price of electricity, heat and heating oil very unfair. The Citizens' Panel on climate actions concluded that although people want actions against the climate change, any price increases should consider fairness especially from the perspective of low-income citizens. The Panel is of the opinion that the primary ways of encouraging consumers to phase out oil heating should not be price increases, but other means, such as investment subsidies.

Policy measures.

- A subsidy will be provided for phasing out fossil oil heating in detached and semi-detached houses. The amount of the subsidy will be EUR 4,000 for switching to district heating, geothermal heating or air-to-water heat pump system. When switching to some other form of heating, the subsidy will be EUR 2,500.
- Support will be provided for phasing out fossil oil heating in buildings owned by municipalities, parishes and associations, and there will be an increase in aid intensity.
- The energy grants for residential buildings will be continued in the 2020s.
- Energy aid for heating solutions based on renewable sources of energy will remain a part of the palette of measures.

- Efforts will be made to ensure that the new agricultural programme period from 2023 onwards will contain appropriate funding for investments for phasing out oil heating.
- An increase in the maximum amount of domestic help credit and credited percentage will be provided when phasing out oil heating.
- A model will be prepared for state loan guarantees for private households and a model for supplementary State guarantee for supporting climate-friendly investments in limited liability housing companies. The model could focus on investments that significantly improve the energy efficiency of buildings or renovate heating systems to use renewable energy, such as geothermal energy, wind or solar power.
- The energy content tax of heating fuels will be increased to EUR 2.7 per MWh from the beginning of 2021.
- Upcoming amendments to regulations will tighten the energy efficiency requirements of new buildings by 10%.
- The upcoming amendments to regulations will tighten the energy efficiency requirements of renovations and specific systems by 10%.
- The distribution obligation of biofuel oil in light fuel oil will be increased to 30% by 2030.
- New construction and large-scale renovations will be subject to a minimum requirement of renewable energy.
- An EU-wide emissions trading system for road transport and heating of buildings will be deployed. The Commission's proposal divides emissions reductions between road transport, building-specific heating, district heating covered by the effort sharing sector and non-road mobile machinery used in households and the service sector.
- The Government has proposed that the Ministry of Agriculture and Forestry must continue its subsidies for renewable energy investments in production buildings and dryers in the EU's CAP period that starts in 2023.
- At the beginning of 2021, electricity tax category II was reduced to the minimum EU level, which lowered the electricity taxation in agriculture and served as an incentive for further electrification in agriculture. In addition, the political control of emissions from professional greenhouses entitled for a tax refund and operated by energy-intensive companies will increase, when the tax refunds for heating fuels used by energy-intensive companies are gradually discontinued by 2025. However, professional greenhouses will continue to be entitled for a refund on the energy tax on oil products like the rest of the agriculture sector.

Impact of policy measures concerning building-specific heating on the emissions from the effort sharing sector: 0.7 Mt CO₂-eq in 2030.

6.2.4 Non-road mobile machinery

It is possible to reduce the greenhouse gas emissions from non-road mobile machinery by increasing the distribution obligation of biofuels and promoting the electrification of the machinery fleet, for example. The provision of information might also have a significant impact on the emissions from non-road mobile machinery. Attention must also be paid to the knowledge base on how to reduce emissions from non-road mobile machinery.

The situation with mobile machinery is very different from the heating of buildings, where several options exist for replacing oil boilers with low-emissions or cost-effective solutions, such as systems based on heat pumps or biomass fuels. Replacing oil in non-road mobile machinery with other sources of energy is considerably more difficult and the availability of electric machinery, for example, is still very limited. Using biofuel oil in non-road mobile machinery seems more beneficial than using it for heating, since several other options exist for heating than oil.

The possibility of using biogas in non-road mobile machinery is also being investigated. The Government outlined in its budget sessions in September 2021 that the promotion of biogas in the effort sharing sector seeks to reduce emissions by 0.1 Mt by 2030. A part of this also applies to non-road mobile machinery.

The modelling of scenarios for the non-road mobile machinery sector identified fairly large uncertainties especially in the development of technology in non-road mobile machinery and its impact on the realisation of the electrification potential by the target years 2030 and 2035. If the uncertainties are taken into account, a successful combination of measures is found and the energy efficiency, operating methods and automation are developed further, it will be possible, however, to significantly reduce the emissions from the non-road mobile machinery sector.

Some of the measures to reduce emissions from non-road mobile machinery are extensions to the current policy actions and some are entirely new. The Government launched an analysis, assessment and research activity project in September 2021 to investigate political steering mechanisms for reducing emissions from non-road mobile machinery. The results of the investigation will be published in 2022, followed by an assessment of the necessary further measures. The actions being investigated in the project are: progressive increases in energy taxes of fuels for non-road mobile machinery and heating, the options available for increasing the distribution obligation of light biofuel oil, political measures for promoting electrification and biogas and expanding the registration obligation of non-road mobile machinery.

The data that forms the basis for estimating emissions from non-road mobile machinery is incomplete, since Finland does not have a comprehensive registration and investigation

scheme for non-road mobile machinery. The gaps in the data cause uncertainties in the calculation of emissions, scenarios and targeting of emissions reduction measures. It might be sensible to expand the registration obligation of non-road mobile machinery and possibly subject the machines to regular inspections in order to improve the accuracy of the data. This would create better opportunities for political control, monitoring and emissions calculations. Due to these needs, the project will investigate how the registration and inspection obligation of non-road mobile machinery should be expanded in order to improve the quality of data in the registers to serve the quality and accuracy of emissions inventory efforts and emissions projections.

Policy measures.

- The energy content tax of heating fuels will be increased to EUR 2.7 per MWh from the beginning of 2021.
- The distribution obligation of biofuel oil in light fuel oil will be increased to 30% by 2030.
- Maintaining an expanding zero-emission worksites and the non-road mobile machinery green deal.
- Actions that would promote the attainment of the emissions reduction targets of the sector are the inclusion of new machinery classes into the non-road mobile machinery green deal and introducing new operators into the zero-emissions worksite green deal.
- Overhaul of the TYKO emissions model.
- The TYKO model will be revised as part of the revision of the LIPASTO calculation system, but the model must be revised in a way that enables the investigation of the impact of new financial control mechanisms and new sources of power.
- Expanding the non-road mobile machinery training project and mobile machine expertise in Finland.
- Economic driving methods are known to have a large impact on the emissions and drivers differ by orders of magnitude in this. The tendering processes in public procurement can already favour low-emissions non-road mobile machinery when selecting the winning bid, and the training seeks to increase the procuring parties' awareness of this fact. Motiva has created a training package for non-road mobile machinery with funding and coordination from the Ministry of the Environment. The training package is complete and freely available for operators in the non-road mobile machinery sector. The parties who prepared the training package acknowledge that the training is a process whose content needs to be updated and expanded in line of the trends in the sector.

- The Government is looking into the possibility of introducing procurement support for electric and biogas-powered tractors and other non-road mobile machinery.
- Finland seeks to have an impact on the development of the Stage Regulation (2016/1628) so that it would also cover CO₂ emissions.
- An EU-wide emissions trading system for road transport and heating of buildings will be deployed. According to the Commission's proposal, the new emissions trading system would also impact the emissions from households and non-road mobile machinery in the service sector.

Impact of non-road mobile machinery policy actions on the emissions from the effort sharing sector: 0.5 Mt CO₂-eq in 2030.

6.2.5 Waste management

The significance of landfills as sources of greenhouse gas emissions from waste management continues to fall. One of the most important reasons behind this is the regulation banning the deposition of organic waste in landfills that entered into force in 2016. The regulation has achieved a significant drop in the quantity of organic waste deposited on landfills. The recovery rate of landfill gas will increase a little, since in the future, a slightly larger share of landfill gas will come from landfills equipped with gas recovery system. However, the recovered quantities of landfill gas will reduce, since the quantity of biodegradable waste deposited in landfills is significantly less than in the previous decades and will continue to drop in the future. No new gas recovery facilities are expected to be built, since landfill gas is released from several small landfills, which makes building a recovery facility financially unviable.

Due to the decrease in landfill disposal of waste, using waste as an energy source has increased significantly in the last decade. If waste incineration keeps increasing, the resulting greenhouse gas emissions are likely to increase as well. Measures for reducing emissions from waste incineration have been investigated, such as a waste incineration tax or a voluntary agreement on waste incineration. As of yet, the EU Commission has not proposed that waste incineration be included in the emissions trading system.

The Government budget session in autumn 2021 set the target for emissions reduction from waste incineration by 0.1 Mt CO₂-eq by 2030. To achieve this target, the government will also prepare a voluntary agreement, a 'green deal' that takes into account the entire value chain of waste, not just incineration plants. The intent is also to carry out pilot projects on carbon capture and utilisation or storage (CCU/CCSU) technologies.

Preliminary negotiations on waste incineration and the green deal for the entire waste value chain were started in autumn 2021. If the green deal is concluded, it will reduce emissions from the waste sector and waste incineration, but its concrete impact is still difficult to assess. Closely associated with the green deal is the implementation of separate collection for plastics. The need for a waste incineration tax will be assessed based on the experience gained from voluntary agreements. The target in the long term is to reduce emissions from waste incineration by a third, but to reach such a high reduction, Finland needs to adopt CCS technology on a large scale, among other measures.

Finnish waste laws were reformed in 2021 with the purpose of reducing the amount of waste and increasing reuse and recycling. Obligations on separate collection of waste will become stricter in the future, which will result in an increasing amount of municipal waste being recycled instead of incinerated. Updates to the national waste plan seek first and foremost to prevent the generation of waste and, supported by legislation, to increase the recycling rate. These policy measures will reduce greenhouse gas emissions from the waste sector in the long term.

The revision process of the Urban Waste Water Directive (1991/271) has identified new challenges, such as issues related to energy consumption and circular economy, nutrient circulation and production of renewable energy. Utilisation of renewable energy produced from sludge (biogas) and the thermal energy in waste water should be increased in order to improve the energy self-sufficiency of waste treatment plants and replace fossil fuels with renewables sources of energy. Recovering nutrients from waste water can affect greenhouse gas emissions in many ways. For example, recovering nitrogen from concentrated waste water fractions reduces the amount of nitrogen to be removed elsewhere in the treatment process, which in turn reduces nitrous oxide emissions from the process. On the other hand, the nitrogen removal process itself should be optimised to minimise the generation of nitrogen oxide as an intermediate product. The recovered nutrients can replace fertilisers manufactured from virgin raw materials, which reduces the emissions from fertiliser manufacture.

Policy measures.

- Prepare a voluntary green deal for the incineration of municipal waste that covers the entire waste value chain in order to reduce greenhouse gas emissions.
- Carry out pilot projects on carbon capture and utilisation or storage (CCU/CCSU) technologies in waste incineration plants.

Impact of policy actions on waste processing on the emissions from the effort sharing sector: 0.1 Mt CO₂-eq in 2030.

6.2.6 F-gases

Regulations on fluorinated greenhouse gases cause a steep downward trend in emissions already in the baseline scenario. Additional measures on the development of expertise, technology and public procurement and the reform of the EU F-gas Regulation (517/2014) can reduce emissions further so that they are almost zero in the target year of carbon neutrality, 2035.

Policy measures.

- Reform of the EU F-gas Regulation: The proposal will implement the commitments in the Montreal Protocol on the reduction of the production and consumption of HFC compounds after 2030 and will harmonise the F-gas regulations on the EU's increasingly strict climate targets. The reform of the F-gas Regulation started in autumn 2021.
- Update the estimates on the quantities of F-gases and ozone-depleting substances in existing devices and products and publish guidance on how to reduce emissions from them.
- Implement a demonstration project on how to improve the energy efficiency of professional kitchens that use natural refrigerants. The implementation depends on whether funding is received.
- Avoid equipment containing F-gases in public procurements. To this end, a political control measure is a set of public procurement criteria for alternatives to HFC compounds.
- Promote the adoption of alternative technologies and refrigerants and enhance the recovery of F-gases by means of education and communication.
- Training is reformed to include competence on alternative refrigerant technologies as part of the existing qualifications in the refrigeration sector. Educational institutions in the field are provided support for the procurement of the equipment needed for training.
- Education and training for new entrants in the field and further education and training for qualified professionals will accelerate the transition towards alternative technologies by providing more information on new technologies and teaching professionals to use them safely. The need for a trained workforce will increase significantly as alternative technologies gain ground. The Finnish National Agency for Education will be responsible for defining qualification requirements.
- Consumer awareness of the importance of capturing F-gases and the appropriate ways to do this will be raised through information activities by public authorities and the sector. The sector will be encouraged to implement voluntary measures, such as attaching labels to equipment and devices in

connection with sales and/or installation to remind users that the capture of F-gases must be undertaken by a qualified professional.

Impact of F-gas policy actions on the emissions from the effort sharing sector: 0.3 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.

6.2.7 Industry and other emissions

Several decisions to change energy taxation were made in 2020 and 2021. The changes will increase emissions control of plants in the emissions trading sector as well as industrial plants and small district heating plants that belong to the effort sharing sector. The changes consist of an increase in the energy content tax of heating fuels by EUR 2.7 per megawatt-hour starting from the beginning of 2021, progressive elimination of the tax refund for energy-intensive companies by 2025, lowering electricity tax category II to the EU minimum tax level from the beginning of 2021 and changes to electricity taxation of heat pumps, electric boilers and data centres starting from the beginning of 2022. The impact of these changes to the emission trends of the entire effort sharing sector is relatively small, 0.1–0.2 Mt CO₂-eq, depending on the assumptions used in the calculations. While these changes increase emissions control, a change that decreases emissions control is the temporary increase of the upper limit for tax-free use of peat until 2030, which will affect industrial plants and small district heating plants in the effort sharing sector.

Policy measures that concern the industry in the effort sharing sector are mostly the same as in the emissions trading sector. Energy aid will continue to be an important tool for supporting the introduction of new energy technology and increasing the use of renewable energy and energy efficiency. Energy aid is an inseparable part of the package that consists of energy efficiency agreements and energy audits. In 2020, more than 700 decisions were made to issue energy aid amounting to a total of about EUR 95 million. The majority of the total amount of grants, almost EUR 60 million, was allocated to large demonstration projects. The total amounts awarded to renewable energy projects and energy efficiency projects stood at about EUR 67 million and EUR 28 million, respectively.

The climate and energy strategy outlines new measures and measures decided previously. Of these, measures that reduce emissions also in the effort sharing sector are included in the action plan of the Climate Change Policy Plan. Several measures can be funded via the Finnish recovery and resilience plan approved by the Council of the European Union in October 2021. The plan contains several significant investments in energy infrastructure (EUR 155 million), new energy technology (EUR 161 million), low-carbon hydrogen and

capture and utilisation of carbon dioxide (EUR 156 million) and the direct electrification and low-carbonisation of industrial processes (EUR 60 million).

The defence sector seeks to reduce greenhouse gas emissions by at least 0.04 Mt CO₂-eq by 2030 from the 2020 level. In the first phase, the reduction efforts focus on emissions from energy use from real estate used by the Finnish Defence Forces and Defence Properties Finland. Additionally, the administrative branch of the Ministry of Defence will reduce emissions in other areas without sacrificing its performance.

Policy measures.

- An increase in the energy content tax of heating fuels to EUR 2.7 per MWh from the beginning of 2021. Progressive elimination of the tax refund for energy-intensive companies by 2025. Lowering the electricity tax category II to the EU minimum level. Changes to the electricity tax on heat pumps, electric boilers and data centres starting from 2022.
- The distribution obligation of biofuel oil in light fuel oil will be increased to 30% by 2030.
- The reduction of industrial emissions will take place primarily via sector-specific low-carbon roadmaps. The implementation of the roadmaps requires a predictable operating environment that supports low-carbon investments.
- Electrification subsidy supports the implementation of low-carbon roadmaps.
- Continue the energy aid for projects demonstrating new technology. Ensure that sufficient authority exists to grant energy aid for smaller-scale renewable energy projects and energy efficiency projects.
- Expedite the utilisation and adoption of non-combustion forms of heating, such as waste heat, environmental heat and geothermal heat and promote the development of bidirectional district heating networks.
- Support emission reduction and electrification of small-scale industry and energy production by means of EU funding instruments, including Regional Development Funds.
- Ensure that energy efficiency agreements will be continued after the current agreement period of 2017–2025. Sufficient incentives will be created for businesses and municipalities that have entered into an energy efficiency agreement.
- Energy audits are promoted and developed to ensure their viability as a powerful tool for improving energy efficiency.
- An EU-wide emissions trading system for road transport and heating of buildings will be deployed. According to the Commission's proposal, the new emissions trading system would also impact the emissions from district heating production under the effort sharing sector.

- Actions in the defence forces' energy and climate programme.

Impact of policy actions on industry and other emissions on the emissions from the effort sharing sector: 0.7 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.

6.3 Cross-sectoral measures

6.3.1 Climate work in municipalities and regions

Speeding up the climate work of municipalities and regions

Local authorities play a key role as Finland aims to achieve carbon neutrality by 2035, since active climate work in municipalities contributes directly to emissions reductions in several sectors. They can make active efforts to contribute to the amount of their greenhouse gas emissions (municipal carbon footprint). They also have many ways to promote and accelerate emissions reductions among municipal residents, companies, communities and other stakeholders (municipal carbon handprint).

Within their own municipality, local governments are responsible for zoning, land use, transport planning, ownership steering of energy companies, choices between alternative heating systems for buildings and public procurement within their own territories. As a rough rule of thumb, a municipal organisation produces approximately 10% of the greenhouse gas emissions generated in the municipality. The remaining 90% is emitted by other parties, such as residents, the industry, services and farmers. However, the actual proportions vary considerably from municipality to municipality. In major cities, where district heating and public transport are major factors both in absolute and relative terms, the municipal organisation has much greater leverage on reducing emissions than municipalities on average. Municipalities have several means of expediting and promoting the climate work of their stakeholders, such as norms, obligations, financial means or communications, service design, co-operation and partnerships. Municipalities can act as platforms, expeditors, enablers and catalysts of regional and local climate work.

An assessment of the impact of the Towards a Carbon-neutral Municipality (HINKU) network indicates that municipalities that had joined the network were able to reduce their greenhouse gas emissions by 3.1% more on average than other Finnish municipalities (Riekkinen et al. 2020). Expediting climate work in municipalities can therefore significantly also expedite emissions reductions in different sectors and organisations, especially if municipalities are provided an increasing amount of expert support and funding.

Regional differences ought to be taken into account

During the early stages of the drafting of the Climate Change Policy Plan, the authors requested opinions on the impact and fairness of typical climate actions from a wide range of citizens and other stakeholders. In many of the hearings, the participants highlighted the differences between cities and rural areas and hoped that policymakers would take them into account when preparing policy measures. The Citizens' Panel on climate actions emphasised that individual and regional differences would have to be considered and options must be available whenever possible. Also the Sámi Parliament wanted regional differences and needs to be considered in greater detail.

Many stakeholders and the Citizens' Panel highlighted the importance of regional climate work. For example, the parties heard hoped that regional energy advisory and low-threshold activities would be continued so that information about subsidies could reach everyone equally.

Actions in the Medium-term Climate Change Policy Plan will include funding for municipal climate and circular economy solutions. The Climate Change Act will be amended to obligate municipalities, counties or regions to create a climate plan. This is the best way to ensure that climate solutions best suited for local conditions are promoted and scaled up.

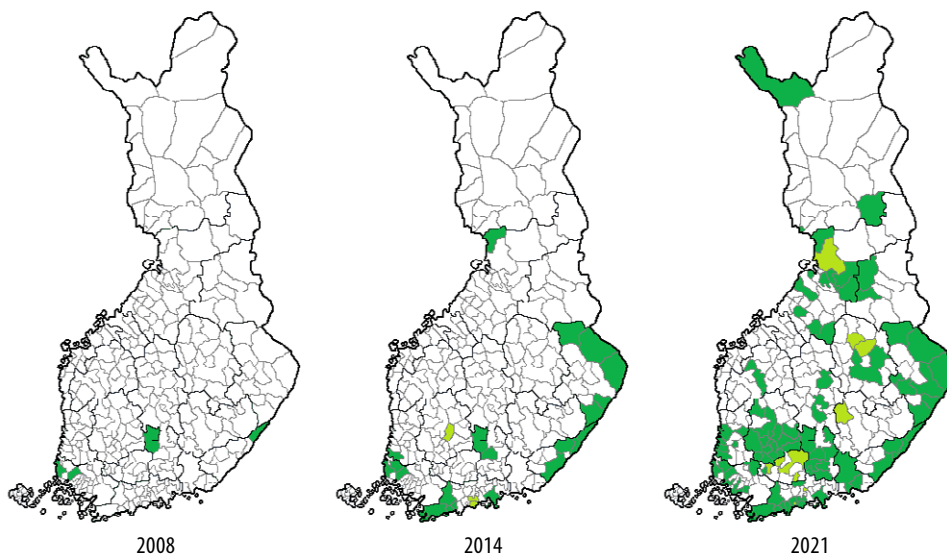
Most Finns live in a municipality that engages in active climate work

Of the 309 municipalities in Finland, 138 have set themselves a municipal, county or regional climate target. These municipalities are home to approximately 80% of Finland's residents. More than 60% of Finns live in municipalities aiming to achieve carbon neutrality or an 80% emissions reduction by 2030. Many municipalities have clearly adopted the role of a pioneer in the mitigation of climate change and have earned international recognition for their efforts (Figure 22).

Municipalities' commitment to climate work can be seen in the increasing popularity of voluntary climate networks, especially the HINKU network. HINKU was established in 2007 by five pioneer municipalities. By the end of February 2022, 82 municipalities had joined the network. In total, they have almost 2.2 million residents. The network grows steadily as interested municipalities join it. The HINKU municipalities are committed to achieving

an 80% reduction in emissions by 2030 from the 2007 level, which is five years before the Carbon-neutral Finland 2035 target stated in the Programme of Prime Minister Sanna Marin's Government

Figure 22. The number of municipalities committed to voluntary but ambitious climate targets has increased significantly in recent years. Municipalities in dark green have set for themselves a target of carbon neutrality or at least an 80% reduction in emissions by 2030 (HINKU municipalities + Helsinki, Espoo, Jyväskylä and Kuopio). Municipalities marked in light green have set for themselves a post-2030 carbon neutrality target.



The pioneer municipalities have started developing their climate change management practices, first by creating climate strategies and climate roadmaps and by establishing a regular monitoring scheme for their emissions. The municipalities have developed tools and operating models for climate change management, such as the Ilmastovahti service that tracks climate actions in Helsinki and the climate budget in Tampere. The municipalities are also increasingly active in developing co-operation with the businesses in the region. The businesses are provided information on climate actions, peer support and help in communications. The municipalities also find it important to speed up the residents' climate efforts as part of the municipal-level climate work. Many different operating models and campaigns have been developed around this theme, for example in food services, traffic solutions and energy advisory.

Regional-level solutions are particularly helpful in supporting the climate work of small municipalities

Regions implement regional climate policy by means of provincial land use planning, traffic planning, provincial development programmes, marine area planning, ERDF funding and regional cooperation. On the regional level, the most important organisations that promote climate work are regional councils and Centres for Economic Development, Transport and the Environment. They are already cooperating well and the cooperation will become even closer in the future. In five regions, the local climate work of HINKU municipalities has expanded to a regional level, giving rise to HINKU regions. Regional-level organisations play an important role in the regional execution of national climate policy, development of regional solutions and supporting the climate work of all municipalities in the region, regardless of their size. At the beginning of 2023, the responsibility for organising healthcare, social welfare and rescue services will be transferred from municipalities and joint municipal authorities to wellbeing services counties. The change will affect the nature and composition of regional climate work, for example by means of energy use of buildings, logistics and procurements.

Challenges and opportunities in municipal climate work

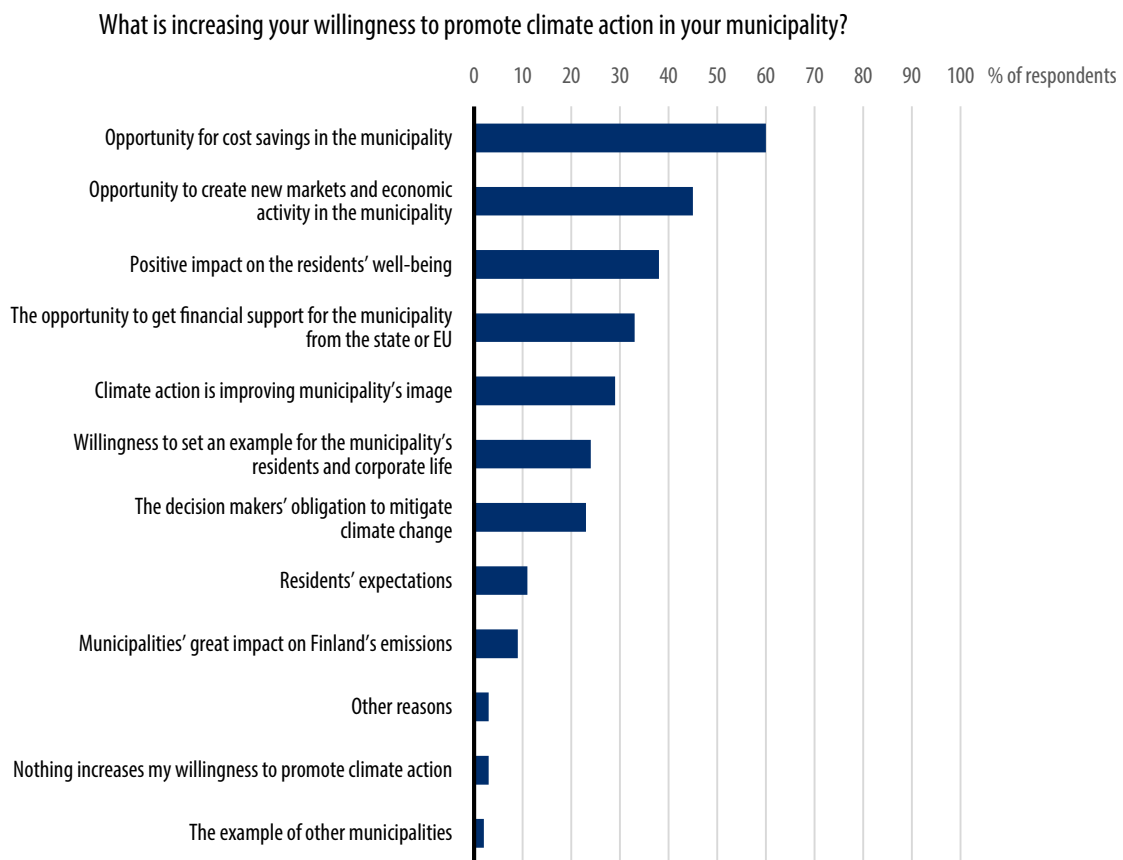
Although Finland is home to several pioneer municipalities in climate matters, many other municipalities have not yet started their climate work. The circumstances faced by municipalities differ greatly, as local authority corporations start to reduce their emissions and expedite emissions reductions of other parties and organisations within the municipality. Many municipalities have a significant amount of agriculture, pass-through traffic or major industrial plants whose emissions cannot be controlled by the municipality very well. Another challenge faced by municipalities is the promotion of low-carbon energy solutions and energy efficiency of privately-owned buildings.

It is often easier for larger cities to find resources for implementing the most cost-effective and high-impact climate actions than it is for small municipalities. However, the small size of a municipality is not necessarily a hindrance to active climate work if there is enough will. The municipality of Ii is a good example of how cost calculations and an approach where residents are genuinely listened to can achieve solutions that are widely accepted and in line with the local characteristics. Since climate work in municipalities is voluntary, political will in a municipality can be the greatest obstacle or asset in climate work.

The results of the 'Ilmassa ristivetoa' survey (Lehtonen et al. 2020b) reveal that municipal decision-makers are motivated to engage in climate actions by cost savings and the vitality of the municipality (Figure 23). According to the survey, decision-makers also need more information on the costs of climate actions and their social and climate impact in order to have them approved in the decision-making process. The survey also

indicates that the primary hindrance for promoting climate actions in municipalities is the fact that their costs are distributed unevenly between demographic groups. The municipal decision-makers were also concerned about the costs of climate actions and their low impact.

Figure 23. Factors that incentivise climate work in municipalities (Lehtonen et al. 2020b)



Municipal climate work is supported in many ways and from several sources

Municipalities and regions can apply for aid from several sources for their climate actions. Support is available for sector-specific actions, such as phasing out of oil heating, a range of energy solutions and the promotion of walking and cycling. Aid is also available for various municipal development programmes and small-scale experiments on climate work, for example from the Municipal Climate Solutions programme or the Sustainable City programme run by the Ministry of the Environment. Support for major climate projects is available through the EU's financial instruments. For example, the EU LIFE programme funds the Towards Carbon Neutral Municipalities and Regions (CANEMURE)

project which is run by the Finnish Environment Institute and promotes climate work in a large number of municipalities and in seven regions and also promotes the dissemination of good practices in Finland.

The Municipal Climate Solutions programme of the Ministry of the Environment expedites climate works in municipalities and regions. The programme funds municipal and regional climate projects and national-level solutions that support them. Key themes in the funded projects, tools, operating models and training sessions are climate management in a municipality, co-operation with companies and expediting the residents' own climate work. The core of the programme consists of interaction and cooperation with stakeholders on the national, regional and local level. The aim is to lower the threshold of participation so that more and more municipalities engage in goal-oriented climate work and can find national and international sources of funding. The programme also funds regional projects that help every municipality in a region to start their climate work. The programme has funded the national climate project of the ELY Centres (Centres for Economic Development, Transport and the Environment). The project created a roadmap tool called IKKUNA for promoting and strengthening the climate work of the ELY Centres.

The municipal energy efficiency agreement (KETS) is an agreement between the Ministry of Economic Affairs and Employment, the Energy Authority and Association of Finnish Local and Regional Authorities on improving the efficiency of energy use in the municipal sector; the current agreement period is 2017–2025. Energy efficiency agreements are an essential part of Finland's energy policy and an important means of fulfilling Finland's commitments to energy efficiency and emissions reduction targets both globally and on the EU-level. More than 120 networked municipalities and joint municipal authorities have already committed to the energy efficiency targets of the agreements. These municipalities are home to more than 75% of Finland's residents. The agreement fosters goal-oriented, systematic and networked operations which enhances and supports the efforts towards energy efficiency in municipalities and joint municipal authorities. Every year, the agreement parties publish a report on the measures and efforts they have taken towards energy efficiency. The state supports the adoption of new energy-efficient technology and, on a case-by-case basis, other investments in energy efficiency in the municipalities that have joined the agreement. Energy efficiency agreements are not limited to municipalities, but also the business sector and real estate sectors have corresponding agreements in place and they contribute significantly to the local, regional and national climate work.

Regional energy advisory services funded by the Energy Authority in the period 2018–2023 are an important way to promote the achievement of energy and climate targets on a local level. The advisory provides objective information about energy, which contributes toward the attainment of the targets for energy efficiency and emissions

reductions. Municipal advisory services, in turn, support the implementation of the energy efficiency agreement through a local network, where an adviser facilitates municipal cooperation at the local level in sharing best practices and information, among other things. Energy audits are marketed to municipalities and SMEs to encourage them to conduct audits. An important part of energy advisory operations is that it increases the awareness of consumers, municipalities and SMEs of the different funding and support types available.

Measures to speed up the climate work of municipalities and regions

- Promote the climate work in municipalities by amending the Climate Change Act in autumn 2022 with an obligation to create a climate plan at the municipal, county or regional level.
- Continue and promote cross-sectoral climate work in municipalities and regions to support and expedite sector-specific emissions reduction measures.
- Encourage municipalities and regions to develop good practices for climate management, cooperation between municipalities and businesses and speeding up the residents' climate actions.
- Encourage municipalities to join and participate in voluntary networks and activities that support municipal climate work, such as the Towards a Carbon-neutral Municipality (HINKU) network managed by the Finnish Environment Institute, the Finnish Sustainable Communities (FISU) network for pioneer municipalities coordinated by Motiva and the Finnish Environment Institute and the Climate Municipalities actions organised by the Association of Finnish Local and Regional Authorities.
- Ensure the continuity of comprehensive and uniform emissions tools that are provided nationwide for the end users for free (a greenhouse gas emissions information service and an emissions scenario tool); also ensure that the tools keep receiving funding and updates. The tools provide commensurate data on a municipal, regional and national level, and also on the sectors covered by the Centres for Economic Development, Transport and the Environment.
- Promote the partnership between municipalities and the central government by developing and concluding a voluntary municipal agreement on the climate and circular economy.
- Ensure that the Municipal Energy Efficiency Agreement (KETS) remains an important way of achieving energy efficiency targets. Encourage municipalities to join the Municipal Energy Efficiency Agreement (KETS) and also reduce greenhouse gas emissions by cost-effective means.
- Promote national and regional energy advisory services.

- Continue the agreement procedures on land use, housing and traffic (MAL) and monitor their effects in major urban areas.
- Support the network of climate experts in the Centres for Economic Development, Transport and the Environment (ELY Centre) and the climate group of the steering parties of the Regional State Administrative Agencies and the ELY Centres and the ELY climate roadmap they have created in the promotion and expedition of climate work in regional state administration.
- Promote the climate work and cooperation of Regional Councils and regional state administration.
- Create capacities for low-carbon and resource-efficient community development based primarily on the existing structure. Strengthen the cohesion of the community structure in large urban regions.
- Determine whether it is possible to instruct municipalities on environmental accounting so that all climate actions could be seen in the accounting in a clear and encouraging way.

Municipal climate work plays a significant role in the attainment of the emissions reduction targets of the effort sharing sector. Most of the actions made in the municipalities will have a direct impact on the emissions of transport, heating and other sectors. By speeding up municipal climate work, Finland can achieve additive emissions reductions on top of the ones achieved by sectoral measures. The magnitude of the additive reductions can be estimated from the emission trends of HINKU municipalities. According to the Finnish Environment Institute, the HINKU municipalities have succeeded in reducing their emissions by an additional 3.1% compared to other municipalities (Riekkinen et al. 2020). By the same token, if the climate measures above were expedited and extended to cover all Finnish municipalities, Finland could achieve an additional 3% reduction in the total emissions from the all sectors. Furthermore, the municipal obligation proposed to the Climate Change Act can be expected to expedite emissions reductions even further.

The impact of speeding up the climate work of municipalities and regions on emissions from the effort sharing sector: 0.2 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.

Community structure and land use

On a national level, land use, community structure and transport infrastructure, which is closely linked to the first two, are highly permanent elements that change only slowly. Therefore, decisions on land use and community structure have a long-term impact. Since the trend of urbanisation remains strong, emissions can be reduced most effectively by solutions that are associated with a functional community structure and transport system,

which are also preconditions to a thriving business life and Finland's competitiveness. The practical solutions for reducing emissions differ significantly depending on the area. In major urban areas, individual decisions on community structure might be significant not only locally, but also on a broader scale.

The strongest impact on municipal emissions comes from the development of the transport system, which is steered by political decisions on zoning and construction in the municipality. Therefore, the impact shows in the emission trends of the transport sector. Political measures can have an effect on the share and traffic performance of transport modalities. Zoning regulations can control which building materials may be used, for example. Promotion of timber construction can reduce the carbon footprint of a building in all phases of its lifecycle, from the manufacture of raw materials to construction, use and recycling.

Trends in community structures

The physical structure of communities changes relatively slowly. The 'Housing Production Need 2020–2040' study by the VTT Technical Research Centre of Finland (Vainio 2020) estimates that 30,000–35,000 new apartments are needed annually. Ninety per cent of this demand would take place in the fourteen largest urban areas with the Helsinki region representing almost half of it. The main drivers behind the need for new housing are urbanisation, immigration and the increase in single-person households.

Zoning has shifted towards locations that favour sustainable mobility and a smooth transport system especially in growing urban areas and municipalities. This shift creates a foundation for improving the functionality and sustainability of the community structure, and its effect in the mitigation of greenhouse gas emissions will be seen in the future years. This trend is slower in depopulating regions.

The best means of improving the sustainability of the traffic system depend on the community structure and are therefore different in different regions. Major urban areas can develop public transport on a large scale and can locate everyday destinations in places that are easily accessible by pedestrians or cyclists. Regions surrounding cities can reduce their emissions by reducing the need for mobility and ensuring that travel chains are smooth, so that most of the journey can be made on public transport and only the connection to the public transport needs to be made by car, or alternatively on foot or by bicycle. Smaller urban areas and depopulating municipalities have fewer opportunities for using zoning to steer people's choices of transport modality, since the community structure is dispersed and there is less construction activity. All municipalities can increase the volume of walking and cycling by improving infrastructure. Remote work and digitalisation can also reduce the need for mobility in all regions.

The community structure also has indirect effects on emissions. Many of the measures to improve the community structure of urban regions are also a precondition for the success of other energy efficiency measures that enable emissions to be reduced.

Multi-local living and working can have a significant environmental impact due to the need for mobility and the associated transport modalities, but also due to the number of living and working premises needed and their location. One of the Government's analysis, assessment and research activities is called 'Thriving and sustainable multisite Finland' (SOMPA) which aims to create a comprehensive picture of the trends and impacts of multi-local life and to identify the key means of promoting sustainable multi-locality.

Existing measures

The planning and steering of land use are key elements in the mitigation of climate change. The goal of the Land Use and Building Act (132/1999) is to arrange land use and construction in ways that create the conditions to a good living environment and promote a development that is ecologically, economically, socially and culturally sustainable. The Act is now undergoing a comprehensive reform to ensure that mitigation of and adaptation to climate change will be taken into account in zoning and construction. The proposed reforms include the promotion of climate change mitigation by strengthening the cohesion of the community structure especially in urban regions and their surroundings, utilising existing infrastructure in a sustainable way, supporting resource-efficient community development and creating the conditions for a sustainable and low-carbon transport system and the utilisation of renewable and low-carbon sources of energy.

In addition to zoning, regional land use targets are a part of the land use planning system under the Land Use and Building Act. The national land use guidelines are a tool for the Government to steer policy on land use issues that are of national importance.

The agreement procedure on land use, housing and traffic (MAL) have been implemented in the seven largest urban regions. The MAL is a way of using land use, housing and the transport system to meet the challenges posed by the climate change. MAL connects the planning of the regional traffic system to the planning, scheduling and implementation of regional land use in order to create a cohesive, functional and competitive urban region. The last round of preparations placed an increasingly stronger emphasis on climate issues. Some guidelines on the MAL regions were included in the National Transport System Plan (Liikenne 12) that was approved in spring 2021. The purpose of the guidelines is to support sustainable mobility in major urban regions. Both the National Transport System Plan and the MAL agreements are updated in each government term, and their goals, actions and funding are adjusted based on the results of monitoring.

The Ministry of the Environment has launched the creation of a national outlook of land use trends that supports Finland's ability to prepare for continuous changes in the operating environment. A carbon-neutral society, wellbeing of the population and the conditions for businesses depend on the framework and opportunities provided by the regional and community structure and its essential component, the transport system. Climate change, urbanisation, segregation of regions and changes in demographics pose a challenge to the sustainable development of land use. The outlook will provide a direction for the sustainable development of regional and community structures.

6.3.2 Carbon footprint of consumption

The major role of people's everyday consumer and other choices in terms of emission trends was recognised in the first Medium-term Climate Change Policy Plan, which encouraged consumers to halve their carbon footprint by 2030. Nevertheless, the average household carbon footprint has not shrunk much in recent years. According to the Finnish Environment Institute, household consumption accounted for about 66% of consumption-based greenhouse gas emissions in Finland in 2015 (Nissinen & Savolainen 2019).

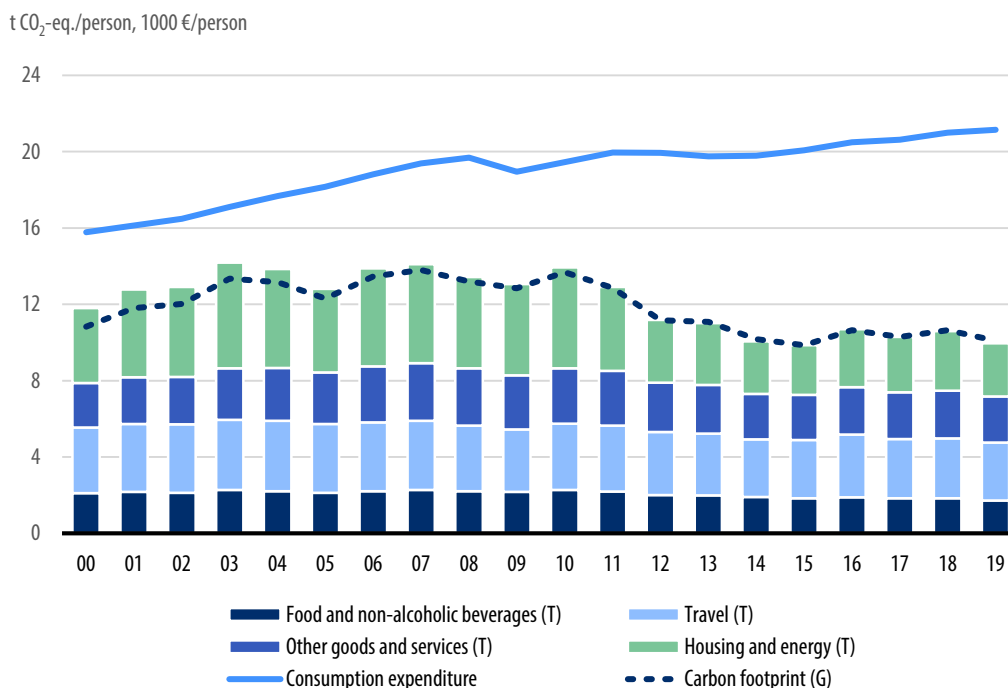
Estimates of consumption-based emissions differ from Finland's official, production-based emissions (produced or generated within the Finnish territory) reported in the greenhouse gas inventory, in that the former include inventory-based emissions as well as overseas emissions from production chains of imported goods, excluding those from production chains of exported goods. In addition to household consumption, consumption-based emissions are generated by public consumption (about 12%) and domestic investments (about 19%). A small amount of consumption-based emissions are also attributed to non-profit organisations. Consumption in the public sector is discussed in the chapter on public procurement (Chapter 6.3.3)

In 2021, the Finnish Environment Institute published two updates to the time series for the carbon footprint of household consumption expenditure. The first time series extended the Annual Climate Report for 2021 to cover the period 2000–2019. Next, the Institute developed methods for investigating changes in the emissions of imported products (Savolainen et al. 2021). The previous calculation method took into account the changes in the emissions factor of imported electricity, but not in other imported products (Nissinen & Savolainen 2019). The new method calculates an annual coefficient for each product group, weighted by the import percentage and emissions intensity of the country of origin. The method also considers the share of imported products of the total annual consumption expenditures of households.

To complement this product-group-specific investigation of emissions intensity, the Institute created a comparative calculation that uses the trends in global emissions intensity (global greenhouse gas emissions divided by the global GDP) and the percentage of imports of the total consumption of businesses and households. The result obtained by considering the emissions intensity of the countries of origin can be expected to give a better idea of the emission trends of imported products than the one calculated with the global coefficient, since Finnish imports differ from the global coefficient in terms of the makeup and shares of the countries of origin. However, the country of origin is not necessarily the most important factor in terms of emissions along the entire manufacturing chain of the product.

An investigation of the product-group-specific emissions intensity reveals that the average annual carbon footprint of household consumption varied from 9.9 tonnes to 14.2 tonnes CO₂-eq, peaking in 2003 and 2007 (figure 24). In 2019, the average carbon footprint amounted to 10.0 t CO₂-eq. The emissions have remained at more or less the same level over the last six years under review. Using the global emissions intensity yields fairly similar results on the latter half of the period under review.

Figure 24. Average consumption expenditure (at 2015 prices) and carbon footprint of Finnish households in 2000–2019. These results use SYKE's ENVIMAT modelling that has been revised in terms of emissions from imported products. The emissions are shown in two ways. The calculation that takes into account product-group-specific emission intensities (T) multiplies the emissions coefficient of each product group by an annual index (2015=1) that describes the emissions intensities of countries of origin of imports (greenhouse gas emissions/GDP). The corresponding global trend in emission intensity is expressed by a dashed line (G). (Savolainen et al. 2021)



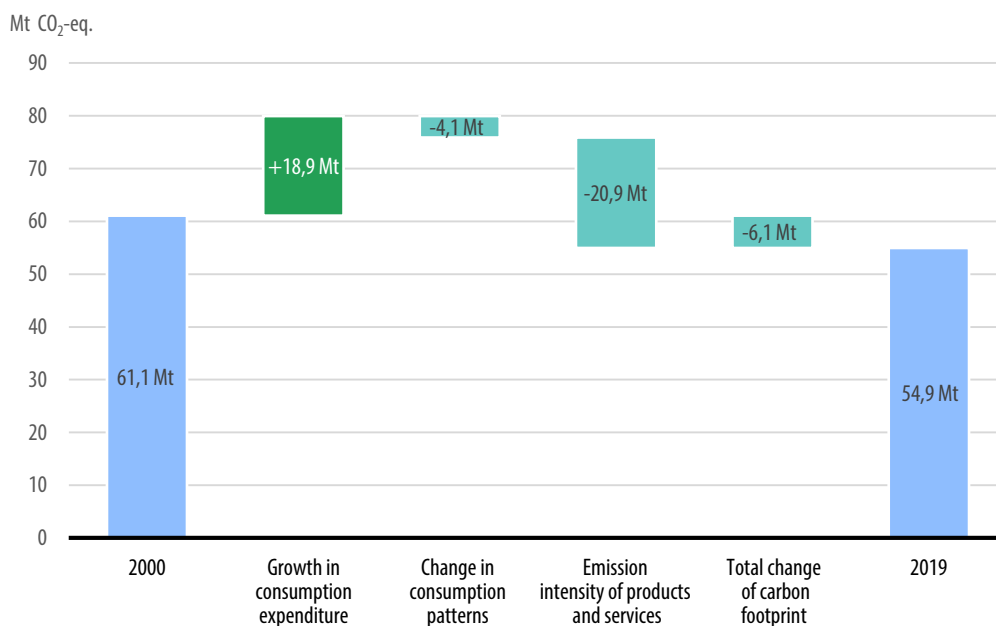
In the first half of the period under review, the two methods differ in their estimates of consumption-based emissions. In 2000, the total carbon footprint of household consumption was 61.1 Mt CO₂-eq in the product-group-specific review and 56.1 Mt CO₂-eq in the global emissions intensity review. Since then, the emissions have fallen by 10% or 1% in 2000–2019, depending on the method of calculation. The previous calculation that was shown in the Annual Climate Report estimated that emissions had grown by 4%.

The Finnish Environment Institute's revised calculation method shows that changes in the emissions intensities of consumption patterns and commodities in 2000–2019 have helped shrink Finnish households' carbon footprint, and the effect has been greater than that of its opposite, the growth in consumption expenditure (Figure 25). When the calculation is made using product-group-specific emission intensities (which results in greater changes than the global emissions intensity), the change in the carbon footprint over the 2000–2019 period can be divided into the following three factors: change in

consumption expenditure (which alone would have increased emissions by 31%), change in consumption patterns (-7%), and change in emissions intensity of products and services (-34%).

The primary explanatory factor for the carbon footprint of household consumption is income level, which affects the consumption expenditure. This eclipses the role of all the other factors (Salo et al 2021)- Households have some say on the types of products or services they consume. The consumption patterns can be affected by political means, for example by using taxation to change relative prices. It should be noted that households have little power over the emissions intensities of the different product groups (in other words the technological development in the background).

Figure 25. Factors of change in household carbon footprint over the 2000–2019 period. The data is based on updated calculations from the Finnish Environment Institute’s ENVIMAT model. (Savolainen et al. 2021)



Per capita emissions can be based on several different calculation methods. In 2015, Finland’s greenhouse gas emissions amounted to 10.1 tonnes CO₂-eq per capita, calculated on a regional basis. Consumption-based emissions, in turn, stood at 13.4 tonnes CO₂-eq per capita, with the majority attributable to household consumption. According to an updated calculation, consumption-based household emissions amounted to 9.9 tonnes CO₂-eq per capita in 2015. The latter calculation method is the most relevant point of reference from the consumer perspective. Most of the consumption-based emissions

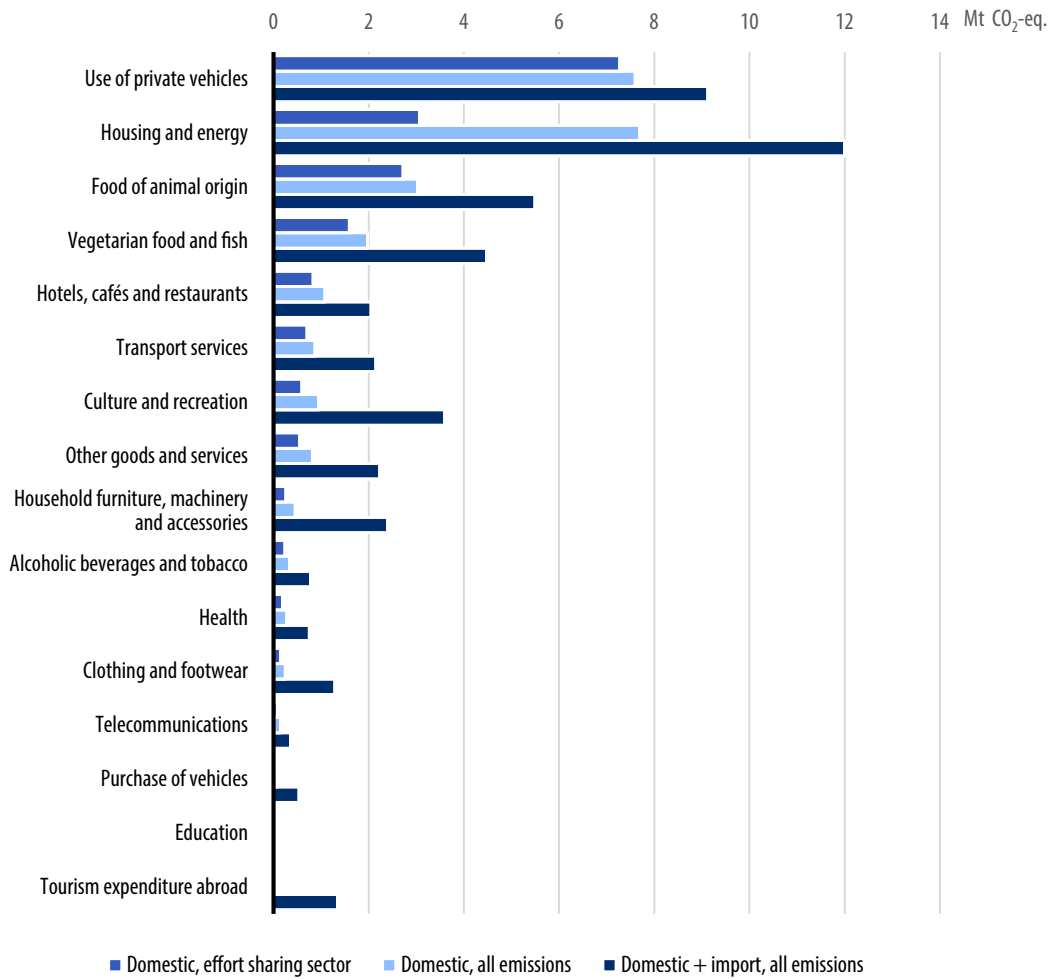
come from transport (30%), housing (28%) and food (18%). Twenty-five per cent of the emissions come from other goods and services.

The sustainable level of consumption-based emissions is estimated at about 2.5 tonnes CO₂-eq per capita in 2030 if global warming is to be limited to 1.5 degrees Celsius. The Finnish Climate Change Panel estimates that the household carbon footprint should decline by about 70% when the 2016 carbon footprint is compared with the 2030 climate targets (Linnanen et al. 2020). The carbon footprint of domestic consumption expenditure in 2015–2019 did not continue the falling trend seen in 2010–2015.

According to research carried out by the Finnish Environment Institute, consumption correlates with income level, whereas place of residence and family type play a less significant role (Nissinen et al. 2019; Salo et al. 2021). The Finnish Climate Change Panel estimates, based on data from 2016, that the carbon footprint of the highest income decile is almost three times as large as that of the lowest decile (Linnanen et al. 2020). The greatest differences between income deciles come from greenhouse gas emissions from transport, which are almost four times higher in the top income decile than in the bottom one. Emissions from goods and services are estimated to be more than three times as high. Emissions from food and housing are twice as high in the highest income decile than in the lowest.

The carbon footprint of consumption is critical for Finland's direct emissions and the emission targets set on the basis of the direct emissions. The Finnish Environment Institute participated in a consumption project run by the Finnish Climate Change Panel (Savolainen 2021) to investigate how the carbon footprint of households is divided between the Finnish effort sharing sector and emissions trading sector and the corresponding sectors abroad through imports. In 2015, 52% of consumption-based emissions originated in Finland, and 71% of these emissions originated from the effort sharing sector. Figure 26 shows that the use of private cars is by far the most important source of emissions in the effort sharing sector. Foodstuffs come second, when emissions from animal-based and plant-based foodstuffs are added together. The figures do not include the LULUCF emissions caused by foodstuffs. The third largest emissions category in the effort sharing sector is housing and energy, which also has the highest total carbon footprint. Emissions from these three consumption categories make up 80% of the emissions in the effort sharing sector. Approximately 70% of the emissions from household consumption in the Finnish effort sharing sector originate from goods and 30% from services.

Figure 26. Carbon footprint of household consumption by sector and commodity in 2015 (Savolainen 2021). The difference between the total emissions and the effort sharing sector emissions in Finland indicates the emissions from the emissions trading sector.



Policy measures.

Provision of information and subsidies were seen as good ways of reducing emissions from consumption

During the early stages of the drafting of the Climate Change Policy Plan, the authors requested opinions on the impact and fairness of typical climate actions from a wide range of citizens and other stakeholders. A frequent topic in hearings intended for citizens was the reduction of emissions from consumption. Respondents of the public citizen survey were of the opinion that the most acceptable climate actions were provision of information and financial subsidies.

The Citizens' Panel on climate actions stated that climate actions must emphasise the manufacturer's responsibility, since consumers are rarely in the position to determine the origin and ecological quality of the product in a comprehensive way. The Panel's opinion was that any financial measures should be communicated powerfully and clearly to the consumers, so that all income classes could apply for subsidies or reductions or otherwise take the financial changes into account. The Panel stated that information must be provided comprehensively, for example as climate education starting from primary school.

Hearings for young people came up with suggestions for using taxation as a means of increasing and incentivising the supply of climate-friendly products. The young were of the opinion that all climate solutions must be made in a socially fair way.

Actions of the central government can affect the consumers' carbon footprint. The policy instruments associated with consumption can be divided into legislative instruments, economic instruments, such as taxation and grants, as well as information-based instruments, including campaigns, education and other communications, such as product eco-labels. Consumption can also be guided by altering the markets, supply, provision of services, nudging or voluntary agreements, green deals and product or service design (Nissinen et al. 2012; Nissinen et al. 2015). Values and cultural factors have an important and fundamental influence on lifestyle and consumption patterns.

Companies and public authorities also have an effect on which products, services, infrastructures and other solutions are available to the consumers and which are not (Nissinen et al. 2021; Lettenmeier et al. 2019; Akenji 2019). Since price and the sustainability of products are key factors that guide consumer choices, effective political tools are ones that create financial incentives for more sustainable products, services and lifestyles. On the other hand, existing infrastructures that create a lot of emissions might cause a lock-in effect that causes consumers to stick to old models and solutions. In such cases, it would be essential to alter these structures so that they no longer hamper climate-friendly consumer choices. Programmes for sustainable consumption and production seek to find ways of simultaneously improving the sustainability of production and consumption (Heiskanen et al 2012; Nissinen et al. 2017). The acceptability of policy instruments that affect consumption is also considered important and has been researched (Heiskanen & Saastamoinen 2011).

The state promotes fair transition and acceptability of policy instruments by the following measure, among others:

- To ensure a fair transition, the Government is preparing a subsidy scheme that seeks on the one hand to make the energy tax system more climate-friendly and on the other hand respond to the unreasonably harsh social consequences of large increases in fuel prices.

The consumers' carbon footprint can also be reduced by issuing regulations under the Ecodesign Directive for product groups and introducing energy labelling regulations under the Energy Labelling Regulation. The ecodesign regulations lay down requirements for products that consume energy or are associated with energy in order to improve their energy efficiency or otherwise reduce their adverse impact on the environment.

Research shows that the overall sustainability of consumption can only be improved by several concurrent and long-term means. For example, a Swedish study concluded that controlling consumption requires several mutually consistent policy instruments (Hennlock et al. 2015; Nissinen et al. 2015). Therefore, effectiveness is hampered by not having an overall package of consistent measures that encourages customers to adopt low-emissions consumption patterns.

The Government is taking the following actions to reduce Finland's carbon footprint in general and to halve the Finnish consumers' footprint in particular, focusing on food, transport and housing:

- Strengthen the knowledge base on guiding consumption patterns and identify the needs for structural changes that can be affected by regulations (norms) and those that need other means. Create a cross-governmental action plan/understanding on a coordinated comprehensive reform of policy instruments that guide towards sustainable consumption in order arrive at a consistent package of policy instruments. (Ministry of the Environment in cooperation with other parties)
- Investigate means for guiding advertising on carbon-intensive products and services and low-carbon products and promotion of environmental labels.
- Life cycle emission assessments of food and other consumer products will be developed with a view to directing consumption taxation in ways that allow for impacts on climate and the environment. This type of taxation will be reviewed after 2023. (Ministry of Finance/Ministry of the Environment/Ministry of Agriculture and Forestry/Ministry of Transport and Communications/Ministry of Economic Affairs and Employment)
- Support regional and local nudging and scale experiments and accelerators of sustainable lifestyles that support sustainable choices that save natural resources. (Ministry of the Environment)
- Support the dissemination of the current learning material on climate and circular economy. Engage in communications targeted especially to adults on the reduction of one's carbon footprint. Ensure that the material expresses the scale of the measures. (Ministry of the Environment in cooperation with other parties)
- Ensure that sufficient resources exist for disseminating information and providing energy advisory services. Municipal energy advisory services offer independent and up-to-date information on energy saving, energy efficiency, renewable energy solutions and opportunities for flexible consumption. Regional energy advisory services will be included as part of the energy efforts from 2023 onwards.
- Promote the adoption of a digital product passport in product groups with a high environmental impact, and promote dissemination of information on product lifetimes, warranty periods and climate impact. (Ministry of Economic Affairs and Employment/Ministry of the Environment/Ministry of Agriculture and Forestry)
- Promote repairability and serviceability in product design and product-as-a-service solutions. Support circular economy services (such as sharing, renting, borrowing) by policy instruments and increase their attractiveness.

Encourage, inspire and network municipalities and communities to adopt a culture of sharing. (Ministry of the Environment/Ministry of Economic Affairs and Employment)

The selection of the measures takes into account the wishes expressed in the hearings and by the Citizens' Panel especially on consumer incentives and provision of information. Young people also wished for further actions on taxation and incentives.

In addition to the general measures above that seek to reduce emissions from consumption, the state also carries out sector-specific measures to reduce of consumers' carbon footprint. Examples of these are support for the procurement of electric vehicles and charging stations and extending domestic help credit to cover energy overhauls, since they encourage consumers to make climate-friendly consumption choices. Furthermore, these consumption choices have a direct impact on the emissions reductions needed in the effort sharing sector. As in the first Medium-term Climate Change Policy Plan, consumers are still encouraged to halve their carbon footprint by 2030.

Various calculators and online services are available for individual consumers to assess their own carbon footprint. The Finnish Environment Institute's Climate Diet Calculator, updated in 2019, allows users to calculate their personal carbon footprint from consumption of housing, transport, food and other goods and services. The calculator provides feedback on the results and suggests measures to reduce the carbon footprint.

Another popular calculator is Sitra's Lifestyle Test that has been taken by more than a million times already. People are increasingly interested in monitoring their carbon footprint but it is currently not well known how consumers' awareness of their carbon footprint guides consumption choices. Sitra's calculator displays a list of suggested measures and a Pledge2050 instrument that enables consumers to make their own climate pledge. The Pledge2050 instrument contains a tool for making annual plans towards a sustainable lifestyle. Data entered by the users in the tool indicates that on average, the users strive towards a 30% reduction in their carbon footprint per year, which means that if a consumer achieves this target for two years in a row, they have reduced their carbon footprint by 51% in two years.

Table 5 contains a list of consumers' opportunities for reducing their carbon footprint. From an individual's perspective, the feasibility and impact of the actions depend on whether they own a car or whether they live in a house heated by oil. Sustainable everyday life consists of many choices, some of which are large one-off investments and some are repeated daily actions.

Table 5. Consumers' opportunities for reducing their carbon footprint. The measures with highest impact are in bold.

Goods and services	Food
<ul style="list-style-type: none"> • Redistribution and reduction of consumption: longer product lifecycles, borrowing, lending, sharing and renting of products. • Selecting climate-friendly solutions, for example by favouring sustainable and modifiable products, using recycled goods and favouring products labelled with a circular economy label or environment label. • Climate-friendly lifestyle: servicing and repairing old products. 	<ul style="list-style-type: none"> • Reducing consumption: preventing food waste. • Selecting climate-friendly solutions: climate-friendly food. • Climate-friendly lifestyle: preventing food waste, favouring seasonal products and local produce, collecting berries, mushrooms, etc.
Transport	Housing
<ul style="list-style-type: none"> • Reducing consumption: considering the need for transport, borrowing/lending/sharing/renting cars and bicycles, reducing flying and replacing it with other modes of transport. • Selecting less carbon-intensive solutions: low-carbon modes of transport • Investing in climate-friendly solutions: substituting a car with an electric car or electric bike. • Climate-friendly lifestyle: reducing high-emissions transport, increasing walking, cycling and rail transport. 	<ul style="list-style-type: none"> • Reducing consumption: considering the floor area of housing, lengthening the lifecycle of furniture and household appliances, reusing raw materials, for example by a shower that recycles and purifies water, borrowing/sharing/renting/lending goods. • Selecting climate-friendly solutions: favouring products labelled with a circular economy or environmental label, sustainable and modifiable products. • Selecting less carbon-intensive solutions: emissions-free electricity and heat, recycled goods, favouring circular economy products, sustainable products. • Investing in climate-friendly solutions: phasing out oil heating, improving energy efficiency, heat pumps, solar power. • Climate-friendly lifestyle: repairing and maintaining old products, energy-saving, borrowing/lending/sharing/renting of goods. • As for housing, individuals can influence the solutions of a housing company or municipal rental housing.

Impact of the consumption actions on the emissions from the effort sharing sector

Households and other consumption play a crucial role in the attainment of the emissions reduction obligation in the effort sharing sector. The impact of climate actions on emissions in different sectors (see Chapter 6.2) are partly based on changes in consumption patterns. However, the Climate Panel (Ollikainen et al. 2021) estimates that changes in diet could reduce emissions from agriculture by 0.2 Mt CO₂-eq by 2030, which is not included in the estimated amount of emissions reduction in the agriculture sector. It should be kept in mind, however, that it is difficult to assess exactly how much a change in consumption patterns affects emissions from production. It is also likely that measures targeting consumption create additive emissions reductions in the transport and housing sector.

One of the ways of assessing the impact of measures that target consumption is the carbon footprint of consumption. The Finnish Environment Institute's ENVIMAT calculations (Savolainen 2021) show that emissions from domestic consumption in the effort sharing sector are approximately 20 Mt CO₂-eq. Sector-specific measures will reduce the footprint to approximately 13 million tons by 2030. If 10% of the population actively reduced their carbon footprint of food, housing and domestic mobility by 15 percent more than the overall trend, the impact would be 0.2 Mt CO₂-eq. This can be seen as a plausible and cautious estimate on the additive effect on emissions reduction in the effort sharing sector that arises out of actions that target consumption.

**Impact of the consumption actions on the emissions from the effort sharing sector
0.2 Mt CO₂-eq in 2030 + 0.1 Mt CO₂-eq in 2035.**

6.3.3 Public procurement

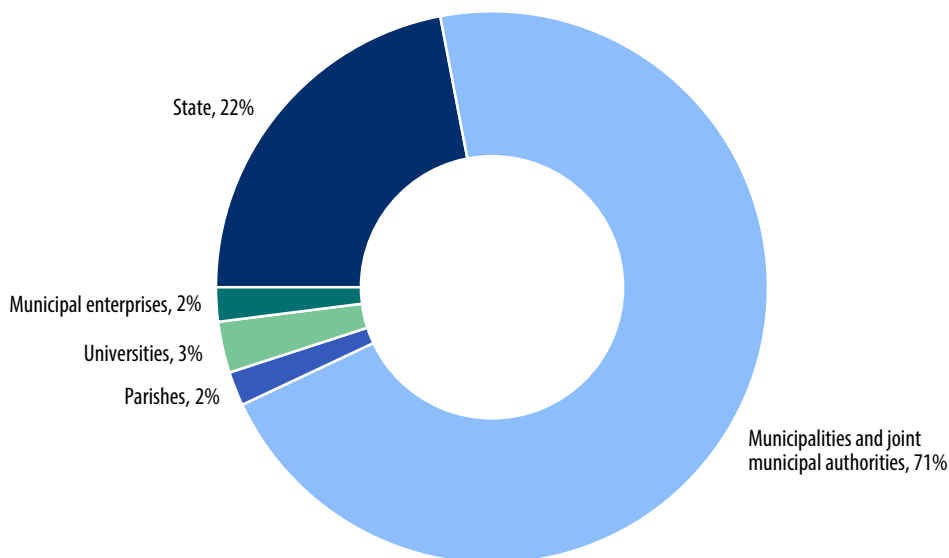
Finland has approximately 2,800 independent procurement units that use a total of EUR 30–50 billion on public procurements annually, depending on the method of calculation (Kalimo et al. 2021). Public procurement is an important way to promote both the achievement of the Sustainable Development Goals and a market for environmentally friendly products.

According to the calculations of the Finnish Environment Institute, the carbon footprint of public procurement in Finland in 2015 was 8.3 Mt CO₂-eq and the carbon footprint of investments by public organisations 2.7 Mt CO₂-eq (Nissinen & Savolainen 2019). The calculation takes into account consumption-based emissions, i.e. import and export.

Based on the data used in the HILMI project (Kalimo et al. 2021) that measured carbon and environmental footprint in procurement, 22% of the emissions from public procurement

and investments were caused by the government's procurement and investment operations, 71% by municipalities and joint municipal authorities and 7% by other public organisations and investments (Figure 27). In procurement by the government, the highest amount of greenhouse gas emissions came from the administrative branch of the Ministry of Defence, followed by the branches under the Ministry of Transport and Communications and the Ministry of the Interior.

Figure 27. Distribution of the carbon footprint of procurement and investment operations by organisation type (Kalimo et al. 2021)



Product groups that have a large financial volume and a significant environmental impact and whose carbon and environmental footprint and other environmental aspects can be determined from lifecycle data or calculation methods are energy for buildings (heating, electricity, gas), house building and maintenance services or buildings and areas, travel and transport, foodstuffs, accommodation and food services, mobile machinery, equipment and fleet, and cleaning services.

Other product groups that have a significant volume and environmental impact are civil engineering, including related repair and maintenance, travel services, medicines and care supplies, cement and batteries, but there is currently limited data on their carbon or environmental footprint or its applicability in procurement processes. Procurement criteria need to be developed rapidly for these product groups.

Existing measures

The Act on Public Procurement and Concession Contracts (1397/2016) encourages taking environmental aspects into account in public procurement, but does not impose this as an obligation. According to studies, the way environmental aspects are considered varies, and the monitoring of the set criteria and environmental targets has shortcomings. Environmental criteria are often mentioned in general terms or as a statement required by the environmental legislation, without a purpose of achieving actual environmental benefits. Although the amount of climate criteria has increased in the last decade, their quality has remained the same (Kalimo et al. 2021).

To develop the procurement legislation, the Finnish Government launched a project under the Government's analysis, assessment and research activities (VN TEAS) to include carbon and environmental footprints in public procurement criteria. The University of Eastern Finland, the Institute for European Studies, the Finnish Environment Centre and the LUT University studied how legislation and public procurement operating models should be developed to take carbon and environmental footprints into account as part of procurement procedures. The background for these initiatives is a Government Programme entry on including environmental and carbon footprint in the legislation on public procurement. The project also assessed how the actualisation of the targets and criteria set for the procurements should be monitored and measured.

The Act on Environmental and Energy Efficiency Requirements in Vehicle and Transport Services Procurement entered into force in August 2021. It replaces the Act on Consideration for the Energy and Environmental Impact of Vehicles in Public Procurement that was enacted in 2011. The Act seeks to promote the mitigation of emissions in transport by increasing the proportion of zero- and low-emission vehicles in public procurement.

The National Public Procurement Strategy (Ministry of Finance 2020), which was completed in September 2020 and issued as a government resolution, aims to support Finland's 2035 carbon neutrality target. The vision set out in the strategy is that, in the 2020s, Finland will be a European pioneer in management, expertise, data utilisation, innovativeness and economic, ecological and social responsibility in the field of public procurement. Eight thematic groups have been set up to implement the strategy. One of the goals of the thematic group on ecologically sustainable procurements is to support Finland's 2035 carbon neutrality goal.

The Finnish Competence Centre for Sustainable and Innovative Public Procurement (KEINO) was launched in March 2018 to promote management of public procurement, making and scaling innovative purchases and improving effectiveness for purposes such as mitigating greenhouse gas emissions. KEINO is a consortium network of organisations

– Motiva, the Association of Finnish Local and Regional Authorities, VTT Technical Research Centre of Finland Ltd, Business Finland, the Finnish Environment Institute SYKE and Hansel Ltd – that are jointly responsible for implementation and development activities.

The KEINO Competence Centre seeks to develop and pilot new operating models for procurement together with contracting entities. KEINO has launched a development programme for low-carbon public procurements under the Procurement Finland action plan with the goal of helping selected contracting entities to achieve low-carbon targets through procurement and to share lessons and experiences with other contracting entities.

Methods to measure green public procurement and assess its impact are being developed. The current status of innovative and sustainable procurement was surveyed in 2018 and 2020. The KEINO Competence Centre is currently developing a model for describing and measuring the degree of innovation in procurement at different stages of the process at both national and organisational levels, using various data sets. The project also includes a supplementary sub-project developing a framework for assessing the low-carbon potential of innovative purchases.

Towards Carbon Neutral Municipalities and Regions (CANEMURE) is a project for implementing Finnish climate policy, funded through the EU LIFE programme. As part of the project, the City of Helsinki is piloting example cases with a view to taking low-carbon and environmental aspects into account in the best possible manner in their procurement processes. This also involves exploring how carbon footprint accounting can be applied by different procurement teams and what kinds of criteria can be formed for the carbon footprint.

Ministries and procurement organisations can sign voluntary agreements (green deals) that set ambitious targets and identify means to achieve the targets. In September 2020, the Ministry of the Environment, Senate Properties and the Cities of Espoo, Helsinki, Turku and Vantaa signed such a voluntary Green Deal to reduce emissions at construction sites. Its aim is that construction sites of the cities and Senate Properties will be fossil-free by the end of 2025, meaning that they will not use fossil fuels. In addition, by 2030, at least 50% of construction machinery and site transport operations will be powered by electricity, biogas or hydrogen. The agreement will be in force up until the end of 2030 and it is the first Green Deal to be signed between public bodies to promote sustainable procurement.

The Energy Efficiency Directive (EED) obligates the central government to make energy-efficient procurements. In its Fit for 55 climate package, the European Commission proposed a reformed Energy Efficiency Directive to the European Parliament and the Council. The proposal takes the current central government obligation to procure, if

a certain threshold is exceeded, the most energy-efficient goods, services or construction contracts and expands it to the entire public sector. The obligation will also be expanded to apply to concession contracts and ordering a work performance. The proposal contains several new obligations. One of the new obligations is to ensure that the contracting entities follow the Energy Efficiency First in public procurements that exceed certain threshold values. The proposal also contains a new obligation, which is to follow the Commission's criteria for environmentally friendly public procurement when producing energy-related products and services.

Policy measures.

- Investigate the opportunities in including an obligation to consider environmental and social aspects (section 2, subsection 1) in the objectives of the procurement legislation. Introducing environmental and social aspects into the objectives of the legislation would be a stronger signal than a mere recommendation. The change requires that the environmental and social aspects be made more specific, for example by requiring that the carbon and environmental footprint be taken into account in procurements where it is available.
- Ensure that Finland has more permanent structures and a funding base to expedite environmentally sustainable and impactful public procurements. The support consists of the production of necessary knowledge, developing expertise, scaling support models that support pioneer procurements and systemic change and developing co-operation between the procurement organisations and value chains.
- Create a government resolution on domestic and low-carbon procurements. The Resolution will set an emissions reduction target for public procurement operations and the achievement of this target will also be monitored.
- Recommend that the climate programmes and climate budgets prepared by government organisations, municipalities and joint municipal authorities take into account the procurement categories that have the highest impact on the attainment of the targets.
- Recommend a study under the national procurement strategy on the adoption of a monitoring system that would leverage artificial intelligence and existing reporting channels of public procurements in order to collect data on the carbon and environmental footprint of public procurements.

The Medium-term Climate Change Policy Plan ties policy measures on public procurement to the package of cross-sectoral measures, including municipal climate efforts, the carbon footprint of consumption and the circular economy. The impact of public procurement

measures on the reduction of emissions in the effort sharing sector is difficult to estimate, but they do play an important role in the attainment of Finland's climate goals.

6.3.4 Circular economy

A circular economy offers solutions for reducing greenhouse gas emissions and mitigating other environmental effects of consumption and production. 'Circular economy' is generally used to refer to an operating model that minimises natural resources extracted for the economy by changing production methods so as to be based on circularity and by shifting consumption patterns from products to services, renting, recycling and sharing. An essential feature in circular economy is that products are designed such that they are resource-efficient and durable and can be repaired, reused and remanufactured and safely recycled. At the end of a product's life cycle, its materials circulate within the economy as long as possible, retaining or even increasing in value. Production side streams are likewise put to use and any valuable materials are recovered from waste as recycled materials that reduce the need for primary raw materials.

Impact chains in circular economy and their significance in reducing greenhouse gas emissions

The most significant emissions reductions resulting from circular economy take place in production, as the use of virgin natural resources and energy required in production processes decrease. Furthermore, circular economy operating models will reduce the carbon footprint of consumption (see Chapter 6.3.2). The most significant way to reduce greenhouse gas emissions and other environmental harm is to reduce the consumption of primary raw materials. Circular economy operating models can reduce demand for primary raw materials and production volumes in many different ways.

The importance of circular economy in the reduction of greenhouse gas emissions is estimated in different ways in different literature, depending on how the circular economy is determined, i.e. which actions and sectors are considered to belong to it. The assessment is highly sensitive to how the definition of circular economy covers the energy production and consumption and land use. The assessment is also affected by assessment methods used for determining the circular economy measures on greenhouse gas emissions. (Trinomics 2018; Ruokamo et al. 2021)

Circular economy measures and their emission reduction potentials

The emission reduction potential of circular economy measures have been investigated in Finland in the 'Kiertotalous vähähiilisyiden edistäjänä ja luonnon monimuotoisuuden turvaajana' ('Circular economy as the promoter of a low-carbon lifestyle and biodiversity') (KIVÄBO) report (Ruokamo et al. 2021). The report focused on the following sectors and material flows in Finland's economy that belong to the effort sharing sector, with the exception of the metal and forestry industry.

- construction and use of properties;
- transport system;
- food system;
- metal industry;
- forest industry; and
- plastics, electronics and textiles.

The construction and real estate industry is already implementing circular economy measures, for example by renovation and recycling of demolition waste (Simons et al. 2018). Nevertheless, there is still room for more circular economy solutions in the industry. Circular economy measures identified as essential for reducing the impact on the climate and the environment are lengthening the lifecycle of buildings, increasing conversion flexibility, using secondary raw materials, reducing the amount of construction waste, better utilisation of demolition waste and sharing economy solutions (Material Economics 2018; Ruokamo et al. 2021).

Transport is one of the largest sources of greenhouse gas emissions in Finland and the target is to halve the emissions by 2030. More than 90% of direct emissions from domestic transport come from road transport. Transport is also one of the primary sources of emissions from household consumption along with housing (Nissinen & Savolainen 2019). Circular economy measures that can achieve significant emission reductions in the transport system include power-to-x technology, synthetic fuels and biogas and recycling and reuse of electric vehicle batteries (Ruokamo et al. 2021).

The food system comprises several sectors and industries, from agriculture to foodstuff manufacturing and food consumption. Finland's roadmap to a circular economy shows that Finland is perfectly capable of creating a food system that is significantly more sustainable than the present one (Sitra 2016). Circular economy can contribute to this change. A study by the Ellen MacArthur foundation (2019) suggests that circular economy measures could halve the emissions from the food system globally by 2050. The most important circular economy measures are cultivation methods that renew agricultural land, minimisation of food waste and recycling of nutrients (Ruokamo et al. 2021).

As for plastics, one beneficial circular economy measure could be avoiding incinerating plastic waste for energy generation, since it could bring significant emissions reductions, provided that certain conditions are met. Incineration should be replaced by other solutions, such as renewable sources of energy. At the same time, single-use plastic should be recirculated into raw material by using novel methods, such as mechanical and chemical recycling. (Ruokamo et al. 2021) Some of the carbon dioxide emissions from the production and incineration of plastics can be cut by increasing the efficiency of recycling and reuse of various types of plastic (Roschier et al. 2020). Mechanical recycling consists of collecting, sorting, washing and mechanically modifying plastic for new purposes. Mechanical and chemical recycling complement each other well in terms of material flows, since they are suitable for different types of plastic flows. Lifecycle estimates indicate that chemical recycling of plastics is clearly a better solution than incineration or virgin plastic in terms of carbon dioxide emissions (CE Delft 2019; Material Economics 2018; Ruokamo et al. 2021)

Strategic programme to promote a circular economy

Finland's strategic programme to promote a circular economy was completed in early 2021 (Prime Minister's Office 2021b), based on which the Government adopted a resolution in April 2021. The resolution sets consumption targets for natural resources and outlined a set of measures for the next few years. The aim is reduce consumption of non-renewable natural resources and enable the sustainable use of renewable natural resources such that the total consumption of primary raw materials in 2035 will not exceed 2015 levels. The productivity of resources must be doubled by 2035 from the situation in 2015. The circular material use rate (CMU) must also be doubled by 2035.

Attainment of the targets of the circular economy programme will be stimulated by concluding an agreement on low-carbon circular economy with interested municipalities, regions, trade associations, companies and organisations. An essential part of the agreement is a scenario process in which organisations that conclude the agreement engage in co-operation with research institutes to design roadmaps to a carbon-neutral and resource-wise future. To implement the measures with the highest impact, the parties will offer tools, find suitable sources of funding and fix any bottlenecks. A total of EUR 110 million of funding will be allocated in 2021–2023 for investments that support the reuse and recycling of industrial sidestreams and essential materials.

The promotion of a circular economy in the Medium-term Climate Change Policy Plan is a part of cross-sectoral measures, including municipal climate efforts, carbon footprint of consumption and public procurement. The magnitude of emission reductions that circular economy measures can achieve in the in the effort sharing sector has not been assessed separately, but they are nevertheless essential for reaching Finland's climate targets.

6.3.5 Bioeconomy

In Finnish parlance, bioeconomy means an economy that uses renewable biological natural resources in a resource-wise way to produce food, energy, products and services. Ecosystem services are a part of bioeconomy. Bioeconomy can also include the development and production of technologies, applications and services that are based on sustainable use of natural resources.

Finland's first bioeconomy strategy (Ministry of Economic Affairs and Employment 2014b) was published in 2014. In July 2020, the Ministry of Economic Affairs and Employment launched a project to update the strategy. An important theme identified in the project is to increase the added value of the bioeconomy. The Bioeconomy Strategy extends to 2035.

In order to promote the wellbeing of society, attention will be paid to the overall sustainability of the bioeconomy and the fair distribution of benefits and disadvantages. The bioeconomy strategy seeks to steer Finland towards a comprehensively sustainable carbon-neutral society in a socially and regionally fair way. The comprehensive sustainability approach of the strategy is based on cooperation between industries and the systemic transformation it enables. Close co-operation is a precondition for creating a joint operating model that is based on information on the total amount of resources that can be used sustainably and how the usage opportunities can be shared between the industries. In the best case, this leads to the identification of new opportunities and an integration between the use and recycling of raw materials, enabling sectors to use resources in parallel and as a continuum, which increases resource efficiency. New opportunities for innovation might also emerge. Sustainability is assessed based on scientific knowledge. Demonstrating the sustainability of Finnish bioeconomy is critical for its future success.

The measures of the Bioeconomy Strategy are divided under four headings: (1) higher added value from bioeconomy, (2) a strong knowledge and technology base, (3) a competitive operating environment and (4) usability and sustainability of bioresources and other ecosystems. The strategy also includes sector-specific measures.

The measures to increase the added value of bioeconomy include implementing an RDI programme for the green transition of bioeconomy, and promoting the establishment of innovative pilot and demonstration facilities and the first industrial-scale plants in Finland. Regions are also encouraged to formulate action plans for the bioeconomy. The measures will be funded through the Sustainable Growth Programme for Finland, for example.

7 Achievement of emission reduction targets

7.1 Emission reductions to be achieved by the action plan

The action plan of the Medium-term Climate Change Policy Plan consists of the sector-specific measures identified in Chapter 6.2 of this report and the cross-sectoral measures on consumption and municipal climate work discussed in chapter 6.3. In addition, the action plan contains a one-off flexibility and LULUCF flexibility, which means that the corresponding extra GHG emissions must be reached in the emissions trading and land use sectors (see Chapter 4.1). The Climate Plan for the Land Use Sector (MISU) scheduled to be published in summer 2022 contains decisions on additional measures whose impact will be at least 3 Mt CO₂-eq in 2035, as agreed in the Vuosaari climate meeting. These additional measures will be implemented proactively so that the land use sector's flexibility for the effort sharing sector (0.45 Mt CO₂-eq per year) is available.

Further planning will schedule the measures in the action plan in a way that aligns the emission trends of the effort sharing sector with the annual emission allocations set by the EU. The emission-reducing impact of the additional measures has been estimated against the baseline scenario (WEM). On the whole, the magnitude of the measures expedites the current trend to correspond to the climate objectives described in Chapter 4. In 2030, emissions from the effort sharing sector must be 17.2 Mt CO₂-eq, which is 5.6 million tonnes less than in the baseline scenario.

The current estimate indicates that the measures in the action plan can reduce emissions in the effort sharing sector by an additional 5.7 Mt by 2030 compared to the baseline scenario, including the flexibilities. This means that Finland would achieve the emissions reduction obligation of 50% proposed by the Commission to Finland.

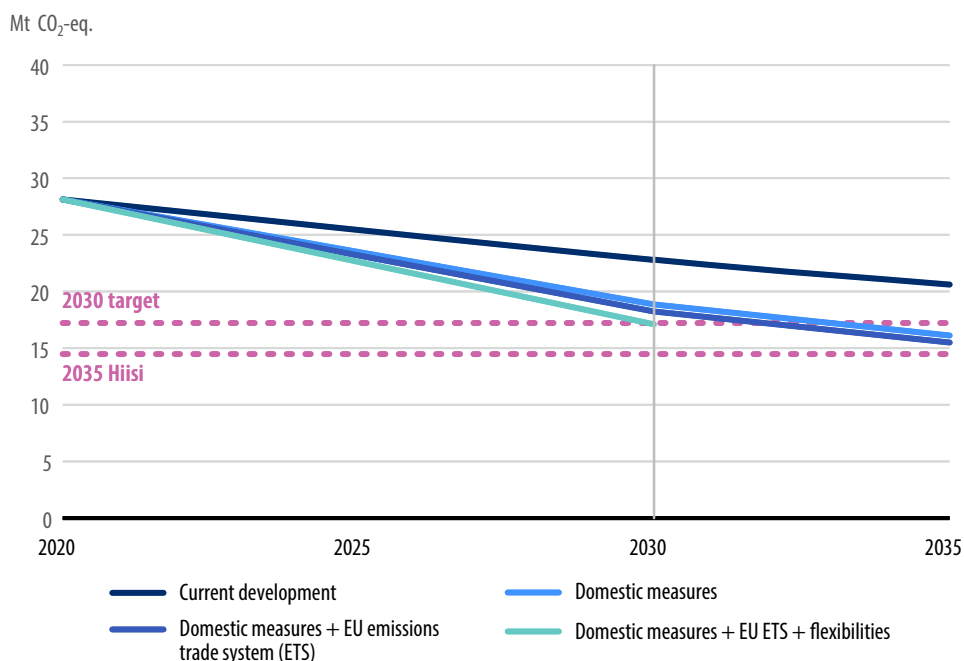
Other economic policy instruments discovered in the background work for the Climate Change Policy Plan but not included in the action plan are an increase of the energy content tax for fuels for non-road mobile machinery and heating, which was investigated in the WEM-S4 scenario of the HISI project (Lehtilä et al. 2021) and the elimination of energy tax refunds in agriculture.

The aggregate emissions in the emissions trading and effort sharing sectors in 2035 should amount to no more than 21 Mt CO₂-eq, i.e. 70% below 1990 levels. The current

and new policy measures in the action plan of the Climate Change Policy Plan would reduce the emissions from the effort sharing sector to an estimated 15.5 million tonnes. Achieving the 14.5 Mt CO₂-eq in the WAM scenario of the Hiisi project (VTT Technical Research Centre of Finland 2021a) would require approximately 1.0 Mt of additional measures. Alternatively, corresponding extra emissions reductions could be gained from the emissions trading or land use sectors.

The uncertainties in the estimated reductions achievable by climate actions increase significantly after 2030. EU climate policy outlines the reductions trends in detail only up to 2030. The target level set for carbon neutrality in 2035 is only indicative. At present, the required reduction in emissions in the effort sharing sector after 2030 depend on the actual emissions level achieved in 2030 without flexibilities and also on the emission trends in the emissions trading and land use sectors.

Figure 28. Emission trends in 2020–2035 in the WEM scenario (VTT Technical Research Centre of Finland 2021a; Ministry of Transport and Communications 2021a; Maanvilja et al. 2021; Forsberg 2021) and WAM scenario in the action plan. The obligation for 2030 is 17.2 Mt CO₂-eq and 2035 Hiisi represents the emission level of the effort sharing sector, which is 14.5 Mt CO₂-eq. in the WAM scenario in 2035.



The emissions reductions achievable by the measures were estimated by experts at the VTT Technical Research Centre of Finland, Natural Resources Institute Finland, Finnish Environment Institute, Ministry of Economic Affairs and Employment and Ministry of

the Environment. The calculations on the impact of the measures, the actualisation of the baseline scenario and the changes in the operating environment involve many uncertainties. There is no detailed plan yet on the implementation and schedule of each measure. Planning of the details of the implementation will continue even after the Medium-term Climate Change Policy Plan has been published. If the proposed measures do not achieve the planned reductions in emissions, new measures need to be prepared and implemented.

Table 6 is a summary of the estimated emissions reductions by sector, and Table 7 is a summary of emissions levels by sector in 2030 and 2035. Sector-specific emissions levels for 2030 were calculated by subtracting from the emissions in the WEM scenario for 2030 the emissions reductions achievable in that sector by the measures in the action plan presented in Table 6. The sector specific emission levels for 2035 were calculated by taking into account the additional emission reductions for 2035 and the emission reductions of the WEM scenario for 2030–2035.

Table 6. Sector-specific estimates of emissions reductions in the action plan of the Medium-term Climate Change Policy Plan (Mt CO₂-eq). The 2030 reductions have been calculated in relation to the baseline scenario, and the additional reductions by 2035 in relation to a situation in 2030 in which the emissions reductions have been met. The reduction target for 2030 is 5.6 Mt CO₂-eq, which would be met with the planned actions.

	2030	2035
Transport (see Chapter 6.2.1)	1.3	0.9
Roadmap to fossil-free transport, phase 1	0.4	
Roadmap to fossil-free transport, phase 2	0.2	
EU emissions trading	0.4	
Increasing the distribution obligation to 34%	0.3	
Agriculture (see Chapter 6.2.2)	0.6	0.1
Actions of the WAM scenario created in the HISSI project	0.3	0.1
Increasing paludiculture and additives in feed	0.2	
Other measures in agriculture	0.1	
Building-specific heating (See Chapter 6.2.3)	0.7	
Phasing out oil heating in residential and service properties	0.6	
Increase of the distribution obligation of bio-LFO	0.03	
Energy tax +2.7 €/MWh	0.01	

	2030	2035
EU emissions trading	0.1	
Non-road mobile machinery (see Chapter 6.2.4)	0.5	
Increase of the distribution obligation of bio-LFO	0.2	
Energy tax +2.7 €/MWh	0.02	
Promotion of biogas	0.04	
EU emissions trading	0.1	
Other measures	0.1	
Waste treatment (see Chapter 6.2.5)	0.1	
Green Deal for waste incineration	0.1	
F-gases (see Chapter 6.2.6)	0.3	0.1
Industry and other emissions (see Chapter 6.2.7)	0.7	0.1
Increase of the distribution obligation of bio-LFO	0.2	
Energy tax +2.7 €/MWh	0.1	
Promotion of biogas	0.06	
Roadmaps	0.2	0.1
Defence Forces' actions	0.04	
EU emissions trading	0.06	
Equivalent emissions in emissions trading	0.05	
Municipal actions (see Chapter 6.3.1)	0.2	0.1
Actions by consumers (see Chapter 6.3.2)	0.2	0.1
One-off flexibility	0.7	
LULUCF flexibility	0.4	
Impact of the current actions in 2030–2035		1.4
Total	5.7	2.8

Table 7. Sector-specific emissions level in 2030 and 2035 achievable by the action plan (Mt CO₂-eq). The emissions were calculated by GWP values corresponding to AR 5 (IPCC 2013). In addition to sector-specific actions, the emissions reduce due to cross-sectoral actions and flexibilities for 2030, which ensure the achievement of the targets, see the table 6.

	2030	2035
Transport	6.3	4.4
Agriculture	5.6	5.5
Building-specific heating	0.7	0.6
Non-road mobile machinery	1.7	1.5
Waste management	1.8	1.7
F-gases	0.2	0.1
Industry and other emissions	2.4	2.3
Total	18.7	16.1
Total including cross sectorial measures and flexibilities for 2030	17.1	15.5

7.2 Uncertainties in the attainment of targets

The HIISI project estimated the uncertainties associated with the attainment of emissions targets (Soimakallio et al. 2021). The actualisation of the WEM scenario is uncertain in and of itself. The WEM scenario is not a forecast, but seeks to describe the expected trajectory that would take place without any new climate measures. In addition to the measures decided on by the end of 2019, the WEM scenario also considers a set of macroeconomic assumptions, for example on the trends of demographics, industrial production volumes and the structure of industry, community structure, the consumption of energy, food and other commodities and the development of technologies associated with them. Naturally, any of the assumptions on individual measures and their expected impact might prove to be incorrect. Likewise, the long-term impact of the COVID-19 pandemic on emissions is uncertain and linked to the changes caused by the pandemic in the consumption of energy and other commodities and services. In order to ensure that the climate targets are met, the package of emissions reduction measures should be oversized from the start.

The key risks in the effort sharing sector that prevent the planned reduction of emissions are associated with the electrification of transport and commercialisation of new energy technologies, availability of bioenergy and using it as a zero-emission energy, actualisation of control measures and ensuring the availability of sufficient funding, use of flexibilities, the actualisation of emissions reduction in line with the annual emission allocations of

the effort sharing sector, actualisation of the emissions trading for transport and buildings proposed by the Commission, actualisation of the proposed Energy Efficiency Directive, promotion of industry roadmaps and the investments required by them, additional emissions reductions by green deals and cross-sectoral measures, and changes in people's values, attitudes and behaviours. Climate change might also involve increasingly strong multiplier effects and feedback loops, which might lead to uncontrollable changes in the operating environment. These changes might trigger problems in international security, financial stability and balance of ecosystems that complicate the achievement of emissions reductions.

When evaluating the action plan of the Climate Change Policy Plan, it should be kept in mind that the sizing of the emissions reduction measures is based on the Commission's proposal on a 50% emissions reduction obligation for the Finnish effort sharing sector. The obligation might change in further negotiations. The emissions reduction sought in 2030–2035 is based on Finland's carbon neutrality target, which is highly sensitive to the trends in the carbon sink of forests and the price of emission allowances in the EU emissions trading. It is also possible that the entire framework of targets will be revised in the next 15 years if the current targets are not found to be sufficient for combating climate change. On the other hand, discontinuing fossil fuels, electrification of transport, heating and industrial processes and changes in consumers' diet might take place quicker than expected at the moment.

A key uncertainty factor in the action plan is whether the Commission's Fit for 55 proposal on emissions trading for transport and buildings will be approved. The estimated impact of the new EU-wide emissions trading mechanism on emissions from domestic transport is 0.4 Mt CO₂-eq and on emissions from the heating of buildings and non-road mobile machinery 0.2 Mt CO₂-eq. If it appears that the new emissions trading system will not become a reality, 0.6 Mt of substitute measures will have to be found by 2030.

All emissions reductions presented in the action plan that can be achieved by single measures are estimates by experts that are based on the best available knowledge, but also on rough assumptions in some aspects. The actual reduction of emissions might therefore differ from the estimates to some extent, due the uncertainty factors above, including funding. The impact of policy measures is fraught with uncertainties which also have an impact on the entire action plan. Another thing to consider when estimating the realisation of the emissions reductions is decision-making risk which refers to uncertainty on whether it will be possible to make decisions on the measures in the action plan in time to ensure the successful implementation of the measures. Due to these uncertainties, further planning of emission reduction measures must strive to do better than the targets by a sufficient margin of error.

At this point, it is very difficult to estimate the impacts of the crisis in Ukraine on the Medium-term Climate Change Policy Plan. The development of the crisis, direction of it or its duration are nearly impossible to predict for now. Based on the conclusions made until now, it can be expected that the crisis will speed up shift away from the use of fossil fuels due to the risks related to them. At least in the early stages of the conflict, the fossil energy prices, such as transport and heating fuel prices have increased. Because of the stronger price signal from the world market prices, the emission trends can change faster than estimated in the scenario of this Medium-term Climate Change Policy Plan. However, it is also essential for emission trends, which actions are chosen to alleviate the effects of the crisis.

8 Links between climate policy and air pollution control

Combustion of fuels releases emissions that have an impact on both global warming and air quality. Almost all climate actions also improve air quality. An improvement in air quality improves human health and comfort, which increases the general acceptability and profitability of climate actions. A reduction in health issues reflects favourably on the economy and lowers the costs of climate actions.

Many kinds of compounds are considered air pollutants. Some of the pollutants warm the climate and some cool it. The most significant short-lived climate pollutants (SLPCs) are black carbon (BC), ozone in the lower atmosphere and methane. Measures to reduce SLPCs have a relatively rapid impact compared to measures targeted at greenhouse gases that remain in the atmosphere for decades or even a century.

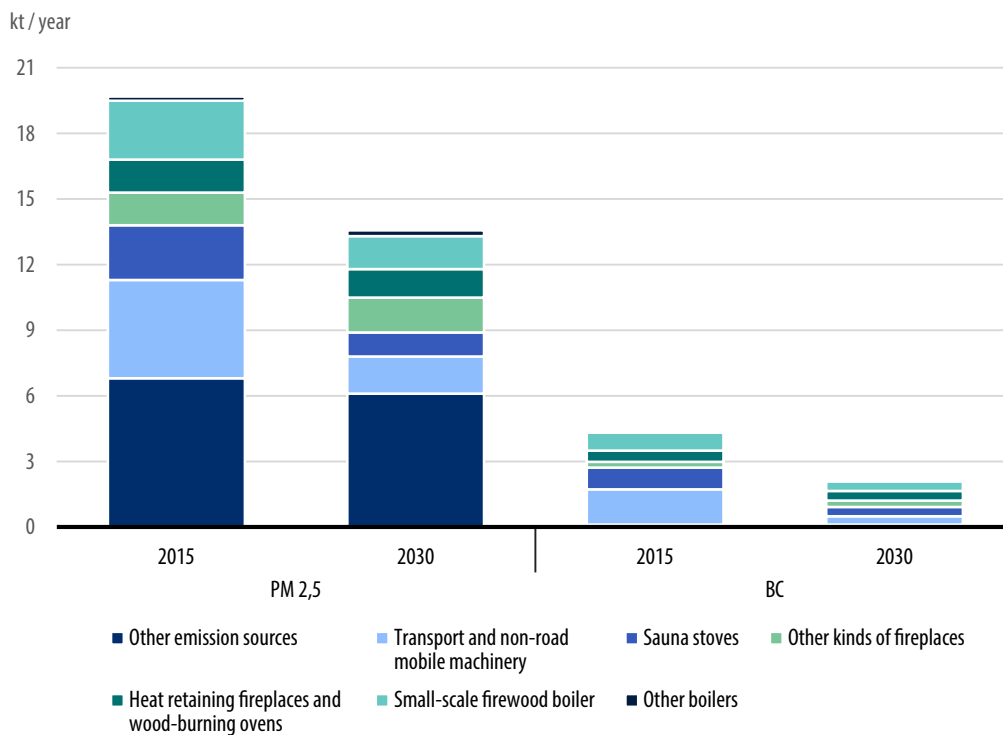
8.1 Key air pollutants in Finland

Air quality in Finland is generally good. Nevertheless, even in Finland air pollutants cause health problems, acidification and eutrophication. Most of the health problems are caused by fine particulate matter ($PM_{2.5}$), but inhalable particles (PM_{10}), nitrogen dioxide and ozone also cause obvious health hazards.

Half of the concentrations of fine particulate matter in Finland are caused by long-range transboundary air pollution from other countries and the other half by domestic sources of pollution. Domestically, the most significant sources of emissions are small-scale combustion of wood and exhaust gases from transport, since they are released at near breathing heights. The adverse effects of small-scale burning of wood are greatest in low-rise residential areas, while significantly fewer people are exposed in sparsely populated areas. Fine particulate matter from combustion processes, such as vehicle exhaust and small-scale combustion of wood are considered particularly harmful to health. In future, the relative significance of small-scale burning of wood as an emission source will further increase as transport emissions will decrease.

Figure 29 presents the total emissions of fine particulate matter and black carbon by emission source in Finland in 2015 and forecasted emissions in 2030 based on the WEM scenario of the climate and energy strategy.

Figure 29. Total emissions of fine particulate matter (PM_{2.5}) and black carbon (BC) in kilotonnes per year in 2015 and 2030 by emission source. Black carbon emissions are also included in the two left bars representing fine particulate matter emissions. Other emission sources in this category are energy production in incineration plants, industrial processes, peat production and agriculture, which here refers only to direct emissions from agriculture. Agricultural emissions from combustion are visible in other sectors. (Savolahti 2021)



In addition to small-scale burning of wood, the main sources of black carbon emissions in Finland include road transport and non-road mobile machinery. Emissions from these two sources will decrease as a result of developments in air pollution control legislation and technology. Future levels of fine particulate matter emissions will, to a great extent, depend on developments in the prevalence of small-scale burning of wood and the methods introduced to cut its emissions. In 2019, black carbon emissions were estimated to be 3.8 kt per year. The emissions are estimated to fall by 42%, i.e. to 2.2 kt per year by 2030.

8.2 Air pollution control legislation and international agreements

Air pollutant emissions are subject to the UNECE Convention on Long-range Transboundary Air Pollution (Air Convention) and its protocols, the most important of which is the Gothenburg Protocol. The EU implemented the Gothenburg Protocol obligations by the National Emission Ceilings Directive (NECD) (2016/2284). The NECD does not directly regulate emissions covered by climate policy, but its requirements concerning fine particulate matter will indirectly also reduce black carbon emissions. The NECD imposes a reporting obligation on black carbon, but no obligation to reduce emissions. The NECD also states that measures to reduce fine particulate matter should be targeted in particular to emissions with a high proportion of black carbon.

On the EU level, air pollution is controlled by the Industrial Emissions Directive (2010/75), the Medium Combustion Plants Directive (2015/2193), Requirements of Ecodesign of Boilers and Fireplaces (2015/1189 and 2015/1185), Directive on Energy Performance of Buildings (2010/31), Euro emissions standards for vehicles, fuel quality standards and directives on air quality that define limits for particles, nitrogen dioxide, sulphur dioxide, lead and benzo(a)pyrene, among other substances.

On the local level, section 145 of the Environmental Protection Act (527/2014) obligates a municipality to create a medium-term or long-term air pollution control plan if the limits are exceeded or in danger of being exceeded. In Finland, only Helsinki has created an air pollution control plan.

8.3 The National Air Pollution Control Programme and its climate measures

The Government approved the National Air Pollution Control Programme (Ministry of the Environment 2019) in November 2019. The Air Pollution Control Programme is a part of the national implementation of the NECD (2016/2284). The Air Pollution Control Programme contains the actions that implement the reduction obligations set in the NECD for air pollutant emissions of sulphur dioxide, oxides of nitrogen, non-methane volatile organic compounds (NMVOC), fine particulate matter and ammonia. The national measures against fine particulate matter play an important role in the Air Pollution Control Programme due to the health hazard they pose. Many measures that reduce fine particulate matter also reduce black carbon emissions.

Calculations show that Finland will achieve the emissions reductions required by the NECD already with the agreed measures in the climate and energy strategy and the agricultural ammonia action plan. Nevertheless, air pollutants keep causing adverse effects on the environment and human health. This is why the programme contains measures that improve air quality further and reduce exposure to these pollutants. The Air Pollution Control Programme contains measures that reduce emissions from transport, mitigate the adverse effects of street dust, reduce emissions from small-scale combustion and link air pollution control widely in the decision-making on different sectors. The measures that reduce emissions from transport and small-scale combustion are also significant for mitigation of climate change.

Vehicle exhaust emissions have already been reduced effectively and the reduction will continue further under EU vehicle legislation. At present, however, the development of the transport system and vehicle stock prioritises the mitigation of climate change instead of reducing air pollutant emissions. On the other hand, almost all climate-related emission reduction measures in transport also reduce air pollutant emissions. Of the climate measures in transport, only the increase of biofuels is a measure that does not cause a simultaneous reduction in air pollution emissions.

Since the emissions reduction measures in transport are closely connected to climate measures, most of the emissions reduction measures in transport are presented in transport policy outlines rather than in the Air Pollution Control Programme. The Air Pollution Control Programme supports these outlines and promotes their implementation. Measures in the Air Pollution Control Programme focus on expediting the transformation of the vehicle fleet, supporting the increase of the share of low-emissions vehicles and supporting the reduction of transport performance of passenger cars. A reduction in road traffic reduces not only emissions, but also the generation of street dust, which improves air quality further.

The measures that seek to reduce emissions from small-scale combustion of wood focus on promoting correct ways to use fireplaces, reducing emissions from wood-heated sauna stoves and prevention of adverse effects from smoke. Below are some examples of the measures in the National Air Pollution Control Programme, all of which also reduce emissions from black carbon:

- Enhancing the spread of good communication practices to municipalities
- Raising awareness of harm caused by small-scale burning of wood among the general public
- Increasing information provision and instruction on the correct ways to use fireplaces

- Determine the possibility for setting technical requirements for wooden stoves.
- Determine the possibilities of making voluntary agreements (green deals) with sauna stove manufacturers.
- Determine the introduction of incentives for replacing old wood-heated sauna stoves.

Measures that seek to reduce emissions from old wood-heated sauna stoves are significant, and they are also important on a national scale both in terms of air pollution control and the climate. Old wood-burning boilers and wood-heated sauna stoves cause significantly higher particle emissions and black carbon emissions than other fireplaces (Figure 28). Wood-burning boilers are gradually being replaced by other forms of heating, and the particle emissions from new boilers are subject to the EU Ecodesign Directive, which applies to new solid-fuel fireplaces and boilers that are entering the market. However, the Ecodesign Directive does not apply to wood-heated sauna stoves, which are being installed increasingly also in urban areas. This means that emissions from fireplaces and boilers under the ecodesign regulations will reduce after 2020, even though the equipment base itself is being renewed only slowly. As emissions from other fireplaces keep falling, the proportion of emissions from wood-heated sauna stoves keeps increasing. Therefore, the Air Pollution Control Programme emphasises the reduction of emissions from wood-heated sauna stoves.

9 Participation in the creation of the Climate Change Policy Plan

A wide range of citizens and stakeholder groups was heard during the preparation of the Medium-term Climate Change Policy Plan. Participation opportunities like these were mostly arranged during the early phases of preparation, so the discussions did not revolve around the final entries in the plan, but were on a more general scale. There is considerable interest in climate matters, which is demonstrated, for example, by the high respondent rate of the citizen survey. This plan is based on the principle that carbon neutrality should be achieved as cost-efficiently and fairly as possible. This wide-ranging engagement of citizens produced valuable information on the impact of various climate actions.

In addition to the hearings described in this chapter, the Ministry of the Environment held two stakeholder events on the fairness and equality of climate actions. The outcomes of these events are described in more detail in Chapter 10.3. For more information on the hearings, see the Climate Change Policy Plan website (Ministry of the Environment 2021b).

9.1 Citizen survey

The Ministry of the Environment set up an online survey to collect citizens' opinions on how emissions could be mitigated effectively and fairly. The survey ran from 19 January to 19 February 2021 and proved to be very popular with 18,000 responses. The themes in the survey were transport, food and housing, which are the primary sources of emissions from consumption. The survey contained multiple choice questions and free text fields which asked the respondents to assess the acceptability of different measures and their impact on the respondent's life. Opinions on the measures differed widely, particularly between residents in urban and sparsely populated areas and different age groups. Young people and residents of urban areas supported climate measures the most.

Of the measures that guide citizens towards low-emissions choices, clear labels on foodstuff packages and well-maintained and safe pedestrian and cycle routes were considered most acceptable by the respondents (Ministry of the Environment 2021c). Direct financial subsidies were also considered effective. The least popular measures were a significant increase in the price of fuel, electricity, heat and heating oil. A steep increase in the price of fuel was considered very unfair or somewhat unfair by 83% of the respondents, and a steep increase in the price of electricity, heat and heating oil was considered very unfair or somewhat unfair by 88% of the respondents. What comes to

effectiveness, only 45% of applicable respondents felt their choices could be affected by menu options in canteens or an improvement in the public transport connections in a city.

In the free-text responses on food topics, the majority of respondents highlighted the importance of pricing. Young people brought up matters related to school lunches, while older respondents talked about food waste. Policy measures on mobility and electrification of transport prompted the highest number of free-text responses. Most of the respondents considered the costs of low-emissions motoring important. Urban dwellers are often interested in recharging possibilities, whereas many people who live in sparsely populated areas described the conditions in the countryside. Under the theme of housing, most opinions were expressed on energy solutions and the possibility to acquire them. Financial support is a recurring topic in many replies, especially with respondents that have a positive attitude towards policy instruments. (Repo & Matschoss 2021)

9.2 Citizens' Panel

The Climate Policy Roundtable and the Ministry of the Environment commissioned the University of Turku to arrange a Citizens' Panel on climate action. The Panel's sessions were held in April 2021. The Panel contemplated the fairness and impact of the climate action in the Climate Change Policy Plan and issued a statement. The Panel had 33 members selected by random sampling. The Panel's input consisted of a list prepared by the Ministry of the Environment on 14 measures on transport, housing and food that might be included in the Climate Change Policy Plan. The discussions in the Panel's small groups adhered to the rules of deliberative discussion, which seek to increase common understanding.

In the general points of the statement the Panel points out that, even if people are prepared to take action to slow down climate change, they are worried about the economic impacts that climate actions may have on them. The Panel considers it important to take individual and regional differences into account in the actions included in the Climate Change Policy Plan.

9.3 Hearing young people and children

Surveys made by young people

To support the preparation of the Climate Change Policy Plan, young people were asked which kind of measures would help mitigate consumers' emissions that originate from housing, mobility and food consumption. To achieve this, the Government cooperated with the first-year students of the European Studies Programme of Tampereen lyseon lukio high school. The students designed surveys to collect opinions on these themes on a larger scale. The surveys reached a total of 2,000 young people as well as older age groups in Tampere and its surrounding municipalities. The suggestions created by the young people contained several concrete measures and information on the acceptability of measures in general, which helps in the preparation of the Climate Change Policy Plan. Messages from the hearings were an important reminder that young people do not see consumption simply as choices made by individuals. Instead, the young expressed their support for political measures that guide consumers towards climate-friendly behaviours.

The young people who responded to the survey highlighted the importance of public transport in particular. The respondents also proposed support for electric vehicles, development of charging infrastructure to cover parking lots of apartment blocks, and a state-owned charging network company. The responses indicate that young people's dietary choices are affected not only by price and quality of food, but also the dietary habits of their families. Vegetarian food was preferred due to its appearance, novelty and climate impact. The respondents were of the opinion that consumption could be made more sustainable by paying attention to consumption patterns, reducing packaging waste, redefining needs and investing in more sustainable products. The young respondents hoped for policy instruments that would target schools and restaurants in particular.

The worst obstacles to sustainable consumption were the habits of the respondents' families and other people close to them. The young people were of the opinion that they would be able to change their own consumption patterns primarily by collecting information and making better choices as a result. The young people also suggested using taxation as a means of increasing and incentivising the supply of climate-friendly products. Furthermore, the young people stated that all climate solutions must be made in a socially fair way without limiting anyone's fundamental rights in the name of climate.

Other hearings of young people

During a course at the Climate University, a hearing in English was arranged for students and researchers in 2020. The need for guidance by information and clarity of information were highlighted at the hearings. Participants hoped for more information on the carbon

footprint of products and certificates that guide towards climate-friendly consumption. The role of businesses was seen as critical for emissions reductions, including the control of businesses through regulation, taxation and public procurements. The need to consider the regulation of advertising was also highlighted the hearings.

A hearing was also arranged for young people in aftercare services in child protection in late 2020. The young people emphasised that consumers should be supported to move away from unnecessary or conspicuous consumption and towards sharing economy, for example in electric cars. The young people also stated that the cost of public transport should be reasonable and the availability of rental bikes should be improved. Other desirable measures were subsidies for affordable climate-friendly food and developing more recipes for climate-friendly food.

In November 2021, the Youth Academy held four workshops for students of vocational schools and upper secondary schools in which the students could voice their opinions on the themes of the Medium-term Climate Change Policy Plan. The workshops for students of vocational schools discussed non-road mobile machinery in particular, while the discussions with the upper secondary school students focused on consumption. Incentives for transferring to low-emission non-road mobile machinery were considered important. A particularly effective solution was the use of environmentally-friendly fuels.

The upper secondary school students considered taxation as an instrument that could steer consumption towards low-emission choices. Many other instruments could also incentivise consumers to change their consumption patterns. In general, both groups of students considered the plan and its measures important for themselves and the future generations.

9.4 Hearings and negotiations with the Sámi

Sámi Parliament

Pursuant to section 9 of the Act on the Sámi Parliament, the Ministry of the Environment reserved an opportunity for hearings and negotiations with the Sámi Parliament on the preliminary measures in the Climate Change Policy Plan. The Sámi Parliament considered the Climate Change Policy Plan important and the transition to low-carbon community structure and transport system essential. The Sámi Parliament stated that a fair transition towards carbon neutrality should take place without the climate measures endangering Sámi livelihoods and culture.

According to the Sámi Parliament, it is important to assess whether increases in prices could reduce the profitability of the livelihoods. Any negative impacts of the climate measures on the costs of or possibility to practice traditional livelihoods should be compensated, said the Sámi Parliament. The Sámi Parliament expressed concern that the measures in the Climate Change Policy Plan might not take into account regional aspects in some sectors. The Sámi Parliament requested further clarifications from the Ministry of the Environment on how the Sámi people are taken into account in the measures of the Climate Change Policy Plan.

Any kilometre-based control scheme for vehicle mobility should be as fair as possible so that it would take into account the costs of non-road mobile machinery, investments and operating costs. The energy efficiency of snowmobiles and ATVs and measures that improve this were considered important. The Sámi Parliament considered local food security as particularly important for the Sámi people.

Skolt Sámi Siida Council

The Ministry of the Environment head the Skolt Sámi Siida Council during the preparation of the Climate Change Policy Plan. The Siida Council stated that an increase in fuel price will affect the cost of practicing traditional livelihoods. The use of fuels for both mobility and non-road mobile machinery was seen as essential also in the long term. Electrification of non-road mobile machinery was not considered likely in the short term due to the lack of suitable technology and infrastructure. Kilometre-based taxation was seen as unfair due to the long distances that are characteristic of Lapland. Furthermore, the need for minerals required for the electrification of transport was seen as a challenge to Sámi livelihoods. The Siida Council proposed that the importance of locally grown food be highlighted in the policy measures. Support instruments for the use of non-road mobile machinery were considered welcome. Topical and essential documents and bulletins on climate policy should be translated into the Sámi languages to provide information for the Sámi.

9.5 Stakeholder consultations

In January 2021, the Ministry of the Environment held an open webinar on the launch of the preparation of the Climate Change Policy Plan. The webinar described the progress of the preparation and opportunities for participating in it.

The Ministry of the Environment also held a workshop in April 2021 where stakeholders were able to express their views on the planned measures in Climate Change Policy Plan. The workshop consisted of a presentation on the preliminary emissions reduction measures in transport, agriculture and energy use of buildings. The participants were

divided into small groups that could state their views on the preliminary measures and present ideas on how to reduce emissions and promote social fairness.

In the transport group, the measures considered most important and having the strongest impact were the promotion of alternative motive powers and the policy instruments for reforming the vehicle fleet. The most important measure of all was subsidies for sustainable mobility. The agriculture and food group discussed the discontinuation of the cultivation of peat fields and restoring them to their original state and the promotion of domestic plant proteins. The stakeholder representatives highlighted that the usefulness of the measures should be investigated comprehensively, taking climate, diversity, the economy and social and regional fairness into account. The building energy group emphasised the significance of energy efficiency, such as a tightening of energy efficiency norms and phasing out oil heating. The group also wanted social fairness to be taken into account in energy repairs, especially regarding low-income individuals.

The Climate Policy Roundtable held a discussion on the Climate Change Policy Plan in early May 2021. Important topics in the discussion were the different dimensions of climate measures, the cost-efficiency of the measures and the coherence of Finland's policy with the EU-level policy. The fairness of climate policy was discussed not only from the perspective of different sectors, but also of different generations.

9.6 Hearing of special groups

The older people's council of the six largest cities in Finland emphasised the carbon footprint and the way it is calculated. The older people's opinion was that investing in public transport is essential for the mitigation of the carbon footprint. The provision of information is also important for the consumption choices of the elderly and should take into account their special needs.

The councils for the disabled in the six largest cities in Finland were heard on the policy outlines of the plan. The councils considered it highly important to develop the transport service system towards lower emissions. Recycling might be difficult for people with disabilities, and the functionality and maintenance of assistive devices might also be important in terms of emissions. Cities should pay attention to the electrification of the car fleet of home care.

9.7 Written statements

The Ministry of the Environment requested statements on the draft Climate Change Policy Plan via the lausuntopalvelu.fi service from 8 December 2021 to 14 January 2022. Two hundred and ten statements were received, comprehensively representing the sectors affected by climate policy. Sixty-seven of the statements came from private individuals. The Ministry of the Environment commissioned Motiva Oy to create a summary of the statements (Motiva Oy 2022).

The majority of the statements that evaluated the impact of the Climate Change Policy Plan's additional measures or action plan sought more ambitious climate measures. In particular, more ambition was desired for the reduction of emissions from transport and agriculture, building-specific heating, carbon footprint of consumption and public procurement. The parties seeking more ambition were mostly associations, communities and private individuals. Many free-text responses expressed support for the targets and measures of the Climate Change Policy Plan, but they also presented many additional suggestions and clarifications. Some of the targets and measures were criticised as insufficient and a few respondents proposed downscaling or a review of some measures.

The action plan was praised for its wide scope of emissions reductions and that the measures contain a large amount of new policy instruments that also promote structural changes. The draft Climate Change Policy Plan was praised for its mix of sector-specific measures and cross-cutting measures. On the other hand, many respondents criticised the uncertainty and slowness of the measures, and wished for more buffers and policy instruments against uncertainties. Some respondents also wished for a more accurate and systematic assessment of impact. A challenge identified in the statements was that the plan contains measures whose political preparation is still ongoing or on which no actual decision has been made. Examples of these are the measures in the EU Fit for 55 package, such as an emissions trading system for road transport and building-specific heating. The statements proposed that the identified additional measures be implemented instead of using flexibilities to achieve the missing emissions reductions.

Regarding measures affecting transport, several of the comments discussed the emissions trading scheme proposed by the European Commission. Comments with a positive attitude towards the scheme proposed a national solution if the EU-level scheme is not implemented. Critical statements considered emissions trading a threat to the competitiveness of the industry and partially overlapping with the current taxation structure. Several statements considered incentives and subsidies as important factors for preventing the adverse effects of climate measures. Many statements that were critical towards the climate measures of the transport sector expressed concern about the impact of the proposed emissions trading, fuel tax increases and the distribution obligation on

low-income households and households in sparsely populated areas. The commenters also wanted the solutions to take regional differences into account.

In the agriculture sector, frequently discussed topics were the ban on clearing peat fields, subventions to the meat and dairy industry and an update to the nutrition recommendations, which many respondents criticised for lacking ambition. On the other hand, many interest groups, in particular, presented partially opposing views, emphasising the importance of carbon-sequestering agriculture and biogas.

Regarding building-specific heating, the blending obligation for heating fuels was considered a step in the right direction, although the respondents considered liquid biofuel oils better suited for other sectors, such as a fuel for non-road mobile machinery. The respondents expressed widespread support for subsidies that encourage people to phase out oil heating and measures that improve the energy efficiency of buildings and the use of renewable energy. Many respondents emphasised that the subsidy and funding mechanisms should be developed fairly and efficiently towards non-fossil energy systems.

Regarding non-road mobile machinery, the statements generally supported the proposed policies. The introduction of procurement support for electric and biogas-powered tractors and other non-road mobile machinery received broad support and so did policy instruments towards the electrification of non-road mobile machinery. Some commenters wanted agricultural and forestry machinery to be included in the plan. Criticism towards the proposed measures stated that the measures result in unreasonable costs for small operators and that an increase in energy tax will also increase the costs of the machinery operators. Expanding the registration obligation of non-road mobile machinery divided opinions.

Comments on the measures for receiving emissions from waste expressed their support on the hierarchy of waste, where first priority is avoiding the generation of waste, followed by an increase in the level of recycling and investing in a more ambitious circular economy. Opinions were favourable towards a voluntary green deal to reduce greenhouse gas emissions over the entire waste value chain of community waste incineration, but reducing the incineration of municipal waste to energy also requires other policy instruments.

Measures that seek to reduce F-gases received widespread support. The reduction targets should also be extended to other strong GHGs, such as anaesthesia gases. The statements called for research on F-gases and new innovations to replace them.

The measures to reduce emissions from industry were considered a step in the right direction, although insufficient. The promotion of electrification received widespread

support. Energy efficiency agreements and energy audits have achieved significant savings and the proposed subsidies for them received widespread support.

As for the carbon footprint of consumption, measures that were seen as beneficial for expediting it were environmental taxes, limiting the advertising of carbon- and energy-intensive products, environment labels and carbon footprint labels. Provision of information on climate-friendly consumption was praised on the one hand, but also seen as an insufficient in and of itself.

10 Impacts of the Climate Change Policy Plan

10.1 Economic impacts

The economic impact of the policy measures in the Medium-term Climate Change Policy Plan were studied as part of the Carbon-neutral Finland 2035 programme (HIISSI; Honkatukia 2021). The economic impact of a tightening climate policy arises out of the extra costs incurred by the necessary measures; these costs will increase as the emissions reduction target becomes increasingly strict. The idea is that the national economy will finance the investments not only through domestic savings, but also by debt, which increases the current account deficit. The impact on the economy has been assessed in relation to the With Existing Measures (WEM) scenario, i.e. as the difference between the WEM and WAM scenarios. The WEM scenario of the national economy is based on the forecasts published in spring 2021 and updated in the HIISSI project with the results of the low-carbon roadmaps from different sectors and the energy system models created on the basis of the roadmaps. The scenario uses Statistics Finland's population projection from 2019, which indicates that the working-age population will decline throughout the period under review.

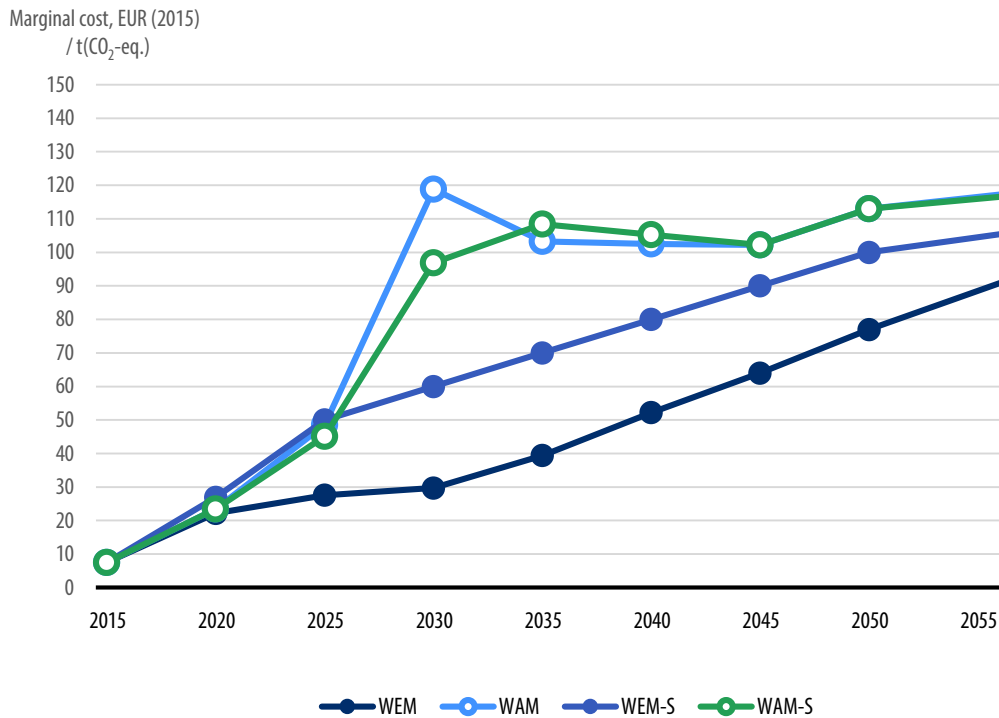
The impacts on the economy arise primarily from additional investments on energy technology, but also from production processes, increased energy efficiency and electrification of transport. On the other hand, these investments reform the consumption and production structures, which brings significant improvements in efficiency and opens new possibilities as the economy becomes increasingly electrified and the emissions from the generation of electricity fall to zero. The structural change is visible in the development of the national economy. The investments required to limit emissions will increase the national product for a large part of the 2020s and 2030s. During this transformation, export volumes and household consumption will fall compared to the WEM scenario, which will mitigate their stimulating effect on growth. However, more productive new technology that is also more energy- and material-efficient will allow the exports to recover and the economy to grow.

The estimates were unable to investigate in detail the financial incentives needed to launch the measures, especially investment subsidies and taxation. The results of the TIMES model indicate that achieving significant emission reductions rapidly will increase the marginal costs of the reductions to a level that is significantly higher than the

estimated price of EU emission allowances. It is therefore likely that domestic emission tax rates need to be increased in order to create the economic incentive for the measures. Likewise, it seems obvious that many of the investments required need support in order to take place rapidly. The economic forecast assumes that energy taxation rates would only stay abreast of inflation up to the 2040s. This would require new decisions on energy taxes. Using flexibilities in the effort sharing sector will reduce the marginal costs to some extent especially in terms of reaching the 2030 target. Figure 30 shows a TIMES model estimate of the marginal costs of emissions reductions in different scenarios. The estimate applies to the entire economy, not just the effort sharing sector, but is nevertheless indicative also for the effort sharing sector. The calculation is based on the optimisation of different measures and assumptions on the costs and actualisation of the measures.

The creators of the plan were unable to comprehensively map the marginal costs of all actions, but the plan contains both very affordable and extremely expensive measures. Among the affordable measures are the improvement of energy efficiency and reduction of emissions from peatlands. By contrast, some traffic sector measures might be fairly expensive from a purely emissions reduction perspective. Estimates from a range of studies indicate that emissions reduction measures in the transport sector will cost from EUR 150 to thousands of euros per tonne of CO₂.

Figure 30. Marginal cost of reducing greenhouse gas emissions in the WEM and WAM scenarios (Koljonen et al. 2021). In the WEM-S sensitivity study, the price of emission allowance is the same as in the WAM scenario. The WAM-S sensitivity study takes the flexibilities of the effort sharing sector fully into account. Using flexibilities has an impact on the marginal costs particularly around 2030.



The investment needs in the effort sharing sector are particularly apparent in the transport sector. However, the largest change comes from a decrease in the consumption of petroleum products. The weakening of household purchasing power can also be seen as a decrease in the demand of consumer goods. Likewise, the demand for many services will remain lower than in the baseline scenario. In 2050, the export of private services will have increased to 3.2%. By contrast, trends in private consumption will decrease the national product by 2.1%, and the only driver for an increase in household consumption will be the demand for electricity.

The structural change will also be reflected in employment rates in the 2030s, when investments are ongoing concurrently in several sectors. More than 11,500 jobs will be created in the processing sector by 2030, and approximately 3,100 in primary production, but nearly 19,000 jobs will be lost from services. The increase in jobs in the processing sector will continue in the 2030s and 2040s and by 2050, the processing sector will have 17,500 employees more than in the WEM scenario. However, the number of people employed in the service sector will fall by approximately 32,000.

The labour demand for specific jobs will also change. The reduction in demand for private services both domestically and in exports will be reflected in service jobs, in which there will be 12,000 fewer by 2050 compared to the WEM scenario, and in office work and expert jobs, which there will be 2,800 and 3,400 fewer in 2050, respectively, than in the WEM scenario. The number of employees in primary production will grow by approximately two thousand.

The structural change triggered by climate policy will affect regional differences, since measures that drive technological reforms and thereby growth will take place mostly in the processing sector and primary production, whereas service production will mostly see investments associated with energy saving (mostly in the building stock). The structural change will increase employment in the processing sector also in the short term, which is why the focus of Finland's national economy will shift towards processing and primary production. This benefits regions where these sectors represent a high proportion of the economy.

The measures in the WAM scenario will primarily and directly affect households' consumption of transport and housing services, but their indirect impact will be evident in the prices of other products and services, depending on how energy- and emissions-intensive their production is. The impact will be relatively higher in the middle- and high-income deciles than in the lower income deciles, since high-income households consume more energy and especially energy-intensive services than lower-income households both in absolute and relative terms. On the other hand, since the impact on employment occurs mostly in the service sector where the earnings level is lower than average, income generation patterns might increase income disparities. Furthermore, costs targeted at households might have a much greater impact on the wellbeing of low-income citizens who consume less than on high-income citizens who consume more (Soimakallio et al. 2021). Households and their consumption patterns can be supported for example in the electrification of transport (procurement subsidies).

The subsidies required by the adoption of new technology will strain the national economy in the 2020s and 2030s, but technological reforms will enable export-driven growth later, which will rapidly balance the economy. The impact of climate policy on households could be compensated by shifting the focus of taxation.

Many measures will initially increase the national product since they increase purchasing power (examples include procurement subsidy for electric vehicles and support for phasing out oil heating) or improve competitiveness (lowering the electricity tax category II) and generate new investments. As a result, total factor productivity will increase, although this effect will dwindle over time when the reform is complete. The increase in net exports will nevertheless persist.

From the perspective of the entire national economy, the additional effects of phasing out oil heating and increasing the distribution obligation will remain small. The package of transport measures is likely to reduce the national product initially due to a drop in private consumption, although the subsidies for electric vehicles and recharging infrastructure will cushion the impact somewhat. After 2030, the increase in total factor productivity will start to have a positive effect on the domestic product.

The limitations of the model calculations should be kept in mind when assessing the economic impacts. At the core of the modelling lies an estimate of the magnitude of the emissions cost shock needed for triggering the investments required by the emissions targets. Many businesses are already expecting an increase in the demand for low-carbon products and services and are making investments on clean solutions even without cost pressures caused by domestic policy. The investments do not necessarily impair the cost competitiveness of the businesses, since the preferences of the export markets are also shifting towards low-carbon products.

The price spike that reduces the disposable income of households might be lower than what the model predicts if the need for a national policy-driven price shock turns out to be less than in the model scenario. If the outlook on export and private consumption is too pessimistic, the scenarios on economic growth and employment are also too pessimistic.

10.2 Impacts on human health and the environment

One of the tasks of the Carbon-neutral Finland 2035 project (HIISI) was to investigate the environmental impact of Finland's emissions reduction targets (Soimakallio et al. 2021). Most of the qualitative investigations were made by comparing the WAM scenario that will reach the targets to the WEM scenario in which the current, already decided policy measures will continue. Both scenarios were modelled in the HIISI project. The HIISI project also reviewed a range of uncertainty factors and risks in the actualisation of the scenarios and examined ways of reducing them.

Reaching the climate goals has positive impacts on the environment and society, but also some negative ones referred to in the Act on the Environmental Impact Assessment of Plans and Programmes by the Authorities. Positive impacts mean consequences that promote the achievement of the set societal objectives, whereas negative impacts mean consequences that hamper the achievement of objectives other than the climate targets. The effects do not only impact the climate, but also air pollution, human health, consumption of natural resources, biodiversity, the soil, bodies of water and citizens' living conditions.

The most significant environmental impacts of the climate measures take place in greenhouse gas emissions, climate change, air pollution, biodiversity, forest carbon sinks and bodies of water. These environmental impacts are linked to human health, comfort and wellbeing. Some of these impacts will be felt outside the Finnish borders. For example, the quantity of emissions that originate outside Finland but are caused by the Finnish national economy is affected primarily by the types of products and services consumed in Finland and how emissions-intensive their production is.

As a rule, attaining the climate targets is assumed to have a positive impact on the environment, since mitigation of climate change will prevent large-scale and partly irreversible and unpredictable effects on the environment and society. The Climate Change Policy Plan contains an action plan for achieving the necessary reductions in greenhouse gas emissions primarily through electrification of transport and by replacing fossil fuels in different sectors by renewable energy and electricity. However, the construction of renewable energy and other infrastructure, including the production of electric vehicles and biofuels, consumes natural resources, which will partly mitigate the environmental benefits. Electrification of Finland's vehicle fleet will increase greenhouse gas emissions abroad, since the manufacture of electric cars produces 40–80% more greenhouse gas emissions than the manufacture of corresponding gasoline-powered cars. The difference is caused by the manufacture of the battery of the electric car. However, the reduction in operational emissions will compensate the emissions from manufacture in less than five years on average.

Electric vehicles will reduce noise and air pollution. On the other hand, an increase in the manufacturing volumes of electric car batteries will increase the demand for rare or critical materials and thereby pressure to open more mines for these materials. The same also applies to renewable energy. Mines might have a significant local impact on the environment and working conditions of miners especially in developing countries. However, innovations in battery materials might emerge. In addition, the recycling of battery materials and the energy storage capacity of batteries can be expected to improve significantly in the next few years. Batteries foster many kinds of trends that contain possibilities for Finnish knowhow and mining, which will create more jobs.

An increase in public transport and pedestrian and cycle traffic and the resulting reduction in transport performance, coupled with an increase in electric cars will have a positive impact on citizens' health and the comfort of their living environment. A reduction of transport performance will reduce street dust emissions and trips made on foot or by bike will increase the physical activity of the population which brings several health benefits. At the same time, it must be kept in mind that the implementation of the policy instruments or regulation might locally increase the pressure on green areas or expose people to noise and air pollution in densely populated communities. The magnitude of these impacts

will be largely determined by planning, design, practical implementation and general technological development.

The concentration of air pollutants will fall, although the health risks from both domestic and transboundary air pollution will remain significant. The largest domestic sources of emissions are street dust and small-scale combustion of wood, which the current climate actions do not affect very much. Exhaust emissions from transport have already fallen significantly and will keep falling as engine technology develops. Therefore, changes in the motive power of vehicles will not have a significant effect on fine particulate matter emissions from exhaust gases. NO_x emissions will fall as electric cars replace petrol and diesel cars and biogas becomes increasingly common in heavy transport. The impact of transport-related air pollution on the air quality of cities and people's exposure to air pollutants ultimately depends on the trends in transport performance, their regional distribution and the community structure.

Small-scale combustion is a source of several air pollutants: fine particulate matter that is hazardous to health, black carbon that contributes to global warming and also small quantities of methane, a greenhouse gas. Emissions from small-scale combustion can be controlled by technical standards, innovations, education and instructions by municipalities. The WAM scenario estimates that small-scale combustion will fall by 20% by 2040 from the 2020 level. If achieved, this would reduce emissions from small-scale combustion and their harmful impact on the environment and health. Emissions from the high chimneys of power plants have an impact on the generation of secondary particles in the atmosphere. The significance of incineration plants on the concentration of fine particulate matter in inhaled air has not been modelled in detail in Finland, but as energy generation shifts away from incineration, air quality can be expected to improve and health hazards reduce.

In agriculture, increasing grass coverage of organic soils and paludiculture reduce the CO₂ and N₂O emissions from the degradation of peat and the leaching of solid matter and nitrogen into bodies of water. Precision farming and the use of catch crops will reduce the need for nitrogen fertilisers and thereby the related emissions into air and water. Methane emissions from dairy cows can be reduced by feed additives. Restricting the clearing of fields can reduce deforestation and the degradation of peat in peatlands, including the associated emissions. Additionally, afforestation of abandoned and poorly productive fields might increase carbon sinks somewhat, but afforestation also reduces the biotopes of species that thrive in open areas and alters the landscape. Producing biogas from biowaste eliminates methane emissions that would be caused by the rotting of the waste and enables nutrients to be recycled, which in turn reduces emissions by reducing the need to manufacture new fertilisers. In farming, biogas production may indirectly reduce land clearing and the consequent emissions into air and water bodies.

Regulation of construction and land use will have a direct impact on living conditions. Old building stock urgently needs energy repairs. While some of the current indoor air problems may be solved as these renovations are implemented, it is necessary to ensure the repairs do not create new indoor air quality risks.

The measures needed to attain the climate targets are based on several different policies that also affect each other. Furthermore, domestic and global economic trends as well as subsidy policies for different types of energy generation will alter the challenges and pressures that the efforts to mitigate climate change will face. The entire course of the development may change rapidly, which increases the uncertainty of impact assessments. Also the intensification of the effects of climate change might hamper the implementation of mitigation efforts, for example due to adverse effects on ecosystems or disturbances in supply chains of energy or raw materials, which would increase costs and the unpredictability of the operating environment. Every individual assumption in the WEM and WAM scenario might prove out to be wrong. Therefore, it will be important to monitor how the anticipated impacts (and those not yet anticipated) develop in order to gain a better understanding of actual developments and to identify areas that need policy changes or more detailed policies. A precondition for this will be systematic data collection on policy implementation and regular evaluation of the consequences.

10.3 Social impacts

One of the premises of the Medium-term Climate Change Policy Plan is to make the transition to low-carbon society as fair as possible. As climate actions are prepared further, their impact on fairness and equality in different sectors, employees and consumers must also be considered. A failure to consider fairness in climate measures could lead to conflicts if the measures cause a disproportionate amount of adverse effect to some groups of people or reduce their income (Soimakallio et al. 2021). The fairness of climate measures can be improved by trying to divide their positive and negative effects evenly in the population, taking into account the needs of different population groups and listening to the stakeholders during the preparation of the measures (Kivimaa et al. 2021).

Under section 6, subsection 1 of the Constitution, everyone is equal before the law. Subsection 2 lays down that no one shall, without an acceptable reason, be treated differently from other persons on the ground of sex, age, origin, language, religion, conviction, opinion, health, disability or other reason that concerns his or her person. Under section 6, subsection 3 of the Constitution, children shall be treated equally and as individuals and they shall be allowed to influence matters pertaining to themselves to a degree corresponding to their level of development. Finland is committed to non-discrimination and equality as part of its international human rights obligations.

The targets for reducing greenhouse gas emissions by 2030 and beyond are so demanding that climate change mitigation measures will have major impacts on people's general living conditions. Some of the measures will encourage innovations, which may offer new business opportunities and jobs. The consumer's position may also change. While technological progress may enable energy savings without the consumers taking on an active role, many of the policies will require a new type of agency from citizens in the changing living conditions. The implementation of the necessary measures might increase income disparity and regional disparity, for example due to increases in the price of energy, unless a fair transition is taken into account in the implementation of the measures. (Soimakallio et al. 2021)

A wide range of citizens and stakeholder groups was heard during the preparation of this Medium-term Climate Change Policy Plan (see Chapter 9). The hearings consisted, for example, of collaboration with schools which ensured that the opinions of children and young people were heard. The indigenous Sámi people were heard in negotiations pursuant to section 9 of the Act on the Sámi Parliament and in a hearing of the Skolt Sámi Siida Council.

The assessment of equality was made by public officials in the Ministry of the Environment in cooperation with the Ministry of Justice and the consultants and researchers who assessed the gender impact of the Climate and Energy Strategy. Equality was assessed in two workshops held for the experts on equality. In addition to the workshops, the assessment of equality also considered the opinions presented in the hearings as well as research data and statistics, including data created during the preparation of the climate and energy strategy and the assessment of gender impact of the Medium-term Climate Change Policy Plan (Paavola et al. 2021).

10.3.1 Social fairness and acceptability of the measures

According to the Finnish Climate Change Panel (Kivimaa et al. 2021), social fairness of climate measures involves several aspects. Examples of these aspects are how the planned policy measures affect the distribution of benefits and adverse effects, how the needs of different groups are taken into account and whether the decision-making process is fair and considers different demographics appropriately. Global fairness and equal human rights must also be taken into account. One of the premises of this Climate Change Policy Plan is to make the transition to low-carbon society as fair as possible. As the climate actions in the plan are prepared further, their impact on fairness in different sectors, employees and consumers must also be considered.

The Finnish Climate Change Panel states that the mitigation of climate change and adaptation to it must be implemented ambitiously to ensure global and transgenerational fairness. The Panel says that climate policy measures can both eliminate or reduce existing inequalities, but might also create new types of inequalities. The mitigation of climate change might also mean that those who consume a disproportionate share of global resources have to give up some of their privileges. The Panel also states that everyone in Finland must be able to afford energy, food and mobility, and must be able to freely choose their place of residence, profession and livelihood.

The hearings held as part of the preparation of the Medium-term Climate Change Policy Plan revealed that as a rule, citizens have a positive attitude towards climate actions, but there are also people who oppose any climate action and people who demand a more ambitious climate policy. The hearings also identified some measures that warrant special attention to ensure their fairness. For example, the results of a citizen survey carried out in 2021 indicate that the most acceptable measures for citizens are clearer labels on foodstuff packaging and the promotion of smooth pedestrian and cycling traffic, while the least acceptable are a significant increase in the price of fuels, electricity, heat and heating oil. Measures considered most effective by the citizens were better communications and price signals that guide consumers towards sustainable choices. Support for climate measures varied by respondent age and place of residence: people under 30 who live in a city or near one had the most positive attitude towards the most ambitious measures, while people in sparsely populated areas expressed less support for climate measures.

The results of the citizen survey and the Citizens' Panel that evaluated the climate measures indicate that the most difficult issues concerning fairness and acceptability are associated with the tax reforms planned along with the climate measures. On the other hand, subsidies, incentives and provision of information were considered very sensible and effective means. Significant tax reforms, bans and limitations raise concerns regarding their appropriate targeting, fairness and acceptability for different groups of people, since regions and their residents differ very much in their capacity to adapt to the regulation without sufficient support. Moreover, wealth inequality and regional inequality, which is accelerated by the structural change in the society, might hamper the execution of climate measures despite the subsidies for a just transition (Kulha et al. 2021). These observations were taken into account when planning the measures in the Climate Change Policy Plan. Achieving the climate targets will nevertheless require a wide spectrum of different measures and the preparation of climate policy must also consider their impact as a whole. The opinions expressed in the hearings are described in more detail in Chapter 9 and the distribution of positive and negative effects as part of the equality assessment (Chapter 10.3.2).

The preparation of the roadmap to fossil-free transport assessed the impact of climate measures in transport. The assessment found that low-income households consume significantly less fuel than high-income households. However, the lowest-income households use a significantly higher proportion of their income on fuel than medium-income or high-income households. Therefore, while an increase in fuel tax would affect high-income households the most in absolute terms, the impact on the lowest-income households might be higher in relative terms, i.e. in proportion to their income. The impact assessment concluded that since the emissions from low-income households are lower throughout Finland than those of medium- and high-income households, the adverse effects of fuel price increases could be compensated to the lowest-income households, and it would only require a small share of the total tax revenue. Promotion of walking and cycling was seen as a way of improving accessibility, especially for the group of people who do not have a car. Lower ticket prices in public transport were seen as a way to prevent mobility poverty. (Ministry of Transport and Communications 2021c)

The draft action plan for phasing out fossil oil heating which was published in spring 2021 assessed the social impact of the phaseout measures. Based on the available data, oil heating as a primary form of heating is distributed fairly evenly across income classes. The assessment found that changing the form of heating is most difficult for lowest-income owners of detached or semi-detached houses, especially if the building is in a poor condition and located in an area where prices of real estate are falling. Supporting the owners of detached or semi-detached houses in phasing out oil heating is financially a more egalitarian solution than the current domestic help credit, since the support for phasing out oil heating is the same in all income categories and households regardless of their size. Phasing out oil heating might make it easier for old people to continue living in their current home, since most of the systems that replace oil heating are easier to maintain. (Ministry of the Environment 2021a).

The Just Transition – JUST FOOD project, a joint research project carried out by several research institutions, investigates how the transition to a climate-wise and healthy food system can be made sustainably, acceptably and fairly. Group discussions held in the project revealed the poor position of farmers and the need for a wide spectrum of political measures and sufficient subsidies to ensure a just transition. Agricultural measures and trajectories do not affect farmers equally. Individual farmers are inevitably in different positions, depending on the line of production, size and geographical location of the farm, the farmer's level of education and previously implemented climate measures. Major crop farms and livestock farms might be financially better equipped to adopt the new technologies and production methods required by the climate measures. As for consumers, soft control measures were considered to be the most acceptable, and public food and catering services were considered to play a key role in the sustainability

of the food system. Climate measures should not increase the existing socioeconomic differences in nutrition. (Paloviita et al. 2021)

Assessments of the social fairness and acceptability of climate measures should also investigate their impact on employment (also see Chapter 10.1). A study on the employment effects of climate policy published in the spring of 2021 (Kuusi et al. 2021) recommends that the changes to the occupational structure and competence needs on the labour market caused by climate change be taken into account when planning climate policy. Based on model calculations, climate policy will have a negative – but relatively minor – impact on overall employment. The study suggests that employment can be supported by shifting the burden of taxation from labour to emissions.

In addition to overall employment, the study recommends that climate policy also take account of the maintenance and development of labour market policy and the functioning of the labour market. Employment and competence related to climate crisis solutions can be supported by means such as raising the level of education. Employment trends can also be influenced by supporting innovation in the production of ‘green’ products.

The Finnish Climate Change Panel (Lipsanen et al. 2021) considers electrification an essential part of the transition to low-carbon energy and has therefore studied the effects of an electrifying society and the energy transition on social fairness. The Panel states that the production and use of critical minerals and metals and energy poverty should be taken into account better in the preparation of policy measures. The price of replacement technology and the form of housing have a massive impact on the fairness of electrification. Subsidies for the procurement of new technology are needed until the new technologies become commonplace and their price falls. The Panel also states that electrification has both positive and negative effects on employment and economy in many sectors, and that these effects should be monitored and also forecasted as far as possible.

Communications can improve the effectivity and acceptability of climate measures. A sufficient amount of reliable information must be available so that climate measures that have a large impact on people’s lives can be justified and made more acceptable (Lyytimäki 2020). The financial impact and policy instruments of climate measures must be communicated clearly and early enough so that people can make the necessary lifestyle changes and apply for the necessary subsidies.

10.3.2 Assessment of equality

The assessment of the equality of the Climate Change Policy Plan supports the identification of links between emissions-reducing policies and equality. As for the rights of future generations, ambitious and diverse actions to reduce emissions support the safeguarding of those rights. One of such safeguards is the assessment of long-term impacts of the climate measures, which will be made in the preparation for further measures.

People's income level and wealth affect their possibilities for engaging in climate actions. The Finnish Climate Change Panel's report on consumption (Linnanen et al. 2020) estimates, based on data from 2016, that the carbon footprint of the highest income decile is almost three times as large as that of the lowest decile. The greatest difference between income deciles comes from greenhouse gas emissions from transport, which are almost four times higher in the top income decile than in the bottom one. Income differences and opportunities to carry out climate actions might affect families and especially the children in low-income families. However, impacts like these can be taken into account in the further preparation of the climate measures by providing compensatory measures to low-income individuals or households.

Some groups of people are more vulnerable than others to the mental health effects of climate change, such as climate anxiety. For example, a survey commissioned by Sitra revealed that young people and women have a higher risk of anxiety (Sitra 2019). The results of the Youth Barometer 2018 indicate that 67% of young people feel moderately or highly uncertain and insecure due to climate change (State Youth Barometer 2018). According to Sitra's study, climate anxiety can be alleviated by practicing a sustainable lifestyle, which is why the consumer-supporting measures in this plan should also target population groups that are particularly susceptible to climate anxiety, such as people under 30 years of age, and treat them as a special group.

Transport

The assessment of the gender impact of the climate and energy strategy revealed that transport sectors are male-dominated. Both positive and negative changes in employment in the entire transport sector and the construction of distribution infrastructure impact men disproportionately. Employment trends in fossil fuel production and distribution might have a negative impact. On the other hand, investments in the manufacture and sales of vehicles powered by new low-emission motive powers and the construction of the fuel distribution infrastructure might create new jobs in the transport sector. The impact on overall employment in medium-term will be positive, especially due to the accelerating rate of car replacement and investments on distribution infrastructure.

If climate measures cause an increase in fuel prices, the impact would be proportionally greatest on low-income citizens but quantitatively highest on high-income citizens. Increased fuel prices would affect especially sparsely populated areas, including the Sámi homeland. However, the price increases could be compensated to the lowest-income groups in taxation, for example (Ministry of Transport and Communications, 2021c). The very lowest-income households often do not have a car, so the impact does not affect them directly.

Some of the measures, such as the scrapping premium and subsidy for low-carbon cars were assessed as supporting medium- and high-income citizens in the purchase of a car, but not low-income citizens. The workshops stated that subsidies or tax deductions for purchasing electric or gas-power cars could be staggered by income or wealth, which might make them more egalitarian than mere lump-sum subsidies. The gender impact assessment of the climate and energy strategy made a significant observation that men represent a higher share of electric car owners than women, probably due to income differences. The workshop proposed a study to determine whether women can be incentivised to purchase electric cars by means of taxation, for example. For lower-income households, support for converting an existing car to run on gas might be a more accessible route to low-carbon mobility than a more expensive electric car.

The National Travel Survey 2016 (Väylä 2018) stated that 85% of men always or almost always have a car at their disposal where they are the driver. The corresponding figure for women is 71%. The opportunity to use a passenger car increases car use and also reduces the use of other modes of transport.

The latest transport statistics show that public transport affects the genders differently. Women use public transport more than men, so if the accessibility of public transport is improved, it will initially have a higher impact on women, especially on young, immigrant and retired women. Promotion of walking and cycling brings health benefits for all groups.

The promotion of public transport should take into account income level, health security, non-discrimination, safety and accessibility to support the mobility of pensioners, people with disabilities, minorities, students and low-income citizens. The workshops came to a conclusion that the special effects on people with disabilities should be investigated in more detail. The promotion of public transport might significantly increase its accessibility to people with disabilities. Regional accessibility should also be kept in mind.

Non-road mobile machinery

Measures targeting non-road mobile machinery were estimated to affect primarily male-dominated sectors. The level of electrification in non-road mobile machinery

varies widely by machine category, and the greatest challenges are in large non-road mobile machinery. Negotiations held with the indigenous Sámi people pursuant to the Act on the Sámi Parliament raised the issue that the Sámi use snowmobiles, ATVs and possibly other non-road mobile machinery for practicing their traditional livelihoods, such as reindeer herding. The transformation to low-carbon fuels and energy-efficient alternatives in these pieces of machinery might result in extra costs for practitioners of the traditional livelihoods.

Oil heating

The residents of oil-heated detached or semi-detached houses face more pressure to make financial investments in heating than people living in other types of housing. Changing the form of heating is most challenging for low-income owners of detached or semi-detached houses, particularly if the building is in poor condition and located in an area where prices of real estate are falling. The situation might be further complicated by the older age of the owners, which might make them less willing to make the necessary investments to phase out oil heating. However, age alone does not necessarily reduce people's willingness to make the investments, especially among the youngest pensioners, unless the other risk factors referred to above are present. Phasing out oil heating might make it easier for old people to continue living in their current home, since most of the systems that replace oil heating are easier to maintain (Ministry of the Environment 2021a). The measures under this plan consist of many forms of support for people living in oil-heated houses. The lowest income groups are taken into account better than with the previous subsidies.

Agriculture

Statistics indicate that the climate measures on agriculture are most likely to affect men, although statistics on full-time farmers by gender are difficult to obtain. When subsidies are targeted fairly and reasonably to achieve the green transition necessary for the mitigation of climate change, it can be concluded that focusing the subsidies more on men than women is acceptable, since it will enable Finland to attain the emissions reduction targets.

Farmers might feel the impact of the transition on their wellbeing in different ways. Some see the climate measures as a positive thing and an opportunity to increase their income and the social acceptability and climate-friendliness of their livelihood. For some people, learning new things in technology or contractual practices, financial investments and the associated uncertainty, adopting a networked operating method or a new role as a producer of climate benefits might increase job stress. Women are, on average, more interested than men in ethical agriculture and small-scale farming, which is why the

promotion of gender equality might contribute towards the adoption of climate-friendly forms of production.

When it comes to climate-friendly food, women often play a more major role than men in the planning of the diet of a household, which is why measures focused on women might have an impact on entire families. Children and young people do not necessarily have a similar say in food choices, which is why homes, day care centres and schools should favour climate-friendly foods. Similarly, older generations who are provided food services, are unlikely to have much of a say. Since research suggests that women's diets are, on average, healthier and climate friendlier than men's, and they have a more positive attitude towards climate-friendly food, the changes in men's health might be more significant and larger than in women's. It is therefore possible that when climate-friendly diets become increasingly popular among men, the health differences between genders will reduce.

Provision of information for consumers

The workshop participants stated that the provision of information to consumers in different ways might promote equality, if information and education is made increasingly available in different languages and easy-to-understand versions of language. The assessment emphasised that the efforts to change patterns of consumption, use of transport and the types of non-road mobile machinery in some professions should take into account the differences in values between men and women. This should also be reflected in communications. The assessment of the climate and energy strategy highlighted that women's values are, on average, more environmentally friendly than men's, but they are also more uncertain about their expertise. Measures that improve the availability of advisory services and support for women might therefore improve women's capabilities in making climate-friendly choices. Men occupy more positions in high-emissions sectors and they have, on average, more financial opportunities to make choices which reduce emissions, which means that men provide higher potential for emissions reductions than women. However, men are more motivated by personal gain in climate actions, such as the financial benefits and technological solutions associated with a solution.

11 Monitoring the implementation of the Climate Change Policy Plan

According to the Climate Change Act, the Government shall monitor the implementation of the Climate Change Policy Plans to a sufficient degree. If the monitoring reveals that the measures specified in the action plan are not sufficient to reach the targets, the Government will decide on necessary additional measures. The uncertainty factors associated with the preparation of the Climate Change Policy Plan have been discussed in previous sections. The outlines and action package in the plan need will be revised and possible corrective actions taken, for example when the final content of the EU's climate and energy framework for 2030 is complete. Additionally, the emissions level required by carbon neutrality is affected by the net sink trend in the emissions trading sector and land use sector. All of these might have a large impact on the targets and measures of the Climate Change Policy Plan.

The effectiveness of the policy measures and any new potential measures are constantly being investigated as part of the planning system of climate policy. The aim is to promote the adoption of new cost-effective means required by the just transition. The subsidy authority should assess the impact, effectiveness and functionality of each individual economic support subsidy programme at regular intervals. This way, the necessity of the subsidy programme and the needs to develop it can be reviewed and the results of the review be considered in political decision-making.

The monitoring operations should also keep in mind that external circumstances keep on changing. Technical and social innovations may affect the significance of different policies and measures and their potential to deliver the desired changes in structures and practices. Trends may change quickly, for example, if new technological solutions become widespread faster than expected or if general political and economic circumstances change significantly. Therefore, it will be essential to monitor how the anticipated impacts (and those not yet anticipated) develop in order to gain a better understanding of actual developments and to identify critical elements that could justify changing or specifying the policies.

Annual Climate Report

Each calendar year, the Government shall provide to Parliament an Annual Climate Report containing information on emission trends, the achievement of emissions reduction targets and the additional measures required to reach these targets. Monitoring will also cover aspects relating to the achievement of carbon neutrality and other targets. Pursuant

to the Climate Change Act, every other year the report must contain information on monitoring of the implementation of policy measures.

The content of the Annual Climate Report has been developed over the years based on the wishes expressed in parliamentary considerations. Climate-related matters are now reported increasingly comprehensively in the Annual Climate Report, since it now reports the emission trends of the emissions trading and land use sector in addition to the effort sharing sector. In keeping with Parliament's proposals, the Annual Climate Report includes an overview of economic and social impacts, as well as analyses of the carbon footprint of household consumption and the positive carbon handprint of companies. Policy measures have been discussed in the Report annually and sectoral indicators have been updated and supplemented with new ones.

According to the Programme of Prime Minister Sanna Marin's Government, the Climate Change Act will be reformed during the current government term, and the overall development needs of the regulatory framework for the Annual Climate Report will also be considered in this context. The reform will specifically address the targets set in the Act and its scope of application. Any changes in the target-setting and scope should be taken into account when defining the contents of the Annual Climate Report.

The rest of the reporting system is described in more detail in Chapter 3.6. Climate-related matters are reported fairly regularly in accordance with both national and international reporting requirements. In the future, it would be worthwhile to investigate whether climate reporting could be made more automatic and indicator-based and whether other reporting systems could be leveraged for monitoring purposes. This might save resources now used for reporting.

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