



Ministry of the
Environment Finland

Annual Climate Report 2021

Johannes Lounasheimo, Magnus Cederlöf and Iris Mäntylä

Publications of the Ministry of the Environment 2021:23

Annual Climate Report 2021

Johannes Lounasheimo, Magnus Cederlöf and Iris Mäntylä

Ministry of the Environment Helsinki 2021

Publication sale

**Online bookstore
of the Finnish
Government**

vnjulkaisumyynti.fi

Publication distribution

**Institutional Repository
for the Government
of Finland Valto**

julkaisut.valtioneuvosto.fi

Ministry of the Environment

© 2021 the authors and the Ministry of the Environment

ISBN pdf: 978-952-361-396-6

ISSN pdf: 2490-1024

Layout: Government Administration Department, Publications

Helsinki 2021 Finland

Annual Climate Report 2021

Publications of the Ministry of the Environment 2021:23		Subject	Environmental protection
Publisher	Ministry of the Environment		
Author(s)	Johannes Lounasheimo, Magnus Cederlöf, Iris Mäntylä		
Language	English	Pages	131
Abstract	<p>Under the Climate Change Act, the Government will submit to Parliament each year an annual climate change report, which is used to monitor the general trends in emissions and the achievement of emissions reduction targets included in the medium-term plan for climate change policy. The report will also contain an overview of policy measures and an assessment of the status of implementation of the adaptation plan.</p> <p>This report explores progress towards fulfilling the obligations set for the effort sharing sector and the overall emissions trend in relation to the 2035 carbon neutrality target. Based on preliminary data, Finland is on track to fulfil its obligation for the 2013–2020 period. In 2020, emissions were especially reduced by the enhanced guiding effect of emissions trading and by the coronavirus pandemic.</p> <p>In recent years, emissions have not decreased as fast in the effort sharing sector as in the emissions trading sector. According to proxy estimates, however, last year saw positive emission trends. The situational picture is currently incomplete and will be refined later.</p> <p>The European Union has decided to tighten the 2030 target. Related legislative proposals will be published during this coming summer. The measures thus far planned by Finland are insufficient to achieve a stricter emissions reduction target. Additional measures will be incorporated into the new Medium-term Climate Change Policy Plan and Climate and Energy Strategy that are currently being prepared. These will be required to achieve both the 2030 target and the 2035 carbon neutrality target.</p>		
Keywords	Annual Climate Report, climate change, annual reports, emissions, reporting, climate policy, environmental protection		
ISBN PDF	978-952-361-396-6	ISSN PDF	2490-1024
URN address	http://urn.fi/URN:ISBN:978-952-361-396-6		

Ilmastovuosikertomus 2021

Ympäristöministeriön julkaisuja 2021:23		Teema	Ympäristönsuojelu
Julkaisija	Ympäristöministeriö		
Tekijä/t	Johannes Lounasheimo, Magnus Cederlöf, Iris Mäntylä		
Kieli	englanti	Sivumäärä	131

Tiivistelmä

Ilmastolain mukaan valtioneuvosto toimittaa vuosittain eduskunnalle ilmastovuosikertomuksen, jolla seurataan yleistä päästökehitystä ja keskipitkän aikavälin ilmastopolitiikan suunnitelman tavoitteiden toteutumista. Lisäksi se sisältää kartoituksen politiikkatoimista ja arvion sopeutussuunnitelman toimeenpanotilanteesta.

Kertomuksessa tarkastellaan taakanjakosektorin velvoitteiden saavuttamista ja kokonaispäästökehitystä suhteessa vuoden 2035 hiilineutraaliustavoitteeseen. Ennakkotietojen perusteella Suomi saavuttaa kaudelle 2013–2020 asetetun velvoitteen. Vuonna 2020 erityisesti päästökaupan ohjausvaikutuksen tehostuminen ja koronapandemia vähensivät päästöjä.

Taakanjakosektorin päästöt eivät ole viime vuosina vähentyneet yhtä nopeasti kuin päästökaupasektorin. Pikaennakkotietojen mukaan päästökehitys oli kuitenkin viime vuonna suotuisaa. Tilannekuva on tässä vaiheessa puutteellinen ja tarkentuu myöhemmin.

EU on tehnyt päätöksen vuoden 2030 tavoitteen kiristämisestä. Tulevana kesänä julkaistaan tähän liittyvät lainsäädäntöehdotukset. Suomen tähän asti suunnittelemat toimet eivät riitä nykyistä tiukempaan päästövähennystavoitteeseen. Lisätoimia sisällytetään valmisteilla olevaan uuteen keskipitkän aikavälin ilmastopolitiikan suunnitelmaan ja ilmasto- ja energiastrategiaan. Näitä tarvitaan sekä vuoden 2030 tavoitteen että hiilineutraaliustavoitteen 2035 saavuttamiseksi.

Asiasanat ilmastovuosikertomus, ilmastopolitiikka, raportointi, päästöt, ilmastonmuutos, ympäristönsuojelu

ISBN PDF 978-952-361-396-6 **ISSN PDF** 2490-1024

Julkaisun osoite <http://urn.fi/URN:ISBN:978-952-361-396-6>

Klimatårsberättelse 2021

Miljöministeriets publikationer 2021:23		Tema	Miljövård
Utgivare	Miljöministeriet		
Författare	Johannes Lounasheimo, Magnus Cederlöf, Iris Mäntylä		
Språk	engelska	Sidantal	131
Referat	<p>Enligt klimatlagen ska statsrådet varje kalenderår sända riksdagen en klimatårsberättelse som ska innehålla uppgifter om den allmänna utsläppsutvecklingen och information om hur målen i den klimatpolitiska planen på medellång sikt har förverkligats. Dessutom ska klimatårsberättelsen innehålla en kartläggning av de politiska åtgärderna och en bedömning av verkställighetsläget när det gäller anpassningsplanen.</p> <p>I berättelsen granskas i vilken grad åtaganden inom ansvarsfördelningssektorn har fullgjorts samt utvecklingen av de totala utsläppen i förhållande till målet om klimatneutralitet 2035. På basis av förhandsbesked kommer Finland att fullgöra åtagandet för perioden 2013–2020. År 2020 minskade utsläppen i synnerhet till följd av utsläppshandelns effektivare styrande effekt och coronapandemin.</p> <p>Under de senaste åren har utsläppen inom ansvarsfördelningssektorn inte minskat lika snabbt som inom utsläppshandelssektorn. Enligt förhandsuppgifter var utsläppsutvecklingen dock gynnsam i fjol. I detta skede är lägesbilden bristfällig och den preciseras senare.</p> <p>EU har beslutat om att målet för 2030 ska skärpas. Lagstiftningsförslag i anslutning till detta kommer att offentliggöras i sommar. De åtgärder som Finland hittills har planerat räcker inte till för att uppnå ett strängare mål för utsläppsminskningen. Ytterligare åtgärder inkluderas i den nya klimatpolitiska planen på medellång sikt som är under beredning och i klimat- och energistrategin. Dessa behövs både för att uppnå målet för 2030 och för att uppnå målet om klimatneutralitet 2035.</p>		
Nyckelord	klimatårsberättelse, klimatförändringar, årsöversikter, utsläpp, rapportering, klimatpolitik, miljövård		
ISBN PDF	978-952-361-396-6	ISSN PDF	2490-1024
URN-adress	http://urn.fi/URN:ISBN:978-952-361-396-6		

Contents

Annual Climate Report 2021 – executive summary	8
1 Introduction	13
2 Emissions reduction targets	15
2.1 Government Programme	15
2.2 Reform of the Climate Change Act	15
2.3 Tightening EU targets	16
2.4 The international policy framework and the Paris Agreement	17
3 Greenhouse gas emissions in 2005–2020	19
3.1 Total emissions	19
3.2 Emissions trading sector	21
3.3 Effort sharing sector	22
3.4 Land use sector	27
4 Greenhouse gas emissions in 2020–2035	29
4.1 Carbon neutrality in 2035	29
4.2 Targets for the effort sharing sector	32
5 Emissions reduction measures by sector	35
5.1 Transport	35
5.2 Agriculture	44
5.3 Building-specific heating	49
5.4 Machinery	53
5.5 Waste management	57
5.6 F-gases	60
5.7 Other emissions	62
5.8 Emissions trading sector	63
5.9 Land use sector	65
6 Cross-cutting measures	67
6.1 Climate work in municipalities and regions	67
6.2 Public procurement	69
6.3 Circular economy	72

7	Impact of climate action	75
7.1	Economy	75
7.2	Employment	76
7.3	Income distribution.....	77
7.4	Health and wellbeing	78
8	Carbon footprint of consumption	80
9	Corporate carbon handprint	84
10	Climate change adaptation	86
	Appendices	91
	Appendix 1. Policy measures	91
	Appendix 2. Sector-specific indicators.....	106
	Appendix 3. Statistics and scenarios used.....	122
	Sources	123

ANNUAL CLIMATE REPORT 2021 – EXECUTIVE SUMMARY

Provisions on drawing up an annual climate change report are laid down in the Climate Change Act (609/2015). The Finnish Government submits an annual climate change report to Parliament every calendar year to report on the trends in emissions, realisation of the medium-term plan for climate change policy and progress towards the targets set for emissions reductions. Parliament has also emphasised the need to examine emission trends in non-effort sharing sectors, the impact of climate change policy and a consumption perspective on emissions. Based on the policies outlined by Parliament, the scope of this 2021 Annual Climate Report was diversified with a view to providing the most comprehensive overview possible of development trends in the field of climate change policy. Its analysis of the carbon neutrality target is based on a new estimate of emission trends produced by a research project entitled 'Carbon neutral Finland 2035'. The report's appendices include an extensive table of policy measures and a collection of climate policy indicators.

Emission trends in 2020

The proxy estimates published by Statistics Finland in May indicate that the 2020 greenhouse gas (GHG) emissions declined by 9% relative to the previous year. Finland's overall emissions amounted to 48.3 Mt CO₂-eq in 2020. This decline was strongly focused on the emissions trading sector, which decreased as much as by nearly 16%. Conversely, the trend was clearly more moderate in the effort sharing sector, where emissions only declined by 3%.

The 2020 reductions in emissions resulted from the warm winter and structural changes in power production. Traffic performance shrank as a result of the coronavirus pandemic, thus reducing transport emissions. Proxy estimates put the land use sector's net sink at -23 Mt CO₂. The sink improved significantly year on year, by more than eight million tonnes, as a result of the reduced volume of forest removals.

Achieving the emission reduction targets

Finland's obligation under EU law is to reduce the effort sharing sector's emissions from 2005 levels by 16% by 2020 and by 39% by 2030. According to Prime Minister Sanna Marin's Government Programme, Finland also aims to be carbon neutral by 2035 and carbon negative shortly thereafter.

Proxy estimates put emissions in the effort sharing sector at 28.6 Mt CO₂-eq in 2020. This is 0.1 million tonnes above the EU emission allocation for Finland. The allocation was also exceeded in the two previous years. However, as Finland is able to make use of its allocation deficits in 2013–2015 and 2017, it is on track to achieve the 2020 target.

By 2030, Finland's emission allocation will decrease linearly to 21.0 million tonnes CO₂-eq. A fresh estimate indicates that current measures will only achieve an emissions level of about 23 million tonnes in 2030, which means that further efforts will be necessary to reduce emissions. Going forward, Finland will need to prepare for the tightening of its -39% obligation, which means an even greater need for emissions reduction measures in all sectors.

A key factor for the carbon neutrality target is the expected number of carbon sinks in 2035, which determines the magnitude of the required emissions reductions. If the land use sector's net sink of -21 million tonnes is adopted as the baseline, emissions should likewise decrease from the current 48 million tonnes to 21 million tonnes. The current measures are estimated to cover about 16 Mt CO₂-eq of the necessary emissions reductions of 27 million tonnes, leaving the remaining 11 Mt CO₂-eq as the so-called emissions gap. New measures required to achieve the carbon neutrality target will be examined during 2021 as part of the process of drafting the Climate and Energy Strategy, the Medium-term Climate Change Policy Plan and the climate plan for the land use sector.

Sectoral trends

Domestic transport emissions account for almost 40% of those in the entire effort sharing sector, which means that the transport emissions trend plays a decisive role for the entire sector. Proxy estimates put domestic transport emissions in 2020 at 10.4 Mt CO₂-eq, excluding aviation. Emissions decreased by almost 6% from the previous year, especially due to the coronavirus pandemic.

The target set in the Government Programme for the transport sector is to halve its emissions from 2005 levels by 2030. Emissions should stand at 6.3 million tonnes, whereas the existing measures are expected to reach the level of about 7.9 million tonnes. In May 2021, the Government adopted a resolution on a roadmap for fossil-free transport, which is intended to provide a basis for achieving the target.

Emissions from agriculture counted towards the effort sharing sector have remained more or less the same over the last few years. The proxy estimate puts agricultural emissions in 2020 at 6.6 Mt CO₂-eq, remaining on par with the previous year. The current measures included in the Medium-term Climate Change Policy Plan are expected to lead to a slight downward trend in agricultural emissions.

Reform of the EU's Common Agricultural Policy (CAP) for the next financing period is currently underway, and the measures will be re-examined in conjunction with the process. The aim is to channel 40% of total EU funding for CAP measures into EU-level climate action and it includes an obligation for Member States to allocate 30% of rural development funds to environmental and climate measures at the national level.

Emissions from building-specific heating have seen a downward trend in recent years 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. This decline is expected to have continued in 2020, especially since the number of heating degree days was below that of the previous year.

The process of drafting an action plan for phasing out fossil fuel oil in heating 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. Newly introduced grants will be used to promote discontinuation of oil use in residential properties.

Greenhouse gas emissions from machinery have declined slowly. The 2020 proxy estimate puts these at 2.4 Mt CO₂-eq, remaining on par with the previous year. Emissions are expected to show a slight decrease moving forward, as the biofuel share of light fuel oil increases in keeping with the biofuel distribution obligation. Furthermore, tax on light fuel oil was raised as of the beginning of 2021, while electrification is also expected to make gradual progress starting from small machinery.

The 2020 proxy estimate puts greenhouse gas emissions from waste treatment at 1.7 Mt CO₂-eq. Waste treatment emissions have been decreasing steadily since the 1990s as a result of a decrease in the landfilling of municipal waste and, correspondingly, increased energy recovery from waste. Landfill gas recovery has also reduced emissions. Emissions from waste incineration are reported in the energy sector. Emissions counted towards the effort sharing sector mainly include those from plants that incinerate municipal waste, which have increased significantly over the last ten years.

The 2020 proxy estimate indicates that emissions from fluorinated greenhouse gases (F-gases) amounted to 1.1 Mt CO₂-eq, which is almost 2% less than in 2019. The largest

amounts of emissions are generated by the use of commercial and industrial refrigeration and cooling equipment. F-gas emissions have declined by almost 20% from the 2013 peak, but they still remain more than twenty times higher than in 1990. Emissions are being reduced by the ever-increasing use of carbon dioxide as a refrigerant.

Cross-cutting measures

Almost two out of three Finns live in municipalities aiming to achieve carbon neutrality by 2035. However, municipal emissions have decreased slowly relative to the targets, but there may be considerable differences between municipalities. As municipal climate action will accelerate the achievement of Finland's emissions reduction targets, it is advisable to promote climate work carried out in municipalities.

The National Public Procurement Strategy 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 launch and promote measures to implement the strategy.

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. Furthermore, circular economy operating models will reduce the consumption footprint. The Government issued a Resolution on the Strategic Programme for Circular Economy in April 2021.

Carbon footprint of consumption

According to a recent calculation by the Finnish Environment Institute (SYKE), the carbon footprint of household consumption stood at 10.3 t CO₂-eq per capita in 2019. Emissions declined from 2010 to 2015, but have thereafter remained more or less unchanged. Consumption-based emissions include regional emissions as well as overseas emissions from production chains of imported goods, excluding those from production chains of exported goods.

Change in carbon footprint can be divided into the following three factors: change in consumption expenditure, change in consumption patterns, and technological change. The Finnish Environment Institute estimates that, over the 2000–2019 period, the consumption footprint increased due to growth in consumption expenditure, whereas changes in consumption patterns and in the emissions intensity of consumer products reduced emissions. Overall, emissions have increased by 4% since 2000. The primary

explanatory factor for the carbon footprint is income level, which eclipses the role of all the other factors.

Adaptation

Accelerating global warming highlights the urgency of adaptation measures and the need to step up broad action to prepare for change. An update to Finland's National Climate Change Adaptation Plan will be launched in 2021 under the leadership of the Ministry of Agriculture and Forestry. The aim of the implementation of the adaptation plan is to reduce the harmful effects of climate change on people's safety, health and living conditions, nature and other environments, livelihoods, infrastructure and society's critical functions.

A knowledge base on the impacts and risks of climate change and methods and tools to prepare for these are being developed in several currently ongoing research projects. At the regional level, key factors include the role of the Centres for Economic Development, Transport and the Environment (ELY Centres) in translating plans into practical action and the statutory duty of local authorities to deliver critical day-to-day services in all conditions.

Finland's ability to prepare for climate change will improve by strengthening broad-based cooperation, forging partnerships and developing climate-resilient solutions. At the same time, these will contribute to creating opportunities to promote export of Finnish expertise and technologies in order to address global challenges relating to food security, adequate access to clean water and sustainable use of natural resources.

1 Introduction

Provisions on drawing up an annual climate change report are laid down in the Climate Change Act, which entered into force in June 2015. The Act specifies the parts of the planning system for national climate change policy as well as its schedules and responsibilities. Under the Climate Change Act, the planning system comprises three parts: a long-term and a medium-term plan for climate change policy and an adaptation plan. The Finnish Government submits an annual climate change report to Parliament every calendar year to report information on emission trends, progress towards the emissions reduction targets set out in the medium-term plan for climate change policy, as well as on any further measures required to achieve the targets. The report will also be supplemented with information on policy measures under the medium-term plan for climate change policy every two years and details of the adequacy and effectiveness of the adaptation measures included in the adaptation plan every four years.

According to the Government Programme, the Climate Change Act will be reformed during the current government term, while also considering the overall development needs of the regulatory framework for the annual report 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 report.

The first Annual Climate Report was submitted to Parliament in June 2019. It explored the situation in 2018, emission trends in the effort sharing sector and implementation of the Medium-term Climate Change Policy Plan completed in 2017. As part of the consultation organised in conjunction with the parliamentary consideration of the first Annual Climate Report, suggestions were made for developing the annual report. A specific aspect raised in this context was the need to discuss the trends in emissions as a whole, rather than focusing exclusively on the effort sharing sector. In its report (1/2020 vp), the Environment

Committee also stressed the need to address emission trends in non-effort sharing sectors with a view to compiling an Annual Climate Report that would provide a full overview of emission trends. The Committee further proposed that the annual report should be developed in a more strategic direction, particularly by evaluating the effectiveness and adequacy of the implemented emissions reduction measures.

The 2020 Annual Climate Report was submitted to Parliament in June 2020. Its drafting process took account of the development needs raised in the Committee report and the feedback received as part of consultations, particularly regarding the scope of reporting. In addition to emission trends in the effort sharing sector, the emissions trading and land use sectors were also included in the analysis. The report also included information on policy measures and adaptation, similar to the year before.

In its report (YmVM 10/2020 vp), the Environment Committee presented some new development needs for the annual report. The report stresses the importance of the overview provided of emission trends, particularly in relation to the carbon neutrality target. It further highlights the need to evaluate the adequacy and impact of policy measures in the broadest terms possible.

In keeping with Parliament's proposals, this year's annual report includes an overview of economic and social impacts, as well as analyses of the household consumption footprint and the positive carbon handprint of companies. Similar to the year before, the report also covers a review of adaptation measures, overviews of cross-sectoral packages of measures such as municipal climate change policies and the circular economy, as well as an extensive appendix table on policy measures to mitigate climate change. The sectoral indicators included in Appendix 2 have been updated and supplemented with new ones.

Finland's national climate policy has traditionally been based on government programmes and plans. The planning system under the Climate Change Act currently coincides with the process of drafting the Climate and Energy Strategy. The Climate and Energy Strategies cover the emissions trading, effort sharing and land use sectors as well as climate change adaptation. They have been prepared regularly since 2001, and they set out the energy and climate change policy guidelines on a general level as well as at the level of measures. The most recent National Energy and Climate Strategy was published in 2016. In keeping with the Government Programme, a climate plan for the land use sector is currently being drafted as part of the energy policy planning process. Furthermore, a new medium-term plan for climate change policy and a national climate and energy strategy are being prepared during 2021. The Government intends to submit these as reports to Parliament this coming autumn.

2 Emissions reduction targets

2.1 Government Programme

According to Prime Minister Marin's Government Programme, Finland aims to be carbon neutral by 2035 and carbon negative shortly thereafter. This means that, in 2035, emissions should stand at or below the level of sinks, which should subsequently exceed emissions. According to the Government Programme, emissions reduction measures will be carried out in a way that is fair from a social and regional perspective and that involves all sectors of society. The Medium-term Climate Change Policy Plan and the Climate and Energy Strategy will be updated to meet the new targets.

By 2030, the carbon neutrality target will require larger emissions reductions in the effort sharing sector than those set out in the Medium-term Climate Change Policy Plan completed in 2017. It is also necessary to plan new measures for the post-2030 period. Considerable emissions reductions in the emissions trading sector will likewise be required to achieve carbon neutrality. In keeping with the Government Programme, electricity and heat production must be made nearly emissions-free by the end of the 2030s while also taking into account the perspectives of security of supply and servicing. Further objectives include reducing emissions from the land use sector and strengthening carbon sinks in the long and short term. The carbon neutrality target specified in the Government Programme is more ambitious than the corresponding targets currently in place at the EU level.

2.2 Reform of the Climate Change Act

The Government is currently preparing a proposal for reforming the Climate Change Act. In support of the drafting process, a working group was set up in early 2020, comprised of representatives from the relevant key ministries. The mandate of the working group ended at the end of March 2021. The preparatory work has continued on the basis of the

working group's efforts, with a view to completing a draft government proposal in early summer. Following a consultation process, the Government intends to submit its proposal to Parliament in the autumn of 2021.

As part of the reform, the Climate Change Act will be amended in keeping with the Government Programme to include the objective of carbon neutrality by 2035 and the emissions reduction targets for 2030 and 2040 in line with the path to carbon neutrality. The 2050 target will also be updated. Under the current Climate Change Act, Finland's national target is to reduce emissions by at least 80% by 2050 relative to 1990 levels. The land use sector and an objective of strengthening carbon sinks will also be included in the Act, while aiming to strengthen the role of the Climate Change Act as a policy instrument. The new Climate Change Act will probably set stricter national emissions reduction targets for Finland by 2030 than the current EU legislation would require.

In terms of scale, the reform is quite substantial and will result in expanding the Act's scope of application and specify its targets in further detail. Regardless, the revised Act's basic character will remain a framework act, laying down provisions on the planning system for climate change policy.

2.3 Tightening EU targets

By the decision of the European Council of December 2020 on the EU Climate Law, the European Union is committed to reducing net greenhouse gas emissions by at least 55% from 1990 levels by 2030. The role of carbon sinks will also be taken into account in calculating net emissions. Raising the target from 40% to 55% aims to ensure that climate neutrality can be achieved in the longer term. In May 2021, the Council and the European Parliament reached an agreement on the content of the EU Climate Law. The law will include both the new target for 2030 and the target of a climate neutral European Union by 2050.

The intention is to issue the specific sectoral legislative proposals required to achieve the new 2030 target during the summer of 2021. Under the currently effective emissions reduction obligations, emissions are to be reduced by 43% and by 30% from 2005 levels in the emissions trading sector and in the effort sharing sector, respectively, by 2030. As a result of raising the general target, the targets for both the emissions trading and the effort sharing sector will also be increased. The land use sector is likewise expected to see stricter obligations. The current Regulation on the inclusion of greenhouse gas emissions and removals from land use, land-use change and forestry (the 'LULUCF Regulation') obliges the Member States to keep greenhouse gas removals in the land use sector at least at the level of the emissions calculated for the sector during the 2021–2030 period.

2.4 The international policy framework and the Paris Agreement

As parties to the UN Framework Convention on Climate Change that entered into force in 1994, its supplementary Kyoto Protocol effective up until 2020 and the Paris Climate Agreement, Finland and the European Union are committed to comply with and promote their goals. The UN Framework Convention on Climate Change 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 Framework Convention does not contain quantitative emissions reduction targets, its supplementary Kyoto Protocol imposed legally binding reduction obligations for industrial countries' greenhouse gas emissions. The Paris Agreement on climate change was adopted at the 21st Conference of the Parties to the UN Framework Convention on Climate Change in 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. The EU and its Member States have adopted the Agreement. In Finland, the Agreement entered into force in December 2016.

The Paris Agreement is a significant achievement in international climate policy. The Agreement aims 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. 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. 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. The key elements of the Paris Climate 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.

More specific rules for the implementation and application of the Paris Agreement, known as the 'Katowice Rulebook' or the 'Katowice Climate Package', were adopted at the 24th Conference of the Parties to the UN Framework Convention on Climate Change in 2018. Negotiations are still ongoing on some of the Rulebook's contents. The 2020 Conference of the Parties could not be organised due to the coronavirus pandemic. The 26th Conference of the Parties to be held in Glasgow in November 2021 will continue negotiations

concerning details such as market mechanisms, voluntary cooperation between the parties, the transparency framework and climate financing. The Glasgow Conference will also review the parties' updated nationally determined contributions and long-term strategies and their adequacy in relation to the goals of the Paris Agreement.

By April 2021, more than 50 countries had notified the Secretariat of the Climate Change Convention of their new NDC commitments. While these still fall short of achieving the Paris Agreement goals, the situation is improving. Having rejoined the Paris Agreement, the United States declared its NDC commitment of cutting its emissions by half of 2005 levels by 2030 at a summit organised by President Joe Biden in April 2021. Should the measures now declared be implemented in full, it would be possible to limit the global average temperature increase to approximately 2.4 degrees Celsius.

In addition to the nationally determined contributions to the Climate Change Convention, almost 130 countries have announced a target of net-zero emissions by 2050 while China has committed to the target by 2060. Should these targets be achieved, the increase in the global average temperature would probably stand at about 2 °C above pre-industrial levels. Working towards stepping up NDC ambition plays a key role in 2021, particularly in all of the major economies.

3 Greenhouse gas emissions in 2005–2020

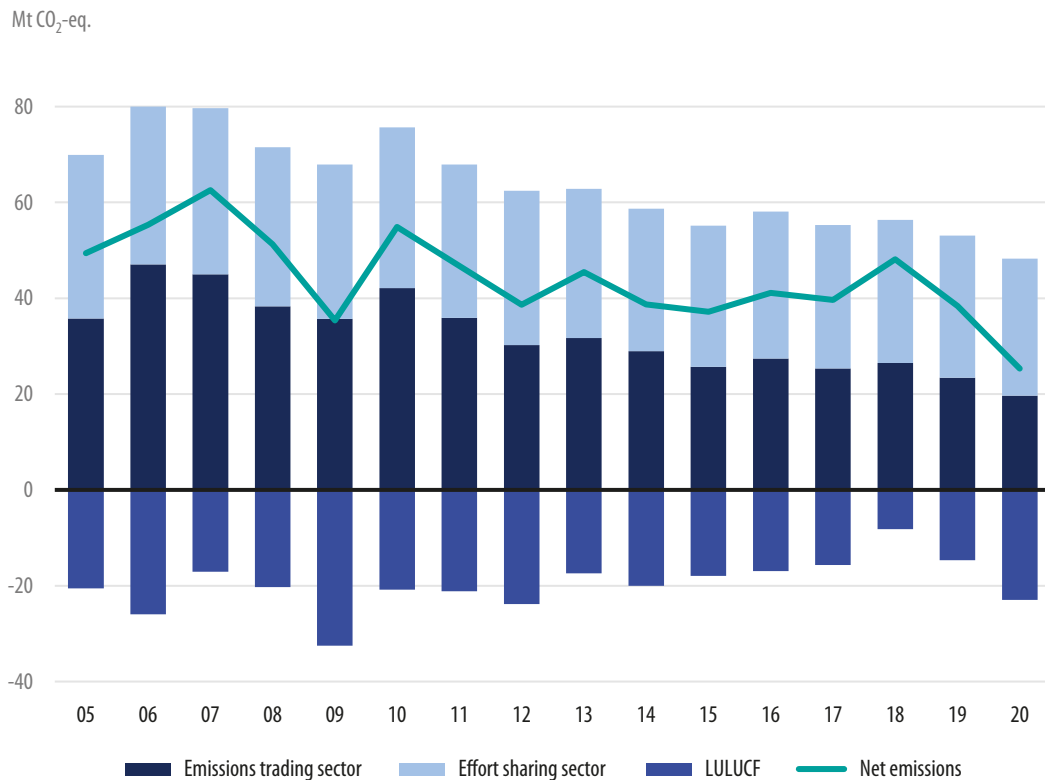
3.1 Total emissions

Finland's total emissions excluding the land use sector (land use, land-use change and forestry, LULUCF), i.e. aggregate emissions from the emissions trading and effort sharing sectors, amounted to 53.1 Mt CO₂-eq in 2019 and, based on proxy estimates, to 48.3 Mt CO₂-eq in 2020. Emissions decreased year on year by 3.3 Mt CO₂-eq in 2019 and by another 4.8 Mt CO₂-eq in 2020 (Figure 1). This drop was influenced by the significant decline in the use of coal and peat. In 2020, emissions decreased as a result of the warm winter, recent structural changes in power production and decreasing traffic performance. The effects of the coronavirus pandemic on the decline in emissions cannot be directly derived from Statistics Finland's inventory data because the amounts of emissions were also due to weather and cyclical fluctuations in manufacturing. However, the emergency conditions were reflected in a decrease in transport emissions.

Since 2010, total emissions have decreased by an average of 4% per year. The pace of decrease has stood at 7% per year over the last two years. Over the period from 2005 to 2020, total emissions have decreased by 21.6 Mt CO₂-eq, equating to 31%. The change stands at -32% relative to 1990 levels.

Trends in net emissions play an essential role in terms of climate change mitigation. Net emissions refer to total emissions minus the land use sector's net sink. Achieving the Government's carbon neutrality target requires net emissions to reach zero by 2035 and turn negative thereafter. In 2019, net emissions amounted to 38.4 Mt CO₂-eq, reverting to more or less the same level as in 2014–2017 (Figure 1). The 2020 proxy estimates indicate that net emissions dropped to a record low of about 25.3 Mt CO₂-eq. This drop was influenced both by the reduction in emissions and by the growth in carbon sinks. Over the period from 2005 to 2020, net emissions have decreased by 24 Mt CO₂-eq, equating to 49%. The change is -56% relative to 1990 levels.

Figure 1. GHG emissions in the emissions trading, effort sharing and land use (LULUCF) sectors in 2005–2020. The figure for the emissions trading sector includes inventory-based CO₂ emissions from domestic aviation. The 2020 data is a proxy estimate.

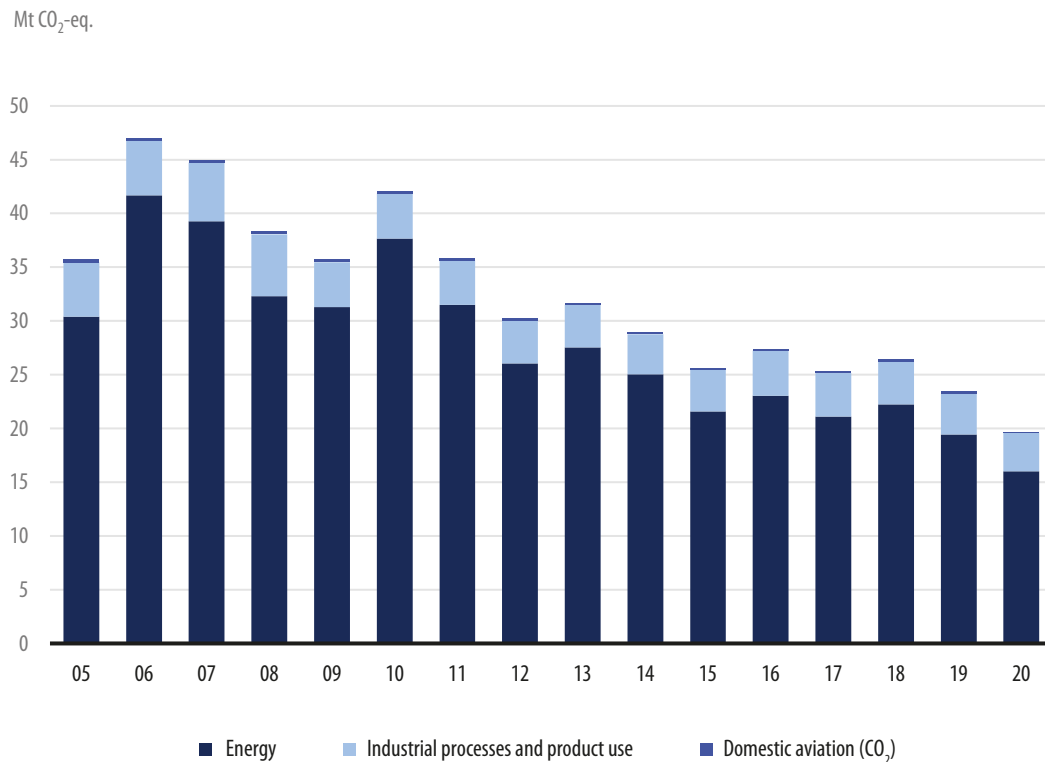


Emission trends need to be analysed taking account of cross-sectoral links, which means that a specific trend in one sector may impact on emissions in another. A typical example is electrification of various functions of society. There is a significant electrification trend underway in the transport sector, for example, due to the transition from combustion to electric engines in vehicles. While an electric engine does not generate direct emissions, it will increase electricity consumption and may therefore also push up emissions from power production. At the same time, the emissions generated will be moved from the effort sharing to the emissions trading sector. Similarly, connections also exist between the emissions trading, effort sharing and land use sectors. Achieving carbon neutrality calls for action in all sectors and for ensuring that progress made in one sector will not be cancelled out by increasing emissions or shrinking sinks in another.

3.2 Emissions trading sector

The EU emissions trading system (ETS) covers major industrial and energy production plants as well as aviation within the European Economic Area. In 2020, the total amount of emissions from Finnish plants falling within the emissions trading system was 19.6 million tonnes of carbon dioxide equivalent (Figure 2). Emissions decreased by 3.6 Mt CO₂-eq, i.e. almost 16%, from the previous year. This drop is attributable to considerably lower consumption of both black coal and peat relative to the previous year. Since 2010, emissions have decreased by an average of about 7% per year. Relative to 2005 levels, net emissions have decreased by 15.9 Mt CO₂-eq, equating to 45%. In 2020, energy-based emissions accounted for about 82% of total emissions in the emissions trading sector, while the figure for industrial processes and product use stood at about 18%. The proportion of process emissions has shown a slight increase in recent years (Figure 2).

Figure 2. GHG emissions in the emissions trading sector and inventory-based CO₂ emissions from domestic aviation in 2005–2020. Emissions are calculated on the basis of the current coverage of the emissions trading system. Please note that the coverage of emissions trading and its calculation method for aviation differ from the inventory calculation method.



According to the proxy estimate, carbon dioxide emissions from domestic aviation based on the greenhouse gas inventory decreased by 58% to 0.1 million tonnes in 2020, especially due to the pandemic. In total, emissions in the emissions trading sector accounted for 41% of total emissions. The proportion has clearly decreased in recent years.

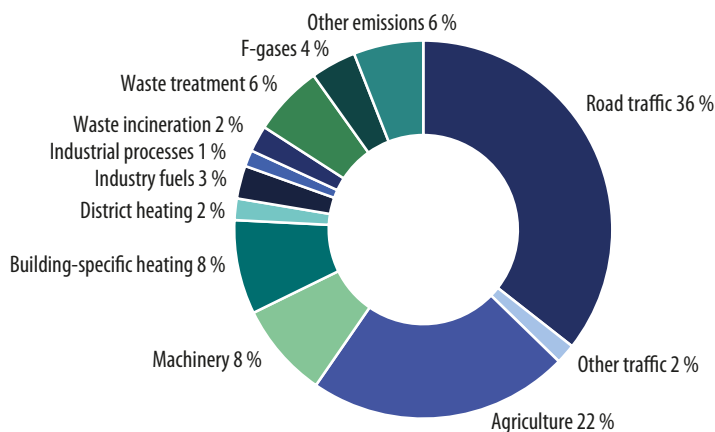
Emission trends in the emissions trading sector are influenced by the declining use of fossil energy sources as well as factors such as demand for electricity, weather-dependent consumption of heating energy, and the Nordic hydropower situation, which has a bearing on electricity prices and, consequently, its imports and the need for separate electricity production. A crucial factor is the price of an emission allowance in the EU emissions trading system. The price has increased from the level of about EUR 5 in 2017 to over EUR 50 per tonne CO₂ in 2021 (see Appendix 2, Figure 29).

3.3 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, machinery, waste treatment and F-gases.

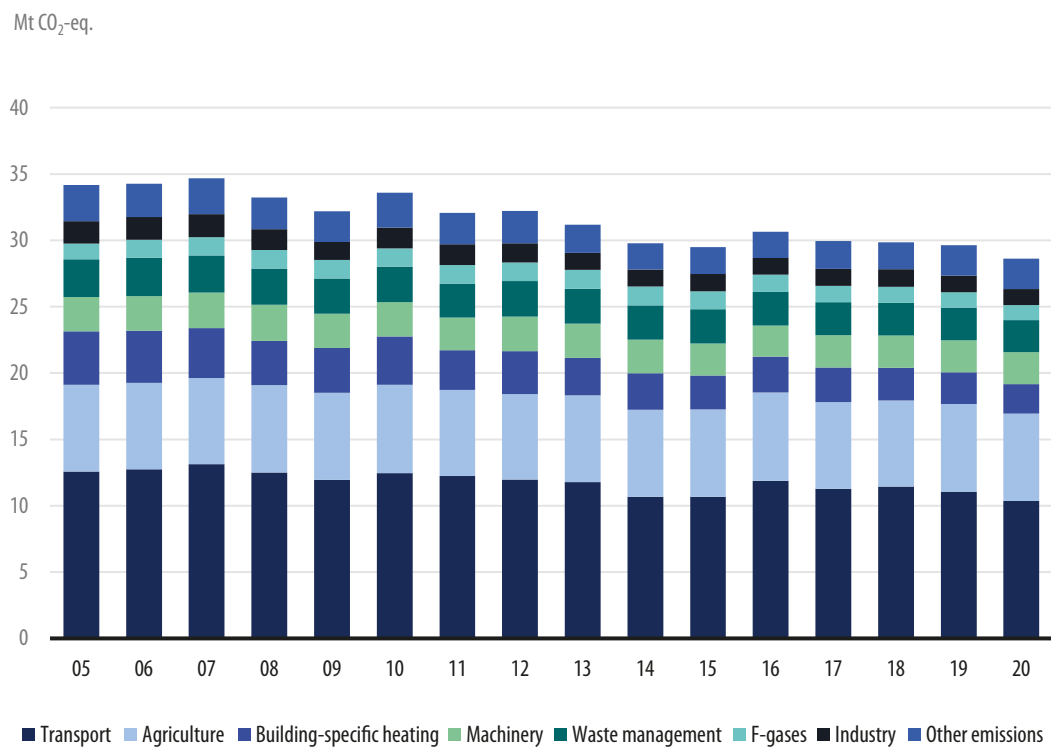
The effort sharing sector further covers emissions from fuel use in small-scale industries and the defence forces, other unspecified fuel uses, as well as non-CO₂ emissions from energy use in the emissions trading sector. Waste incineration is also mostly included in the effort sharing sector. Figure 3 shows the breakdown of emissions in the effort sharing sector in 2019.

Figure 3. Breakdown of GHG emissions by source in the effort sharing sector in 2019.



As regards heating of buildings, it should be noted that emissions from heating-related electricity consumption and the majority of district heating fall within the emissions trading sector. Within the effort sharing sector, heating of buildings covers building-specific heating with oil as the leading source of emissions, as well as non-ETS district heating plants. Some of the emissions from waste incineration can likewise be considered to fall indirectly within heating of buildings through district heat production. Heating of industrial properties, in turn, falls within emissions from industrial fuel use to the extent that it is not purchased electricity or district heat.

Figure 4. GHG emissions in the effort sharing sector in 2005–2020. The 2020 data is a proxy estimate. 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-based 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.



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 29.6 Mt CO₂-eq in 2019 and, based on proxy estimates, 28.6 Mt CO₂-eq in 2020. Emissions were 0.2 Mt CO₂-eq lower in 2019 than the year before, declining by another 1.0 Mt CO₂-eq

in 2020 (Figure 4). 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. The 2020 proxy estimates indicate that transport emissions continued to decline, while agricultural emissions remained almost unchanged. Reductions were also created in emissions from landfills, industrial processes and F-gases. The proxy estimate indicates that emissions from building-specific heating also decreased because the number of heating degree days fell below that of the previous year.

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 16% below 2005 levels. Emissions from transport (excluding domestic aviation) have decreased by about 2.2 million tonnes CO₂-eq, while the preliminary estimate for heating of buildings shows a decline of about 1.8 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 1).

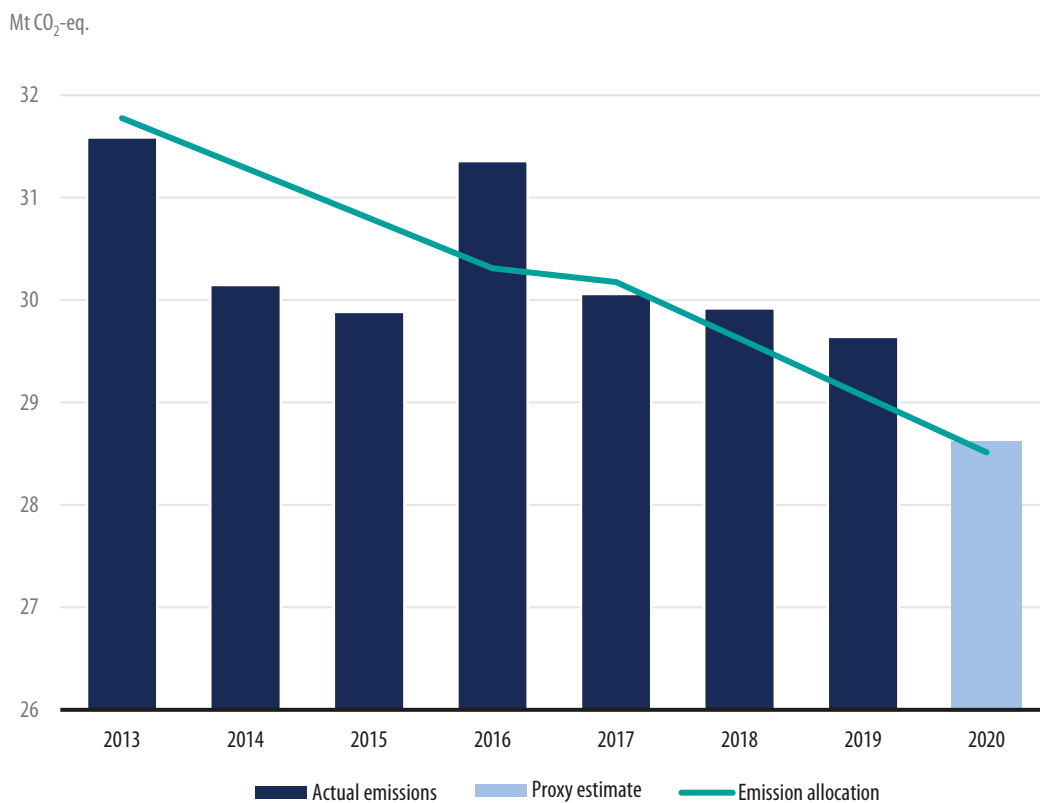
Table 1. Emissions in the effort sharing sector in 2005–2020 and change on 2005. The 2020 data is a proxy estimate.

	2005	2019	2020	Change 05–20 (Mt)	Change 05–20 (%)
Transport	12,6	11,1	10,4	-2,2	-18 %
Agriculture	6,5	6,6	6,6	0,1	1 %
Building-specific heating	4,0	2,4	2,2	-1,8	-45 %
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	1,2	1,1	-0,1	-4 %
Industry	1,7	1,2	1,2	-0,5	-28 %
Other emissions	2,7	2,3	2,3	-0,5	-17 %
	34,2	29,6	28,6	-5,6	-16 %

The 2020 data for total emissions, emissions from transport, agriculture, machinery, waste treatment excluding incineration and F-gases is based on Statistics Finland's proxy estimates. Emissions from heating of buildings are a preliminary estimate based on heating degree days. The shares of emissions from incineration included in waste treatment, industrial and other emissions are estimates based on total emissions and the breakdown of emissions in the previous year.

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. Conversely, emission allocations were exceeded in 2016, 2018–2019 and, based on the proxy estimate, in 2020 (Figure 5).

Figure 5. GHG emissions in the effort sharing sector in 2013–2019, the 2020 proxy estimate and emission allocations for 2013–2020.



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. There were enough surplus units to also offset excess emissions in 2018–2020. 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 proxy estimate and the final emission data for the previous years, 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 0.3 Mt CO₂-eq in surplus units calculated cumulatively for the entire 2013–2020 period (Table 2). The 2020 proxy estimates will be further refined prior to submission of the inventory due in 2022 and fulfilment of the 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.

Table 2. Finland’s emission allocations for the 2013–2020 period, actual emissions in 2013–2020 and difference between allocations and emissions (in Mt CO₂-eq). The 2020 data is a proxy estimate.

	2013	2014	2015	2016	2017	2018	2019	2020
Emission allocation	31,8	31,3	30,8	30,3	30,2	29,6	29,1	28,5
Actual emissions	31,6	30,1	29,9	31,4	30,1	29,9	29,6	28,6
Difference between emissions and allocations	-0,2	-1,1	-0,9	1,0	-0,1	0,3	0,6	0,1
Cumulative difference	-0,2	-1,3	-2,2	-1,2	-1,3	-1,0	-0,4	-0,3

The difference between emissions and allocations is expressed as a negative figure where actual emissions fall below the allocation and as a positive figure where emissions exceed the allocation.

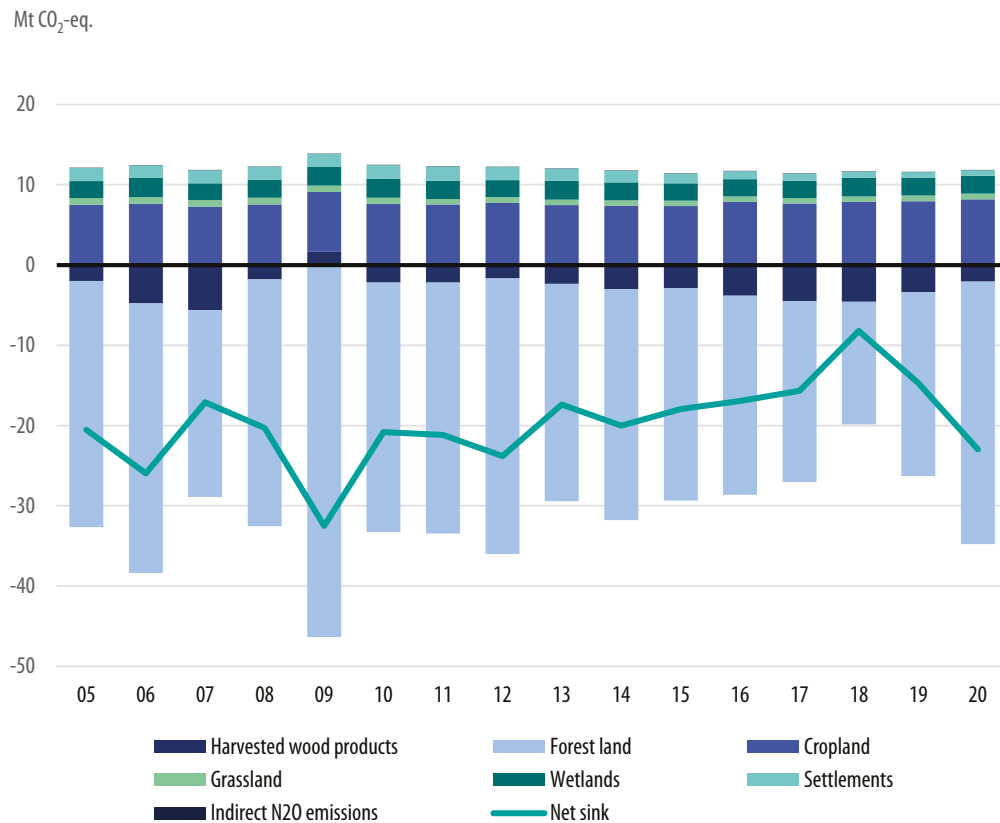
In addition to the European Union’s own emissions reduction targets, EU Member States and Iceland share a common obligation of a 20% reduction from 1990 levels for the second commitment period under the Kyoto Protocol from 2013 to 2020. The European Union has divided its commitments into an EU-level obligation in the emissions trading sector and specific obligations for each Member State, covering non-ETS emissions and the impact on the commitment of LULUCF activities under Kyoto Protocol Article 3, paragraphs 3 and 4. Accordingly, Finland was required to limit its emissions in the effort sharing sector to 240.5 Mt CO₂-eq over the 2013–2020 period. In 2019, Finland had spent 210.6 Mt CO₂-eq of this emissions budget. The 2020 proxy estimates indicate that cumulative emissions in the effort sharing sector amounted to 239.2 Mt CO₂-eq, which means that Finland is likely to meet its obligation. However, the result will only be confirmed once the effects of LULUCF activities are specified and the final 2020 emissions data is verified.

3.4 Land use sector

In 2019, the net sink in the land use sector (land use, land-use change and forestry, LULUCF) amounted to -14.7 Mt CO₂-eq, while the proxy estimate puts the 2020 figure at -23.0 Mt CO₂-eq. The net sink has improved significantly since 2018 as a result of the reduced volume of forest removals. The net sink covered 28% and 48% of the aggregate emissions in the emissions trading and effort sharing sectors in 2019 and 2020, respectively.

The land use sector comprises six land use categories – forest land, cropland, grassland, wetlands, settlements and other land – as well as harvested wood products. The land use sector’s net sink is derived by adding up emissions by sources and removals by sinks in all of the land use categories (Figure 6). Forest land is the sector’s most important net sink, as its removals from the atmosphere exceed emissions. Harvested wood products have also mostly functioned as a carbon sink.

Figure 6. Land use categories in the land use sector and their net emissions or removals in 2005–2020. The sum of net emissions is positive while that of net removals is negative. The 2020 data is a proxy estimate, including estimates for forest land, cropland and harvested wood products, whereas figures for the other land use categories correspond to the previous year’s levels.



The forest land sink is particularly influenced by the increment of growing stock and harvesting levels. The reduction in net sinks in 2018 resulted from the record level of roundwood removals that year. The total volume of roundwood, pulpwood and energy wood harvested in 2018 amounted to 78.2 million cubic metres. The harvesting level decreased to 73.3 million cubic metres in 2019, while preliminary data from the Natural Resources Institute Finland places the figure for 2020 at 65.2 million cubic metres (see Appendix 2, Figure 49). The 2020 forest removals included a total of 56.4 million cubic metres for forest industry needs or export, 8.5 million cubic metres for use as energy wood, and 0.3 million cubic metres for use as household wood by forest owners.

Emissions and sinks in the land use sector vary considerably from year to year. In addition, the knowledge base and impact of the measures in the land use sector involve greater uncertainties compared with other sectors. The estimates for the most recent years will typically become more accurate when further data on details such as the increment of growing stock and surface areas in different land use categories is available from the National Forest Inventory according to its inventory cycles. In particular, the proxy estimate for the land use sector's net sink may differ considerably from the result subsequently calculated from revised baseline data.

4 Greenhouse gas emissions in 2020–2035

4.1 Carbon neutrality in 2035

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 quantity of carbon sinks in 2035, which determines the magnitude of the required emissions reductions. Analysis of the carbon neutrality target can be based on an assumption of the level of net sink in the land use sector at -21 Mt CO₂-eq, as was done in the 2020 Annual Climate Report. 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.

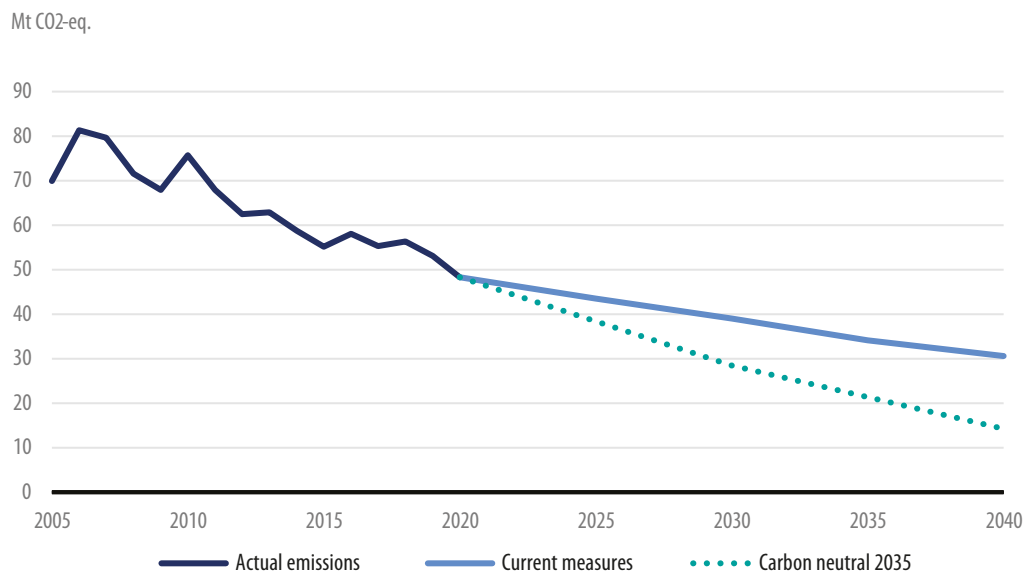
Beyond 2035, carbon negativity will require emissions to remain below sinks. The Finnish Climate Change Panel recommends an 80% emissions reduction target for 2040 and 90%–95% for 2050. Carbon sinks should likewise become somewhat stronger to ensure that emissions remain within the limits of the carbon budget calculated as a globally fair share for Finland.

According to the baseline scenario developed as part of a project entitled 'Carbon Neutral Finland 2035 – measures and impacts of the climate and energy policy' (HIISI), Finland's greenhouse gas emissions will amount to 34.1 Mt CO₂-eq in 2035 (Figure 7). The current trajectory and measures implemented to date will lead to an emissions reduction of 14 million tonnes from the level indicated by the 2020 proxy estimates. A summary of policy measures already decided is included in Appendix 1.

The HIISI project's baseline scenario, dubbed 'With Existing Measures' (WEM), takes account of the decisions made by the end of 2019 on emissions reduction measures. Modelling made use of the latest assumptions recommended by the European Commission for trends in fuel import and emission allowance prices. The emissions

estimate is also informed by factors such as trends in different manufacturing industries and the population projection.

Figure 7. Total emissions in 2005–2020, the HII project’s estimate for the emissions trend with existing measures (WEM) and an example of the emissions trend by 2040 in line with the 2035 carbon neutrality target. The 2020 data is a proxy estimate.

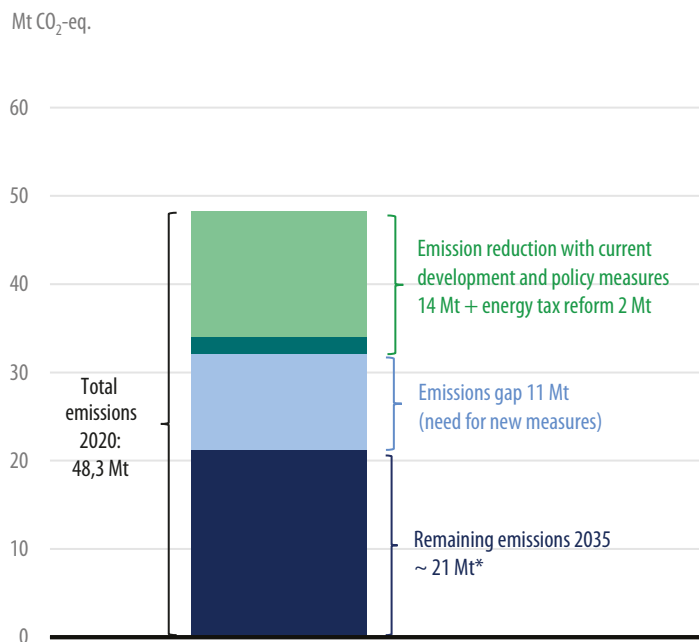


If calculating carbon neutrality is based on the assumption of sink level at 21 million tonnes in 2035, the emissions gap between the WEM scenario and the target is approximately 13 Mt CO₂-eq. The decisions made in 2020 on reforming energy taxation will narrow the gap to the tune of roughly 2 Mt. On top of this, new emissions reduction measures should bring about further reductions of about 11 Mt (Figure 8). New measures required to achieve the carbon neutrality target will be examined during 2021 as part of the process of drafting new versions of the Climate and Energy Strategy and the Medium-term Climate Change Policy Plan (KAISU), as well as the climate plan for the land use sector.

The emissions gap of 11 million tonnes presented here includes packages of measures that are yet to be decided. By way of example, existing measures do not include halving emissions by 2030 outlined in the roadmap for fossil-free transport and the measures in keeping with the subsequent emissions reduction path for fossil-free transport. Instead, these are currently part of the emissions gap that needs to be closed. While the WEM scenario already projects a fairly considerable reduction in emissions from heating of buildings, additional measures have been compiled into the draft action plan for phasing

out fossil fuel oil in heating, for example, which was circulated for opinions in May 2021. Sectoral low-carbon roadmaps have also identified significant opportunities to reduce emissions. Chapter 5 describes both existing and planned measures by sector, depending on the status of the drafting process.

Figure 8. Emissions reductions achieved by 2035 with existing and planned measures compared with current levels and the need for new emissions reduction measures. The 2020 emission data is a proxy estimate. *The level of emissions required to achieve the carbon neutrality target depends on the level of sinks in 2035. The level assumed here is the land use sector's net sink at 21 Mt CO₂.



At its Vuosaari climate meeting in February 2020, the Government outlined measures required to achieve carbon neutrality. The situational picture was refined in connection with the mid-term policy review session in April 2021. The Government intends to decide on the additional measures required to close the emissions gap at its budget session in autumn 2021 as part of discussions on the Medium-term Climate Change Policy Plan and the Climate and Energy Strategy. The Government maintained the policy outlined at the Vuosaari meeting on strengthening net sinks in the land use sector by 3 Mt relative to existing measures.

The plan is to promote the implementation of climate action required for carbon neutrality through the Sustainable Growth Programme for Finland and the EU Just Transition Fund (JTF). The Sustainable Growth Programme makes use of the EU stimulus

funds to promote clean energy production; to make investments in hydrogen technology and circular economy demonstration plants; to step up environmental solutions in the built environment and construction sectors; to phase out the use of oil for heating; and to support charging infrastructure for electric vehicles. The programme is due to be adopted during 2021. Current estimates indicate that the investments will significantly reduce emissions. The green transition accounts for a total of about half of the programme's funding, i.e. about EUR 1,040 million. The plan is to also make use of the EU Just Transition Fund (JTF) to ease a fair transition to a low-carbon society. Some of the funding is to be dedicated to mitigating the negative effects on regional economies of the declining use of peat for energy, for example.

The estimate for progress of implementation of climate action will be updated in the spring of 2022 as part of the Government's spending limits discussions.

4.2 Targets for the effort sharing sector

Finland's currently effective emissions reduction obligation for 2030 in the effort sharing sector is 39% of 2005 levels. Progress towards meeting the obligation is assessed on the basis of annual emission allocations. Finland's emission allocation for 2021 is 28.8 million tonnes CO₂-eq, which will decrease linearly by 2030. The emission allocation for the 2030 target year is 21.0 million tonnes CO₂-eq.

The first Medium-term Climate Change Policy Plan (KAISU) from 2017 outlined measures to achieve the 2030 target. The plan estimated that the additional emissions reductions required relative to the baseline trajectory would amount to about 6 Mt CO₂-eq. While some of these measures have already been implemented, the HIISSI project's WEM scenario indicates that the current trajectory will fail to reach the 2030 target. Under the baseline scenario, emissions will amount to 23.2 Mt CO₂-eq in 2030, which means that existing measures will fall short of the target by just over 2 million tonnes (Figure 9).

Achieving the target will be facilitated by the possibility of making use of temporal flexibilities, which means that any surpluses from previous years can be used to compensate for deficits in subsequent years as required. Furthermore, Finland can use the one-off flexibility mechanism that entitles it to transfer a limited number of units from emissions trading to the effort sharing sector. In practical terms, this means that the target for the emissions trading sector will accordingly become stricter. According to the relevant Government Decision, emission allowances in the emissions trading sector will be cancelled to the maximum amount specified in the EU Effort Sharing Decision, which is equivalent to 0.7 Mt CO₂-eq per year, or 7 Mt CO₂-eq in total over the 2021–2030 period.

Similarly, there is also a bidirectional link between the targets for the effort sharing and the land use sector. If the LULUCF sector is a carbon sink in compliance with the accounting rules under the LULUCF Regulation, a Member State can make use of the credits generated by certain types of afforested land, cropland and grassland in order to meet the targets of the effort-sharing sector. The amount of this flexibility has been limited. To meet the targets of the effort-sharing sector, Finland can use credits of up to 4.5 million tonnes of carbon dioxide equivalent between 2021 and 2030. However, if the LULUCF sector is calculated to be a source of emissions, Finland may have to compensate for the emissions with additional reductions from the effort sharing sector.

The current -39% emissions reduction obligation can be met by 2030 by continuing the measures outlined in the Medium-term Climate Change Policy Plan and implementing the planned measures. Halving transport emissions would alone cover about three quarters of the emissions reduction deficit. The measures will be reviewed as part of the process of drafting a new medium-term plan for climate change policy during 2021. At the same time, the process will also involve assessing any need for new measures or measures to replace previously planned measures that would keep the Finnish effort sharing sector's emissions within the limits of its emission allocation over the 2021–2030 period.

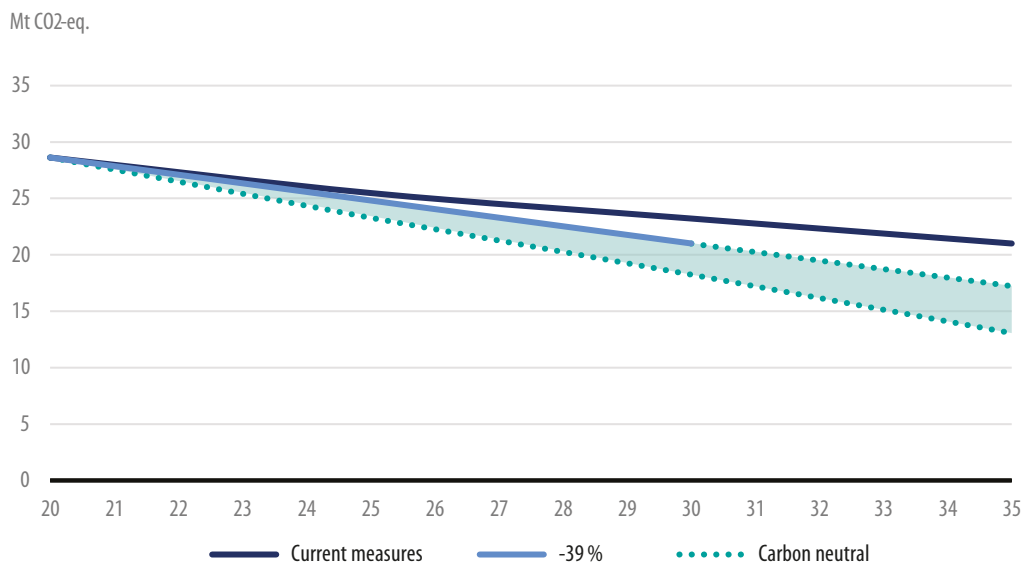
The new medium-term plan will be drawn up so as to meet the Government's objective of achieving carbon neutrality by 2035. Planning will also take account of the stricter EU emissions reduction targets. It is still uncertain how emissions reductions will be allocated to the emissions trading and effort sharing sectors, while the total reduction required for carbon neutrality will depend on the land use sector's net sink. In any case, the effort sharing sector will need a substantial number of new emissions reduction measures from the perspective of both the carbon neutrality target and the new EU obligation in sight.

In the modelling exercises based on the new EU emissions reduction target of at least 55%, the EU-level target is divided such that the obligations will increase from 43% to 64% in the emissions trading sector and from 30% to 39% in the effort sharing sector, provided that the scope of application of the latter will remain unchanged. While emissions trading will play a more prominent role, the effort sharing sector may also see considerably higher country-specific obligations than before. On the other hand, a more ambitious target for 2030 will help achieve carbon neutrality by 2035.

According to the current EU calculation model, the new obligation for the Finnish effort sharing sector's emissions would be 47% of 2005 levels by 2030. This corresponds to an emissions level of about 18 million tonnes in 2030. However, as the accounting criteria may change, assessment of future country-specific obligations still involves significant uncertainties at this point.

In order to achieve carbon neutrality, a preliminary estimate suggests that the effort sharing sector's emissions should be reduced to a level of about 13–17 million tonnes by 2035 (Figure 9). The average of the target range amounts to 15 million tonnes CO₂-eq. The cost-efficiency of measures to be implemented in different sectors will impact on the final emissions level. The tightening EU obligation for 2030 would, in any case, seem to be in line with the carbon neutrality target.

Figure 9. GHG emissions in the effort sharing sector in 2020–2035 with existing measures (WEM scenario), the current -39% EU obligation for 2030 and an estimate of the target range for carbon neutrality for the effort sharing sector.



Since emissions in the effort sharing sector arise from several sources, it is important that measures to reduce emissions are carried out in all sectors. Modest emissions reductions in one sector will translate into a greater burden for others. The total emissions reductions achieved in the effort sharing sector will impact on the need to reduce emissions falling within the emissions trading system. Conversely, if emissions in the emissions trading sector decrease or the net sink in the land use sector increases more than expected, carbon neutrality may be achieved even if emissions were to remain slightly higher in the effort sharing sector.

5 Emissions reduction measures by sector

5.1 Transport

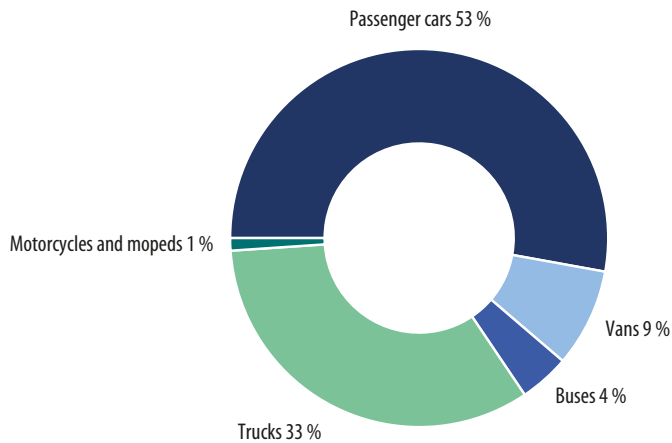
After the energy industry, transport is the second largest source of emissions – and the largest in the effort sharing sector – in Finland. Measures to reduce transport emissions play a key role in attaining the 2030 target in the effort sharing sector. A significant number of the measures in the 2017 Medium-term Climate Change Policy Plan – more than one half when measured in terms of reductions in emissions – focus on transport. In particular, the following three factors have an essential impact on the trends in greenhouse gas emissions from transport: trends in traffic performance, energy efficiency of means of transport, and the power sources – i.e. the sources of energy – used in transport. All of these three factors are addressed in the Medium-term Climate Change Policy Plan by measures and targets.

Trends in emissions from domestic transport

In 2019, domestic transport emissions excluding aviation stood at 11.1 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 Statistics Finland's proxy estimate, 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 coronavirus pandemic (see Figure 11).

In 2020, about 95% of greenhouse gas emissions from domestic transport were generated in road transport, of which passenger cars accounted for about 53% (Figure 10). 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. Aviation emissions are not counted towards the effort sharing sector.

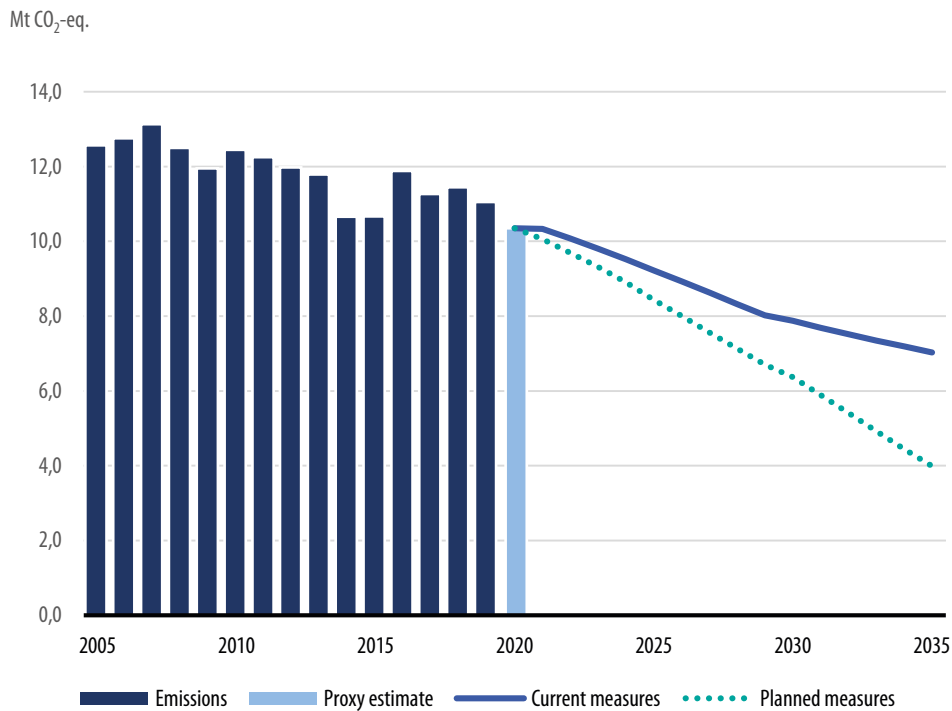
Figure 10. Breakdown of GHG emissions from road transport in 2020.



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 (Figure 11). The downward trend from 2008 on can especially be attributed to the slowing growth in traffic performance and the increasing share of biofuels (see Appendix 2, Figures 31 and 32). In addition to the use of biofuels, the European Union's binding CO₂ thresholds for vehicle manufacturers have also played a key role in reducing transport emissions and will specifically be among the most effective measures in the years to come.

Variation between individual years is to a great extent explained by fluctuations in the amount of biofuels sold for transport and traffic performance, but factors such as trends in vehicle sales also have some bearing. Emissions have generally declined, but the decrease has been very slow. With existing measures, transport emissions will not be reduced in line with the specified targets. Measures decided by the spring of 2020 are expected to reduce carbon dioxide emissions from domestic transport by about 37% relative to 2030 and by 50% relative to 2045, whereas the target levels for 2030 and 2045 are 50% and 100%, respectively.

Figure 11. Domestic transport emissions (excl. domestic aviation) in 2005–2020, as well as estimates in keeping with the baseline scenario and the target trajectory of the roadmap for fossil-free transport (planned measures) for 2021–2035. The 2020 data is a proxy estimate.



Future emissions reduction measures outlined in Government Resolutions

In May 2021, the Government adopted a resolution on reducing domestic transport-related greenhouse gas emissions, known as the ‘Roadmap for fossil-free transport’. The roadmap lays out measures enabling Finland to achieve the target set in the Government Programme of cutting emissions from domestic transport by 50% of 2005 levels by 2030. The roadmap will be implemented in three stages. The first phase includes several subsidies and incentives to promote low-emission transport. The second phase will assess means involving emissions impacts that require further information before a decision can be taken. In the last phase, the Government will assess whether the decisions made at EU level and the means of the roadmap’s phases 1 and 2 are sufficient to meet the targets. If it seems that the targets will not be achieved, the Government will take decisions on other necessary measures.

The Government also adopted separate resolutions in May 2021 to reduce greenhouse gas emissions from aviation and maritime and inland waterways transport, which confirmed national measures and priorities for international efforts to reduce greenhouse gas

emissions from these modes of transport. The resolutions were drafted drawing on the work on the Roadmap for fossil-free transport. The resolutions outline several measures to facilitate the transition towards renewable fuels and support enhancing energy efficiency.

Implementing the measures included in the Medium-term Climate Change Policy Plan

The measures included in the Medium-term Climate Change Policy Plan 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. While the Government is in principle committed to new measures as part of the Roadmap for fossil-free transport, decisions on funding individual measures will be made in conjunction with budget negotiations in autumn 2021 and spring 2022.

The target set in the Medium-term Climate Change Policy Plan is to halt the growth in passenger car traffic in urban areas. It seems that this target will mostly be achieved despite the fact that some of the plan's measures relating to financial guidance are yet to be implemented. Since 2015, passenger car traffic performances on the street network have decreased with the exception of the 2020 pandemic year. In 2020, passenger car traffic performances increased on the street network but declined on highways. Total passenger car mileage decreased by four per cent relative to 2019 while heavy-duty vehicle mileage also declined by just over two per cent in 2020. However, it is to be expected that, as the economy starts to rebound, traffic performances will also pick up, especially in heavy-duty transport.

One of the targets set in the Medium-term Climate Change Policy Plan is that, in 2030, biofuels should account for 30% of all liquid fuels sold for transport (physical proportion without double counting). As the Act amending the Act on Promoting the Use of Biofuels in Transport (419/2019) enacted in line with this target has already been in force since 2019, it is to be expected that the target will be achieved. According to preliminary data, biofuels accounted for 11% of transport fuels in 2020 without double counting, which is more or less on par with the previous year. In April 2021, the Government submitted a legislative proposal to Parliament that would extend the scope of application of the Act on Promoting the Use of Biofuels in Transport to cover biogas and renewable liquid and gaseous transport fuels of non-biological origin (RFNBOs), which transport fuel distributors could use in addition to biofuels to meet their distribution obligation. The distribution obligation would incorporate biogas as of the beginning of 2022 and RFNBOs as of the beginning of 2023. The legislative proposal does not propose any changes to the levels of the distribution obligation, which will be reviewed in autumn 2021 as part of drafting the Climate and Energy Strategy and making decisions on phase 3 of the Roadmap for fossil-free transport.

The annual variation in transport sector emissions is to a great extent explained by fluctuations in the share of biofuels in recent years. These fluctuations are the consequence of legislation that allows frontloaded implementation of the distribution obligation. As a result, fluctuations may also occur in the future, but the growing share of biofuels will reduce emissions gradually up until 2030. The change in traffic performance in the 2020 pandemic year has probably had a larger effect on reduction in emissions relative to previous years. The reduction in emissions is also explained by the increasing proportions of electric and gas-powered vehicles among new vehicles.

Challenges in renewal of the vehicle stock

Other targets set in the Medium-term Climate Change Policy Plan include renewing Finland's vehicle stock significantly more quickly than at present and reducing specific emissions from new vehicles to a level close to the average threshold value (95 g/km) set for vehicle manufacturers in the EU by 2020. Specific emissions declined nearly in line with the targets between 2008 and 2015, but the pace of decrease slowed down during 2016–2019 (see Appendix 2, Figure 34). In 2020, specific emissions from new vehicles took quite a steep plunge from the previous year, equating to about 12% in total. A particular explanatory factor behind this fall was the increasing proportion of electric cars out of first registrations of new passenger cars. Specific emissions from new vehicles and electrification of transport will also advance in the future because the EU tightened the threshold values set for manufacturers in 2019. The threshold values are also about to be reviewed as part of the Commission's climate package in the summer of 2021.

The target of speeding up the vehicle replacement rate has not been achieved. The number of new passenger cars sold amounted to about 114,000–120,000 per year between 2016 and 2019, while the figure for the 2020 pandemic year was only 96,000. The average age of passenger cars in traffic also kept increasing in 2020, when the average age of passenger cars in traffic was 12.5 years. The average age rose by 0.3 years relative to 2019 (see Appendix 2, Figure 36). In order to decrease their average age, the sales of new cars would have to increase from previous years.

In order to renew the vehicle stock, a decision was made in 2020 to carry out a scrapping premium campaign from the beginning of December 2020 to the end of 2021. New criteria for granting the scrapping premium were provided by law, allowing the premium to also be used for the first time for an electrically-assisted bicycle or mobility service including the right to travel on public transport. A total of EUR 8 million was reserved for the campaign to be used for the scrapping premium. The new campaign turned out to be very popular – so much so that the Finnish Transport and Communications Agency Traficom announced that all of the funds had already been allocated by the end of April 2021. Approximately 54% of the scrapping premium budget had been earmarked for electric bicycles, which

were particularly popular. In addition, a new subsidy for purchasing gas-powered trucks was introduced as a new measure as of the beginning of December 2020, amounting to one million euros for the period from 2020 to 2021. The purchase subsidies are available for application between 1 December 2020 and 30 November 2022.

The number of imported used cars decreased in 2020 relative to 2019. Almost 44,000 used passenger cars were imported into Finland in 2020, while the corresponding figure for 2019 was close to 46,000. Nevertheless, the figure is still higher than in 2018, for example, when the number of imported passenger cars fell just below 40,000.

Compared with first registrations, on average, imported used cars tend to be larger diesel cars with higher emissions. At the same time, however, the proportion of vehicles powered by alternative power sources has also increased continuously among imported cars and is already greater than among those registered for the first time in Finland.

Alternative power sources are proliferating

The Medium-term Climate Change Policy Plan includes a target according to which a total of at least 250,000 electric cars (fully electric cars and plug-in hybrids) and at least 50,000 gas-powered cars should be running on Finnish roads in 2030. As it appears that the target of 250,000 electric cars will be easily achieved with the current policy instruments, the number of electric cars will probably be far greater than this in 2030. The target set in the Roadmap for fossil-free transport was 700,000 electric passenger cars in 2030.

The interim targets set for 2020 in Finland's National Plan for alternative transport fuels infrastructure were achieved in good time: the targets of 5,000 gas-powered cars and 20,000 electric cars have already been achieved, the former in 2018 and the latter in 2019. The 2020 interim targets were eventually exceeded by a factor of two: at the end of 2020, there were 12,357 gas-powered and 55,318 electric cars in traffic in Finland.

The considerable increase in the number of electric cars also continued in 2020 in both plug-in hybrids and fully electric cars. In 2020, the number of fully electric cars in Finland doubled from 2019 levels. However, their proportion among all electric cars did not increase year on year. The proportion of fully electric cars has still remained at only around 17% of all electric cars in recent years. In the years to come, it will be essential to promote the proliferation of fully electric vehicles in particular. Plug-in hybrids do not contribute as much to emissions reduction as fully electric cars, particularly if petrol or diesel is used frequently to drive long distances.

Transport system measures being implemented on a broad front

Transport system measures and planning also play a key role in terms of transport emissions. In the autumn of 2020, the central government signed land use, housing and transport (LHT) agreements for 2031–2020 with the Helsinki, Tampere, Turku and Oulu sub-regions. In keeping with the Government Programme, the time span for the agreements was extended to 12 years while intensifying its pursuit of climate change mitigation through integrated community structures and sustainable modes of mobility. The purpose of the LHT agreements is to coordinate the measures to develop community structures and the transport system so as to create the preconditions for a sufficient and diverse offering of plots and housing production, more compact urban structures and a functional, safe and sustainable transport system. The measures promote low-carbon and sustainable community structures and a supportive transport system in order to mitigate climate change while enabling smoothly running daily lives, effective labour markets and vibrant business life. In the summer of 2020, the central government also initiated LHT agreement negotiations with three new urban sub-regions – Jyväskylä, Lahti and Kuopio – and signed agreements with them in April 2021.

Continuous multi-actor cooperation is required to develop station areas and improve their service levels. As transport nodes, rail transport stations play a key role in enabling low-carbon daily lives and travel chains. Versatile services at stations increase the attraction of public transport and make residents' daily lives smoother. However, level of station services varies significantly around Finland. Station areas have in recent years been subject to extensive development pressures, and several concrete projects to develop them have been launched by both cities and the central government. Promoting sustainable transport and developing station areas have also figured prominently in the LHT agreements and in the National Transport System Plan for 2021–2032. The central government bodies involved in the development of station areas include the Finnish Transport Infrastructure Agency and Senate Station Properties Ltd. In addition, the Finnish Transport and Communications Agency Traficom promotes the development of passenger and freight transport nodes, such as transit station areas, as part of the development of the entire transport system, public transport and other transport services. VR Group Ltd also plays an important role in development work.

Provision of services in station areas has been developed in cooperation between the central government and cities in the Smart Stations project in 2018–2020, first as a pilot and later as an ERDF-funded joint project. The project entitled 'Operating model for sustainable collaboration in station areas' was carried out between February and May 2020, with funding from the Ministry of the Environment, the LHT network, the Helsinki Region Environmental Services Authority (HSY) and the Finnish Transport and Communications Agency Traficom. The project aimed to produce an up-to-date situational picture of station areas and their development needs, create operating models for station areas and develop

a peer support network. The project is part of a broader Sustainable City Programme. In recent years, park-and-ride facilities have been developed in long-distance transport station areas. To provide a basis for development efforts, the Finnish Transport Infrastructure Agency produced a publication (7/2019), entitled 'Park-and-ride facilities around railway stations as part of the transport system – Current state of and development needs for park-and-ride facilities at 1st class stations in long-distance transport'.

The national programme for the promotion of walking and cycling is currently being implemented. The target for walking and cycling set in the promotion programme is to increase the number of trips by 30% by 2030. The investment programme for walking and cycling improves walking and cycling conditions on municipal street networks. The amounts reserved for discretionary government grants to local governments stood at EUR 32.9 million in 2020 and almost EUR 30 million in 2021. In 2020, some of the projects included in the investment programme for walking and cycling and some of those funded through government grants for mobility management also promoted the development of bicycle parking at public transport nodes. The 2020 funding for basic transport infrastructure management for walking and cycling was spent on developing park-and-ride facilities at railway stations and bicycle parking at nodal public transport stops, among other things. The Finnish Transport Infrastructure Agency develops cycle park-and-ride facilities in cooperation with local authorities on a continuous basis. Considering the objectives of the programme to promote walking and cycling, however, it seems that the promotion measures fall short. The target set in the programme is very ambitious and will probably require further action.

In the spring of 2021, the Government decided on the National Transport System Plan for 2021–2032. The plan is based on the Act on the Transport System and Highways (503/2005) and was prepared at parliamentary level. According to the plan's objectives and strategic guidelines, opportunities to choose more sustainable modes of mobility will improve, particularly in urban sub-regions. Its other objectives are related to accessibility and efficiency. In keeping with the plan, the conditions for sustainable transport will be enhanced by means such as shifting the focus of transport infrastructure maintenance and development to the rail network, improving infrastructure for walking and cycling as well as park-and-ride facilities, developing public transport and enhancing efficient utilisation of information in the transport system. The plan includes measures to improve the knowledge base for decision-making and cooperation in transport system development.

The Government Programme also outlines an annual subsidy of EUR 20 million for climate measures in public transport. The climate-based central government subsidy is intended for use by large and medium-sized cities and other competent public transport authorities. In March 2021, the Finnish Transport and Communications Agency Traficom launched an application procedure for these climate-based subsidies. Of the total amount

of 2021 subsidies, EUR 7 million is tied up by the land use, housing and transport (LHT) agreements with large urban sub-regions and another EUR 3 million by LHT agreements with medium-sized urban sub-regions. All competent public transport authorities can apply for support from unallocated climate-based subsidies for 2020 and 2021 for promoting green power sources and fleets in bus transport organised by the authorities as well as for projects that seek to increase the modal share of public transport and its monitoring. The government grants available for these themes amount to a maximum of EUR 20 million, which cover the share of climate-based subsidies not tied up by the LHT agreements with large urban sub-regions for 2020 and 2021, nor by LHT agreements with medium-sized urban sub-regions for 2021.

Pricing measures

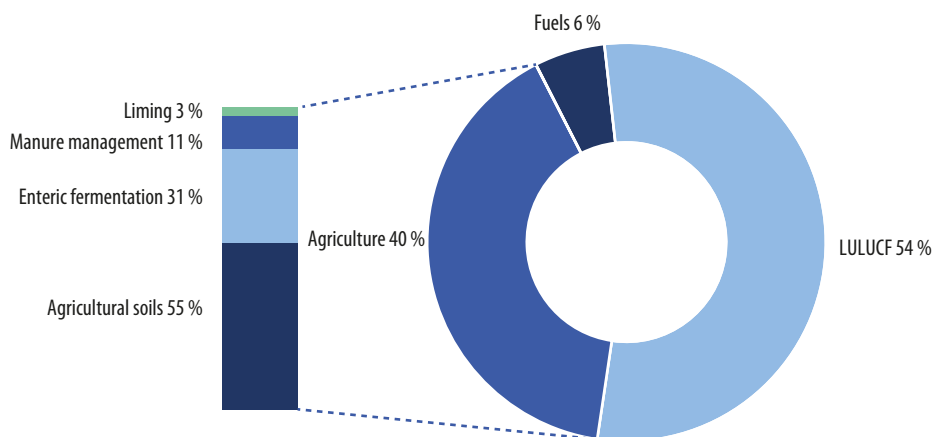
Transport emissions can also be influenced by means of taxation and pricing. In keeping with the Government Programme, the excise duty on liquid transport fuels was raised as of August 2020. The Government Programme also outlines that a transport tax reform will be launched during this government term. Changes to taxation of transport-related employee benefits were decided as part of the budget negotiations held in autumn 2020 and spring 2021. These changes were equally targeted at company cars, company bicycles and employer-subsidised commuter tickets.

The Ministry of Finance preparatory working group on the reform of transport taxation completed its work and published its final report in May 2021. Any decisions on possible measures will be made as part of the budget negotiations in autumn 2021. According to the Government Programme, the reform of taxes and payments in sustainable transport should reduce transport emissions.

5.2 Agriculture

Greenhouse gas emissions from agriculture are reported in several reporting sectors. The effort sharing sector covers methane and nitrogen oxide emissions from agriculture, mostly 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 machinery, building-specific heating and grain dryers are reported in the effort sharing sector (Figure 12).

Figure 12. Breakdown of GHG emissions from agriculture into the effort sharing sector (agriculture and fuels) and land use sector (LULUCF) in 2020 based on proxy estimates. Field burning of agricultural residues and urea application each accounted for 0.03% of agricultural emissions in the effort sharing sector.



Emissions from agriculture counted towards the effort sharing sector – equivalent to emissions from the agricultural sector in the greenhouse gas inventory – have remained relatively stable over the last few years. In 2019, agricultural emissions stood at about 6.6 Mt CO₂-eq, representing a 2% increase relative to 2018 levels. 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. The larger amounts of agricultural residues pushed up the amount of organic matter – and thus nitrogen – in the soil, increasing nitrogen oxide emissions from soil. Livestock numbers continued declining, which decreased emissions from enteric fermentation relative to previous years. Proxy estimates

put the 2020 emissions at 6.6 Mt CO₂-eq. Emissions remained on par with the previous year; the 2020 proxy estimate was less than half per cent below the previous year's levels. The current measures included in the Medium-term Climate Change Policy Plan (KAISU) are expected to lead to a slight downward trend in agricultural emissions (Figure 13).

Figure 13. Emissions from agriculture in the effort sharing sector in 2005–2020 and an estimate of the emissions trend achieved over 2021–2035 with existing measures. The 2020 data is a proxy estimate. 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.

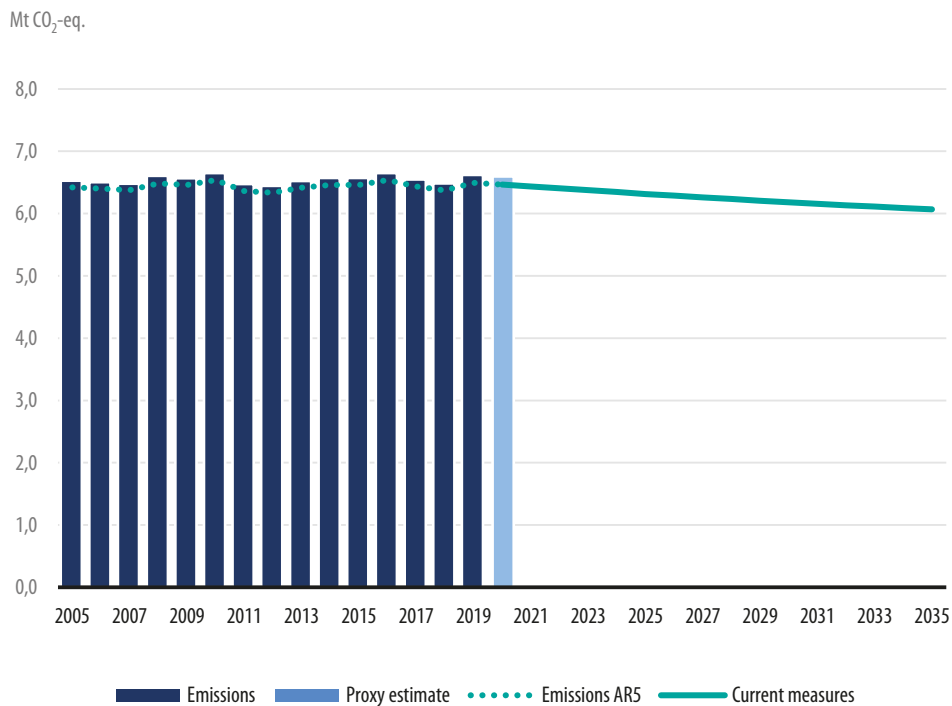
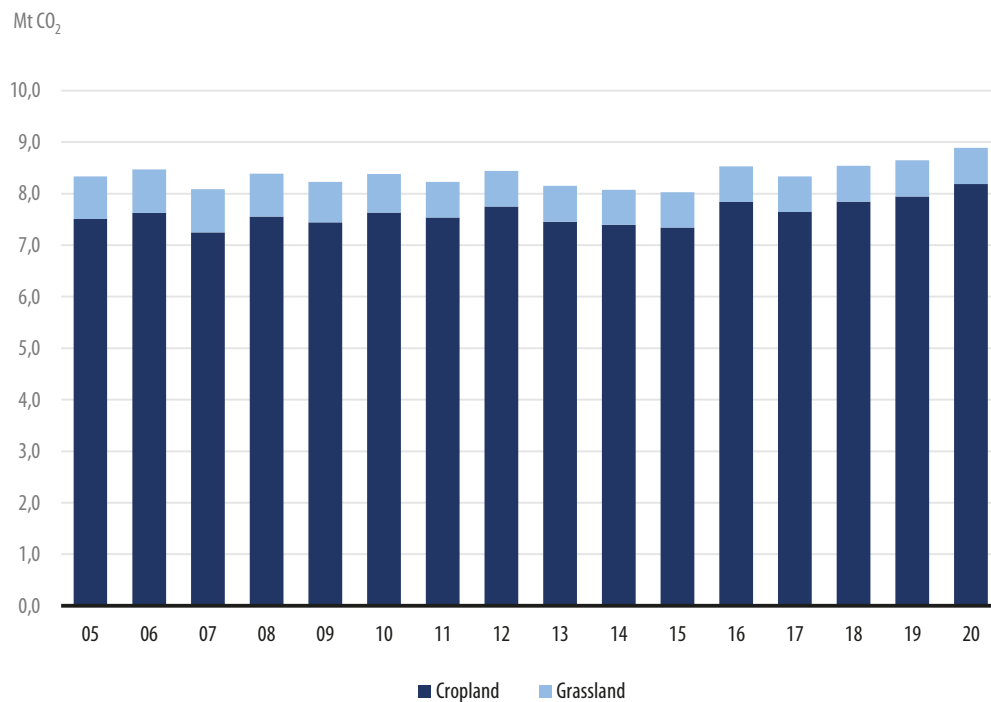


Figure 14. Emissions from agriculture reported in the land use sector in 2005–2020. The 2020 data is a proxy estimate with updated cropland emissions for mineral soils. Consequently, the proxy estimate does not show potential changes in peat field area, for example.



Emissions reported in the land use sector have likewise remained more or less the same since 2005 (Figure 14). About three quarters of total agricultural emissions are related to soil, including both carbon dioxide emissions in the land use sector and nitrogen oxide emissions in the agricultural sector. Three quarters of these emissions, in turn, are related to organic soils. Since research indicates that the most effective emissions reduction measures in agriculture are precisely related to organic soils, the KAISU Plan's emissions reduction measures mainly focus on these soils. These measures will reduce emissions in both the effort sharing and land use sectors.

The Climate Change Act requires that planning related to agricultural production ensures that the measures related to mitigating climate change are planned and implemented so that they do not compromise domestic food production or global food security.

The KAISU Plan includes the following agricultural emissions reduction measures: growing crops in organic soils for several years with zero tillage; raising the water table through controlled subsurface drainage; planting forest and wetland forest in areas with organic soil; promoting biogas production; and promoting the increased sequestration and storage of carbon in soil and the implementation of the 4per1000 initiative through

research projects and experiments. All of the above-mentioned measures are either already in use or are being introduced.

Reform of the EU's Common Agricultural Policy (CAP) for the next financing period is currently underway, and the measures will be re-examined in conjunction with the process. The aim is to channel 40% of total EU funding for CAP measures into EU-level climate action and it includes an obligation for Member States to allocate 30% of rural development funds to environmental and climate measures at the national level. Tripartite negotiations on the entire legislative package for the CAP reform are currently underway. The tripartite negotiations are due to be concluded by the end of June 2021 and the CAP reform is expected to enter into force as of the beginning of 2023. Consequently, a two-year transition period will remain between the present CAP scheduled to expire at the end of this year and the new period. Activities will continue as normal during this transition period. The funding priorities will remain the same as today, but the funds used will fall within the new funds cycle.

The Medium-term Climate Change Policy Plan also provides for the promotion of biogas production in the agricultural sector, which is estimated to yield an additional reduction of 0.3 Mt CO₂-eq. in emissions in the effort sharing sector in 2030. This reduction in emissions is divided between the agricultural, transport and machinery sectors as well as building-specific heating. Based on preliminary data, a total of 858 GWh of biogas was produced in Finland in 2020, including about 20 GWh produced by farm plants. The total production volume of biogas declined by 3% from the previous year, whereas farm plants increased production by 33%.

In keeping with the Government Programme, the Ministry of Economic Affairs and Employment appointed a working group to prepare a national biogas programme in 2019. The working group completed its work in January 2020. The main challenges for development of the biogas sector are still related to its low level of profitability. The working group suggests that profitability could be improved by reducing investment costs, boosting the sales prices for end products and enhancing the efficiency of sourcing agricultural raw materials. High investment costs are a drag on small plants in particular. Implementation of the measures put forward by the working group has started.

The Government has also 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 Ministry of Agriculture and Forestry is allocating up to EUR 5.1 million to an experimental programme used to finance innovative nutrient recycling solutions. The funding application round for the national experimental programme for 2020–2022 was launched in the summer of 2020.

The experimental programme is a continuation of a programme initiated in 2016–2018. The support scheme for biogas investments and new manure processing techniques set out in the Government Programme (EUR 7.5 million in total in 2020–2021) 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 contains a proposal to increase the rates of agricultural investment subsidies and rural business financing for biogas investments to 50% for a fixed period.

The Rural Development Programme for Mainland Finland for 2014–2020 includes measures that impact on waters while also contributing to increasing and preserving soil carbon stocks. The resulting reduction in emissions is attributed to both the land use sector and the agricultural sector. These measures include recycling nutrients and organic matter, disposing of slurry in fields, planting winter cover crops, maintaining environmental grasslands and adjusting water levels through controlled subsurface drainage. Several research and development projects relating to increasing and preserving soil carbon stocks are currently underway.

Other measures highlighted in the Medium-term Climate Change Policy Plan in relation to food consumption include reducing food waste and eating according to nutrition recommendations. The Nordic Nutrition Recommendations are currently being updated to be published in 2022. One of the aims for the new recommendations is to 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 adoption of the Nordic recommendations.

The Natural Resources Institute Finland (Luke) has coordinated work to develop a national monitoring system for food loss for Finland. The entire food system has drawn up a common roadmap 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. The Government Programme sets a target of halving food loss and food waste by 2030. As changes to food loss and waste and dietary habits do not directly reduce emissions reported by the agricultural and land use sectors in Finland, they must also influence the production of Finnish food in order to result in a reduction in emissions.

In line with the Government Programme, a national climate food programme 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. A further goal of the food programme is to support society's transition towards a climate-sustainable food system, which takes into account all dimensions of sustainability: social, economic, cultural and ecological.

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 vegetable-rich food, which is also included in official nutrition and meal recommendations. The recommendations for school meals include a recommendation to offer everyone a free choice of a vegetarian alternative every day or to add a vegetarian food day to the weekly menu. If implemented, these 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.

The National Public Procurement Strategy also 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. It is also preparing a guide to responsible procurement of food and catering services, aiming to promote overall sustainability in the procurement of public food and catering services.

Several projects are also underway that contribute to a low-carbon diet. The Savo Consortium for Education is leading the Responsible Food Services Development Programme as a food chain development project, which contributes to the goals of increasing climate-friendly fish and vegetarian dishes in public food and catering services and promoting responsible food procurement. The Natural Resources Institute Finland, in turn, is leading a Rural Development Fund project aiming to harmonise and develop the life-cycle assessment methodology for foodstuffs and the food system to produce more reliable and comparable results for carbon footprint calculations, for example. There is also a currently ongoing study on the usefulness of calculating the footprints of restaurants, food services, menus and meals and how such calculation services should be implemented.

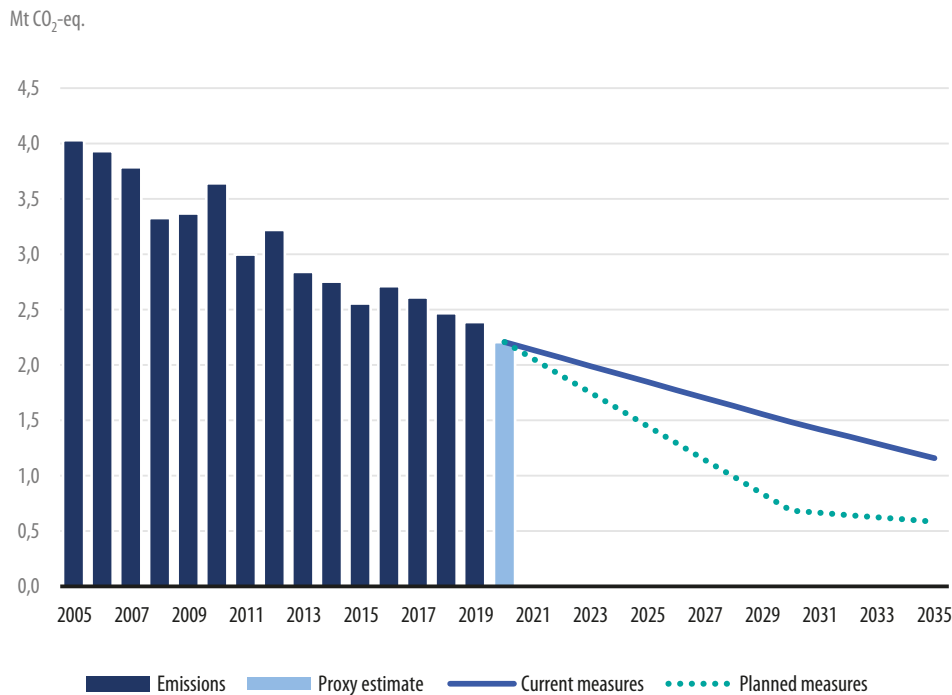
5.3 Building-specific heating

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 (see Figure 7). By way of example, 2015 was a notably warm year, which is why the level of emissions remained below 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 (Figure 15). The proxy estimate puts the 2020 emissions at about 2.2 Mt CO₂-eq. The estimate is based on a decrease in heating degree days because the winter was warmer than the year before. Emissions from building-specific heating have nearly halved from 2005 levels.

Figure 15. GHG emissions from building-specific heating in 2005–2020 and estimates of the emissions trend achieved over 2021–2035 with measures tentatively outlined in the Medium-term Climate Change Policy Plan. The 2020 data is a preliminary estimate, including change in heating degree days but excluding the trend reduction in oil heating.



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 will be adopted to encourage oil-heated properties to switch to other forms of heating during the 2020s.

The oil sector and the central government have signed an Energy Efficiency Agreement on the Distribution of Liquid Heating Fuels (Höylä IV), 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. The Höylä agreement has therefore contributed to the emissions trend.

In the baseline (WEM) 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.

The process of drafting an action plan for phasing out fossil fuel oil in heating 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 discontinuation of 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 some other heating system.

The total amounts of appropriations allocated to the support scheme stand at EUR 28.7 million in 2020, EUR 9.4 million in the 2021 budget and EUR 10 million in the 2021 supplementary budget. The grants for discontinuation of oil heating have stepped up heating system replacement rates to a considerable extent. Almost 13,000 applications were received over the first seven months of the scheme, whereas the number of replaced oil heating systems has usually stood at 3,900 units per year. The estimated impact of the appropriations available on annual emissions stands at about 0.07 Mt CO₂-eq.

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 is 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 mid-term policy review session in April 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 impact on annual emissions is estimated at about 0.14 Mt CO₂-eq. The impact will cover emissions from all residential buildings rather than just oil-heated properties. Consequently, some of the emissions reduction impacts will be allocated to the emissions trading sector.

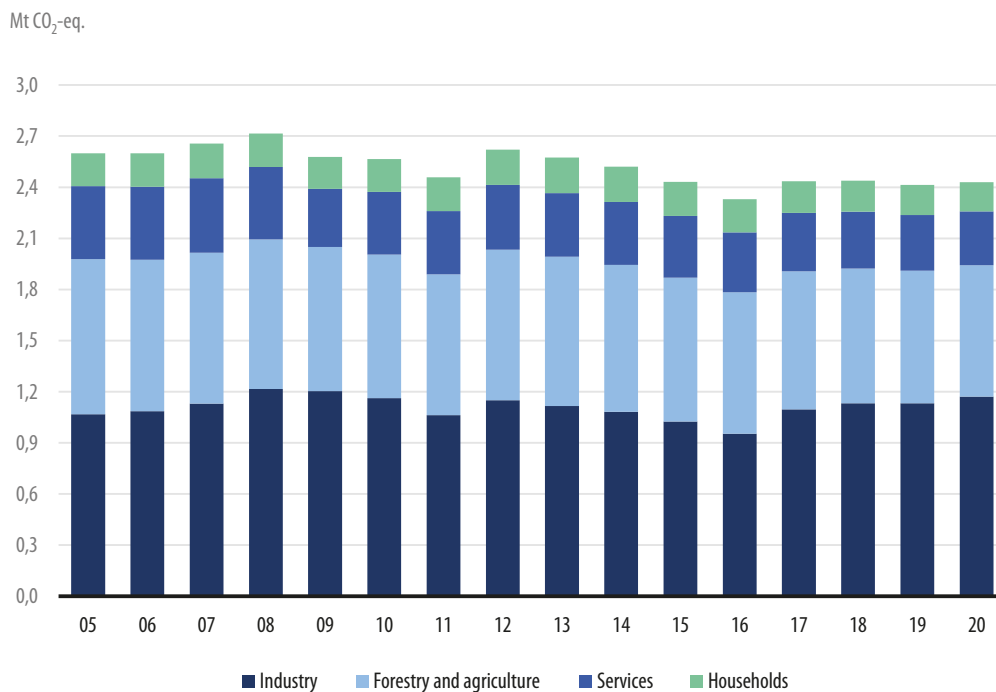
Discontinuation of oil heating and switching to other forms of heating in municipally owned buildings has also been expedited by grants since October 2020. Finland is home to about 9,300 buildings owned by municipalities and unincorporated municipal enterprises, including about 4,300 buildings in use and 5,000 vacated buildings. In many cases, even empty buildings will 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 grant, aiming to achieve an annual emissions reduction of approximately 15 kt CO₂-eq.

Finland's preliminary Recovery and Resilience Plan was completed in March 2021. The green transition projects put forward in the plan also include discontinuing the use of oil heating. The final plan was submitted to the Commission in May 2021. The Commission will assess Finland's plan, which is then due for adoption by the Council of the EU in the late summer of 2021.

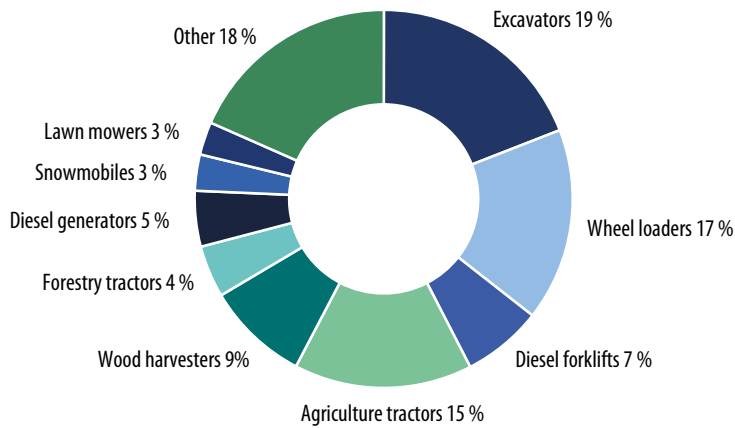
5.4 Machinery

In 2019, machinery emissions stood at 2.4 Mt CO₂-eq, accounting for about 4.5% of Finland's total emissions and 8% of emissions in the effort sharing sector. Machinery emissions have remained more or less unchanged in recent years (Figure 16). The proxy estimate indicates that the 2020 emissions increased by just under one per cent from the previous year.

Figure 16. GHG emissions from machinery in 2005–2020. The 2020 data is a proxy estimate.



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. Machinery emissions 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) developed by VTT Technical Research Centre of Finland. Figure 17 shows the breakdown of greenhouse gas emissions from machinery into the main machinery categories in 2020 and, correspondingly, the emissions trend over the 2005–2020 period is included in Appendix 2.

Figure 17. Breakdown of GHG emissions from machinery in 2020.

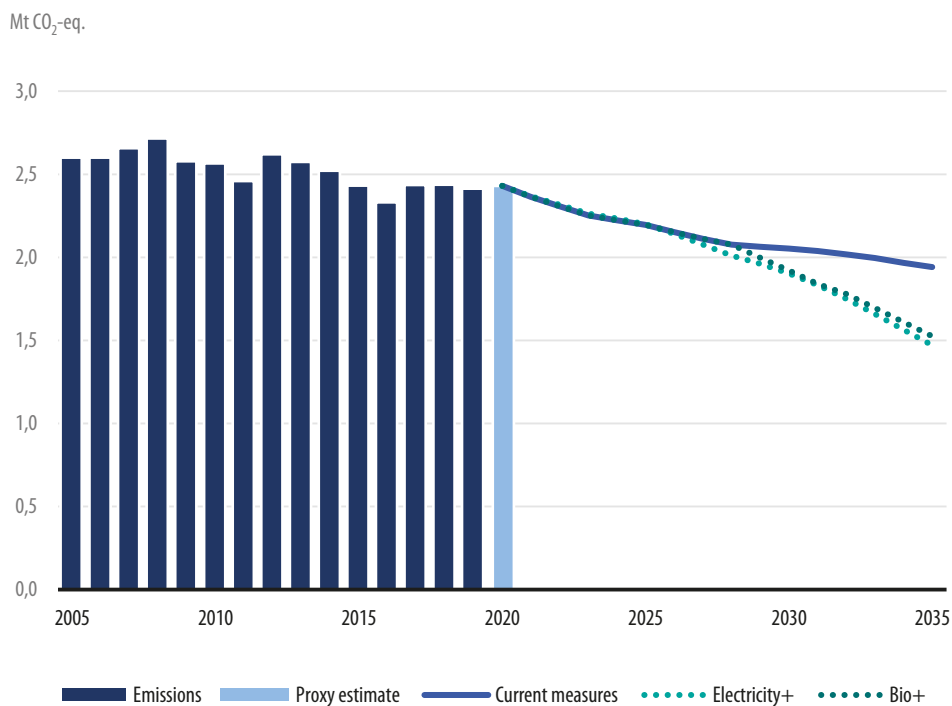
Machines are still almost exclusively powered by internal combustion engines. Diesel or light fuel oil accounts for almost 90% of emissions from machinery fuels. Petrol-fuelled machinery mainly comprises different types of light-duty machines. Machinery age varies significantly in Finland and a considerable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

Most of the environmental impacts of 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 machinery are typically much greater than those of cars. Machinery also generates noise. The role of harmful exhaust emissions and noise is more significant in areas of high population density.

The first medium-term plan for climate change policy, i.e. the 2017 Medium-term Climate Change Policy Plan (KAISU), estimated that the measures on 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. Based on the latest projection, the current trajectory will lead to about 2.1 Mt emissions in 2030, which means that the KAISU Plan's target would not be achieved with the emissions reduction measures implemented to date. The calculation model for non-road mobile machinery (TYKO) does not recognise the impact of all of the implemented policy measures on emissions, which is likely to contribute to the divergence between the current trajectory and the target.

The baseline projection indicates that greenhouse gas emissions in the machinery sector will fall about 15% below current levels in the 2035 target year for carbon neutrality. Figure 18 shows the actual trend in the emission performance of machinery and projections by 2035 based on different scenarios.

Figure 18. Emissions from machinery in 2005–2020 and estimates of the emission trends achieved under different scenarios. ‘Electricity+’ is a scenario for rapid electrification whereas the ‘Bio+’ scenario projects that the share of biofuels will rise to 30% between 2029 and 2030. The 2020 data is a proxy estimate.



Several measures are currently being used to reduce CO₂ emissions from machinery. Under the Act in force as of 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 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. 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 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 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 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 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.

New proposals to reduce greenhouse gas emissions from machinery include tightening the obligation to distribute biofuels and promoting electrification by enhancing the guiding effects of other taxes. Attention is also paid to information-based policy instruments and the knowledge base of machinery emissions reductions.

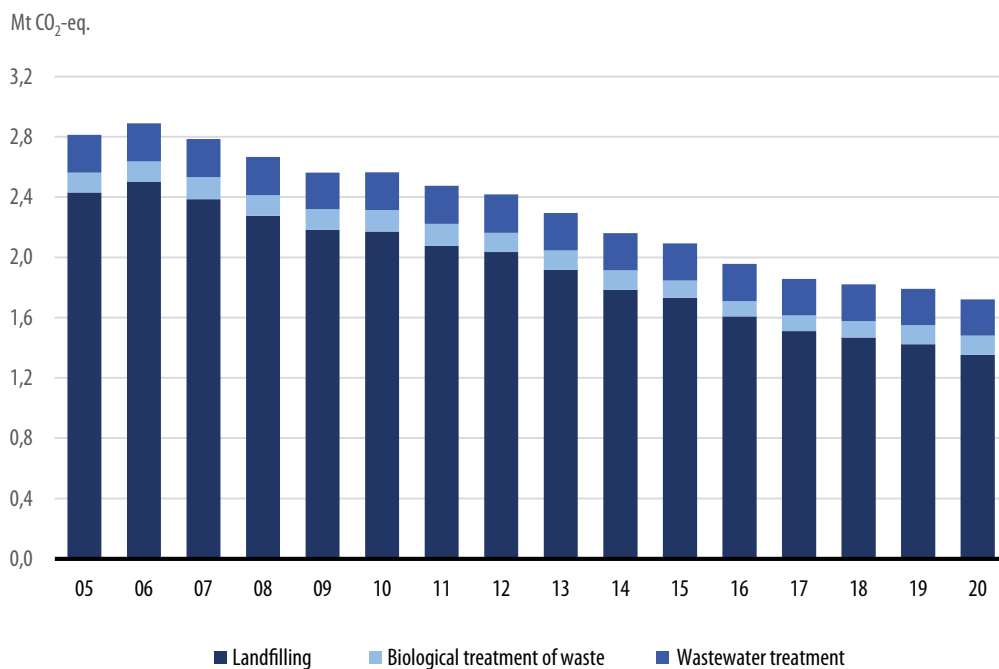
Under the Bio+ scenario shown in Figure 18, the biofuel distribution obligation will rise by 3% per year as of 2029, reaching 30% in 2035. Its impact on emissions amounts to about 0.4 Mt, which is almost as high as the level achieved in the robust electrification scenario. By combining measures, and as the energy efficiency, applications, operation and automation of machinery evolve, it may even be possible to halve the machinery sector's emissions from 2005 levels by 2035.

5.5 Waste management

Greenhouse gas emissions from waste treatment amounted to 1.8 Mt CO₂-eq in 2019 and, based on the proxy estimate, to 1.7 Mt CO₂-eq in 2020 (Figure 19). 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 39% 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 energy recovery from waste. 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.

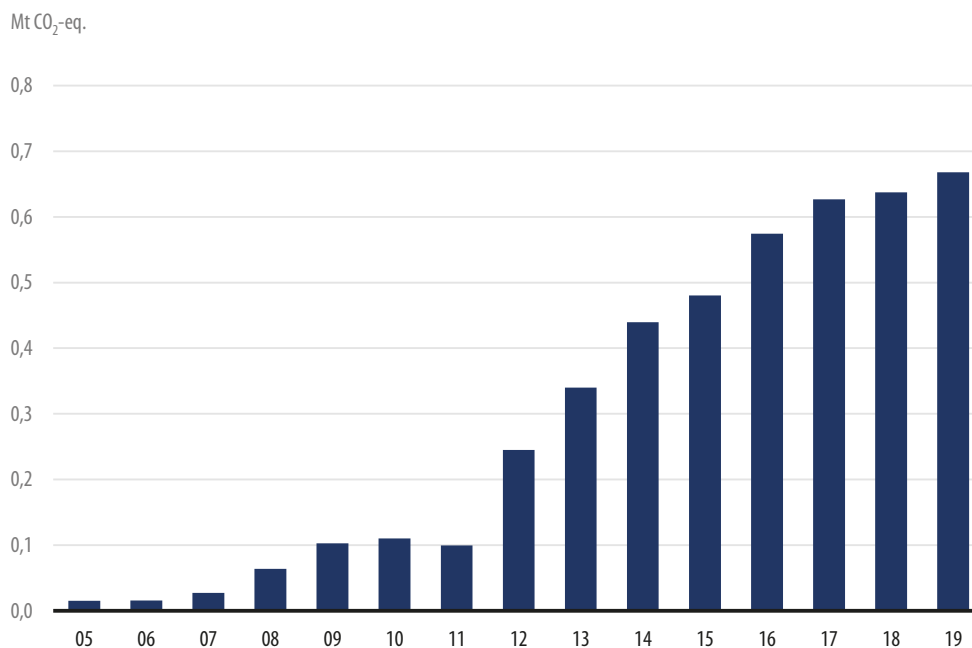
Since 2005, greatest reductions have been achieved in methane emissions from landfills as organic waste landfilling has declined. The decreasing emissions trend is expected to continue in the near future, as the Government Decree on Landfills (331/2013) that restricts landfilling organic waste, in force 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 emissions trend in wastewater treatment have been relatively stable.

Figure 19. GHG emissions from waste treatment in 2005–2019 and the 2020 proxy estimate.



Emissions caused by energy recovery from waste, i.e. waste incineration, are reported in the energy sector, and they are therefore 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 20). This is due to increased energy recovery from municipal waste. About 56% of municipal waste generated in 2019 was recovered for energy, while only about 17% of municipal waste was incinerated in 2008. Waste incineration emissions are expected to grow slightly in the next few years but stabilise thereafter.

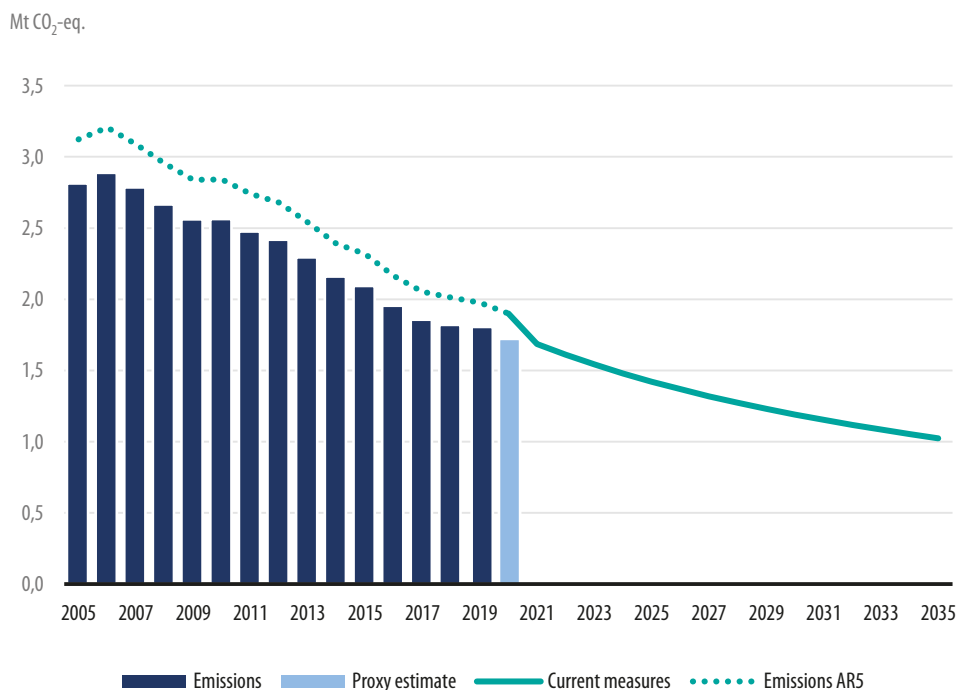
Figure 20. The emissions trend in waste incineration in the effort sharing sector in 2005–2019.



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 municipal waste by landfilling has been almost completely replaced by recycling and energy recovery from waste. Emissions from wastewater management are expected to remain more or less unchanged. Under the

baseline scenario, waste treatment emissions will decrease by 40% of 2019 levels by 2030, falling to almost half the current levels in 2035 (Figure 21).

Figure 21. The emissions trend in waste treatment in 2005–2020 and the baseline scenario estimate of the emissions trend achieved over 2021–2035 with existing measures. The 2020 data is a proxy estimate. 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.



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. Any potential further steps based on the results of the study are yet to be decided.

The reform of waste legislation is currently underway in the spring of 2021. The reform is related to the implementation in Finland of the EU Waste Package adopted in the summer of 2018. Its key objectives are to reduce the amount of waste and increase reuse and recycling. In addition to waste legislation, the National Waste Plan is also being updated. The National Waste Plan sets the targets for waste management and prevention and measures to achieve these targets. The National Waste Plan is being updated with a view to raising the recycling rate at least to the same level as the EU recycling targets. These above-mentioned policy measures will indirectly reduce greenhouse gas emissions from waste management, but their potential for reducing emissions is difficult to assess.

As part of the process of drafting a new medium-term plan for climate change policy, the aim is to also explore measures focusing on waste management and incineration that would help reduce emissions from these activities. Potential means of reducing emissions could include enhanced recovery of landfill gases, reduction of emissions from wastewater treatment, and application of the Green Deal with a view to reducing waste incineration emissions.

5.6 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 22). 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.

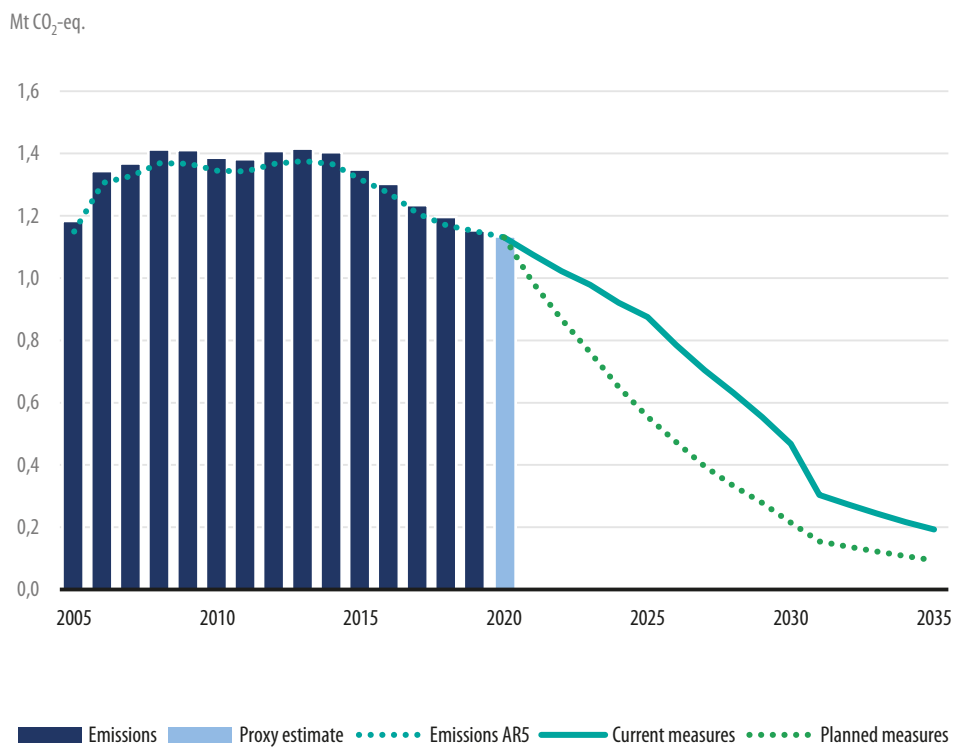
F-gas emissions decreased by almost 4% in 2019 and, based on proxy estimates, by almost 2% in 2020 relative to the previous year. The emissions have declined by almost 20% from the 2013 peak, but they still remain more than twenty times higher than in 1990. In 2020, F-gas emissions decreased in almost 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 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, for example, which aims to gradually reduce the quantity of F-gases placed on the market (see Appendix 2, Figure 48). 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. The planned additional measures can further speed up the already steep decline (Figure 22).

Figure 22. F-gas emissions in 2005–2020 and estimates of the emission trends achieved over 2021–2035 with existing and planned measures. The 2020 data is a proxy estimate.



The new medium-term plan for climate change policy currently being drafted introduces new measures to reduce F-gas emissions, including reform of the EU F-gas Regulation and enhancing its implementation, a demonstration project on the use of natural refrigerants in professional kitchens, a study on Finland's ODS and F-gas banks and their emissions management, and development of guidelines. Further measures include avoiding equipment containing F-gases in public procurement, promoting the adoption of alternative technologies and enhancing the recovery of F-gases by means of education and communication.

5.7 Other emissions

Non-ETS energy emissions are addressed by means of energy taxation, energy subsidies, energy efficiency measures and the obligation to distribute light fuel oil, as described above in this Annual Report.

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 emissions reduction effect of subsidised energy audits is estimated at 0.38 Mt CO₂ in 2020. In 2040, the emissions reduction effect would only amount to 0.13 Mt CO₂. The majority of emissions reductions are created in the emissions trading sector, as most energy savings come from declining consumption of electricity and district heat.

The obligation to distribute biofuel oil, enacted in 2019, does not only reduce emissions from machinery and oil heating of buildings but also from other activities using light fuel oil. In 2019, the amount of light fuel oil used in Finland was almost 19 TWh, with just over a fifth used for applications other than 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 machinery and building-specific heating by a maximum of 0.1 Mt CO₂.

5.8 Emissions trading sector

In the emissions trading sector, greenhouse gas emissions are primarily reduced by means of price controls created by the emissions trading system (ETS). The emissions trading system functions at the EU level and cannot be regulated at the national level. Emission trends in the Finnish emissions trading sector are described in Section 3.2.

The emissions trading system covers large industrial installations, power installations with a total thermal input exceeding 20 MW and smaller installations within the same district heating network, as well as aviation within the European Economic Area. All installations located in Finland that fall within the emissions trading system are required to obtain a greenhouse gas emissions permit from the Finnish Energy Authority. The emissions trading system applies to about 530 installations in Finland. The permit involves requirements to monitor and report emissions and an obligation to surrender each year to the Energy Authority allowances that are equal to the installation's emissions during the preceding calendar year. Each emission allowance gives the holder the right to emit one tonne of carbon dioxide. With the exception of a short stretch in March, the price of an emission allowance varied between EUR 20 and EUR 30 per tonne of CO₂ in 2020, up until early December when it started to rise, already exceeding the level of EUR 50 in May 2021 (see Appendix 2, Figure 29).

Alongside emissions trading, Finland also has in place some national policy instruments, which can influence emission trends in ETS installations located in Finland, at least to some extent. These include energy taxation, energy subsidies, energy efficiency measures, and measures to discontinue the use of coal for energy. As the majority of electricity and district heat production falls within the emissions trading system, emissions from the emissions trading sector will also decrease when the consumption of electricity or district heat declines as a result of energy efficiency measures, for example.

Installations falling within the scope of application of the emissions trading system are also within the energy tax system and subject to the same tax rates and rules as non-ETS entities. As of the beginning of 2021, taxation of heating fuels rose by EUR 2.7 per MWh. Several other changes to energy taxation were also decided in 2020. Those affecting operators within the emissions trading sector in particular include phasing out the energy tax rebate on fuels for energy-intensive companies, lowering category II electricity tax towards the minimum rate allowed by the European Union, and reducing tax subsidies for combined heat and power production.

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. The purpose of these agreements is to guide companies and organisations in improving their energy efficiency. The agreements cover more than 600 companies and their 6,600 sites and nearly 120 municipalities and joint municipal authorities. In 2020, the annual emissions reductions achieved through energy efficiency agreements amounted to approximately 6.1 Mt CO₂. Assuming that the current agreement period for 2017–2025 will continue, annual emissions reductions are estimated to stand at 9.6 Mt CO₂ in 2030 and 10.6 Mt CO₂ in 2040. About 95% of emissions 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. The annual emissions reduction effect of mandatory energy audits in 2020 amounted to approximately 0.13 Mt CO₂, which is estimated to increase to 0.35 million tonnes by 2040. Since the majority of emissions reductions come from declining consumption of electricity and district heat, about 95% of emissions reduced by mandatory energy audits are generated in the emissions trading sector.

The Ministry of Economic Affairs and Employment (TEM) 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 grants for investment projects and studies (TEM/BF) and investment grants for energy projects to replace coal (TEM).

Energy grants are 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. In 2020, more than 700 decisions were made to issue energy grants 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. As a general rule, energy grants will not be awarded to projects falling within the scope of the Emissions Trading Act (311/2011). However, aid may be granted to

investment projects related to activities falling within the Act's scope of application insofar as such a project involves new technologies or the financial benefits of emissions trading due to an investment remain modest.

The Act on the Prohibition of Energy Use of Coal (416/2019) adopted in 2019 basically applies to energy production installations operating within the emissions trading system. The prohibition will enter into force on 1 May 2029. In order to speed up decarbonisation, the Finnish Government issued a decree on investment aid for projects accelerating the replacement of coal in energy production in 2020–2025 (129/2020). The aid is intended to promote voluntary phase-out of coal use by the end of 2025. A total of EUR 90 million is allocated to the aid programme in the General Government Fiscal Plan for 2020–2021. Four projects were granted support in 2020, with a total sum of EUR 7.7 million.

The ban on the use of coal for energy is estimated to reduce the use of black coal by about 3 TWh in 2030 when compared with market-based development without the ban. The aid for accelerated phase-out will further reduce the use of black coal between 2026 and 2029.

5.9 Land use sector

Climate measures implemented in the land use sector contribute to the achievement of climate targets set nationally, within the EU climate framework and in international contexts. Significant measures relating to climate change mitigation and adaptation have been carried out in the land use sector for a long time on the basis of the National Forest Strategy. Several practical measures have also been launched during the current government term while also promoting a wide range of research and development activities and deployment of best practices.

A decree amendment adopted in the spring of 2020 makes a larger number of ash fertilisation projects eligible for support. The aim is to triple the level of ash fertilisation to cover 30,000 hectares per year. Metsähallitus, the state-owned enterprise governing the use of state-owned land, was assigned a growth target for carbon sinks and reservoirs applicable to areas governed by both its Business Operations and National Parks Finland for the first time as part of the new ownership policy adopted for Metsähallitus in the spring of 2020. The aim is to increase carbon sinks by at least 10%.

One of the objectives of the Government Programme is to promote afforestation. A new financial support scheme for afforestation of wastelands was prepared in 2020. The fixed-term Act (1114/2020) governing the support scheme came into effect at the beginning of 2021 and will remain in force until the end of 2023. Financial support may be granted to

private land owners for afforestation of wastelands, such as arable parcels excluded from agricultural production and former peat production areas. As the measure is not intended for the afforestation of arable lands used for cultivation, financial support is only available on condition that no agricultural aid has been granted for the arable area in question since 2019.

Since cost-efficient and effective implementation of measures in the land use sector requires a strong knowledge base and impact assessments, production and efficient utilisation of scientific knowledge play a key role in this respect. Over the course of 2020, an information programme was drawn up for the land use sector to establish the current status of the sector's data sets and identify development needs, taking account of the obligations set out in the UN Climate Change Convention and EU climate reporting provisions. A broad project package has been launched during 2021 to meet information needs, including soil information and land-use change monitoring. A research and innovation programme entitled 'Hiilestä kiinni – Catch the carbon', developed in cooperation with a wide range of stakeholders, was launched in early 2021. Its aim is to produce information that anticipates changes in the operating environment and proposals for solutions on how to make agriculture, forestry and other land use more climate-sustainable, both in the short and long term.

As part of implementing the Government Programme, funding has also been provided for evidence-based practical projects to facilitate agricultural producers, forest owners and other parties involved in making land use decisions to adopt new climate-sustainable practices.

In keeping with the Government Programme, the Government will create a comprehensive climate programme for the land use sector during 2021, including measures contributing to achievement of the 2035 carbon neutrality target. The plan will comprise measures required to achieve the climate target for the land use sector, an implementation plan for these, and a plan on how the measures and their impacts will be monitored. By 2035, the annual net impact of the measures focusing on forests and durable wood products, land-use changes, wetlands and carbon dioxide emissions from agricultural soil should be at least 3 Mt CO₂-eq.

6 Cross-cutting measures

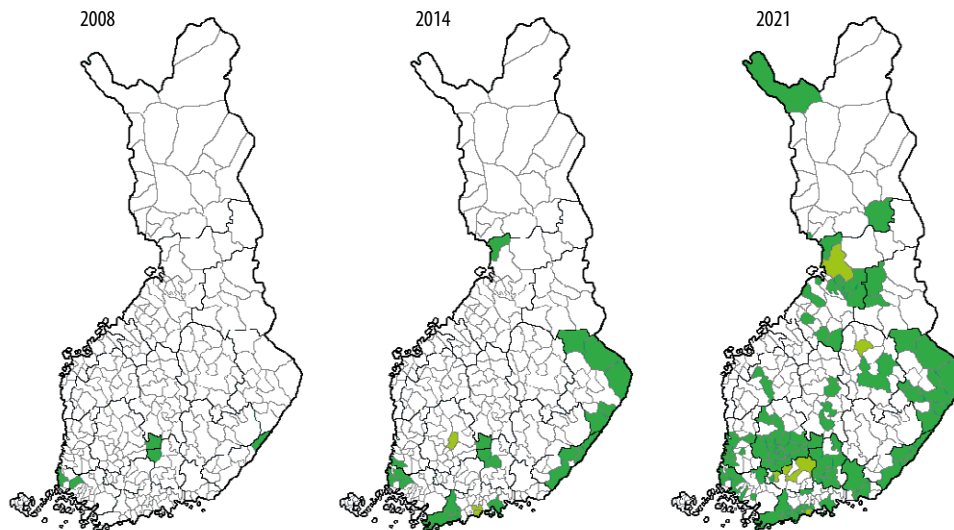
6.1 Climate work in municipalities and regions

Local authorities play a key role as Finland aims to achieve carbon neutrality by 2035. 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 authorities are responsible for spatial planning, land use, transport planning, ownership steering of energy companies, heating choices for many buildings, public procurement, etc.

The number of municipalities with ambitious climate targets has increased significantly in recent years. Almost two out of three Finns live in municipalities aiming to achieve carbon neutrality by 2035 (Figure 23). In addition to the municipal organisation's own emissions, municipal monitoring of greenhouse gas emissions and the carbon neutrality target also includes the majority of emissions from other activities within the municipality. In other words, the targets also cover the emissions trading sector's emissions, especially from electricity consumption and district heat production.

According to the new online emissions data service launched by the Finnish Environment Institute in February 2020, the effort sharing sector's emissions in the whole of Finland – including those of municipalities – only decreased by 13% from 2005 to 2019, but there may be significant differences between municipalities. The figure is higher in terms of total emissions, but the relatively modest reduction relative to the ambitious targets goes to show that more robust action should be taken to promote and accelerate municipal climate work.

Figure 23. Municipalities with a target of reducing emissions by at least 80% by 2030 (dark green) or after 2030 (light green). The figure shows the situation in 2008, 2014 and 2021.



As part of implementation of the Medium-term Climate Change Policy Plan (KAISU) for 2030, the Ministry of the Environment was allocated an annual appropriation of one million euros for the period from 2018 to 2021 to promote climate work at municipal and regional levels. In its spending limits discussions in the spring of 2020, the Government also earmarked an additional appropriation of four million euros for 2021 to accelerate municipal and regional climate work. The appropriation are channelled through the Municipal Climate Change Solutions Programme of the Ministry of the Environment to accelerate local and regional climate work.

The increased appropriation enabled the Municipal Climate Change Solutions Programme to grant funding to 45 municipal and regional projects in the spring of 2021, totalling about EUR 2.6 million. This meant that its geographical coverage became much wider, as funding was also received by many municipalities that had not raised their profiles in climate work before. While the projects cover a wide variety of themes, many are related to development of municipal climate change management, climate-related cooperation between local authorities and companies, and energy solutions for buildings. Each year, the Municipal Climate Change Solutions Programme provides funding for a few large national climate projects that produce results, operating models and tools widely benefiting municipalities and regions throughout the country. By way of example, the programme has funded projects that have produced ready-to-use materials and training courses to develop business cooperation and for campaigns focusing on municipal residents. Furthermore, the Finnish Environment Institute has supplemented the municipal emissions data service with a scenario tool that can be used to form municipal

emissions scenarios based on each municipality's current situation and various factors and measures influencing emissions.

Regional climate work is playing an increasingly prominent role in supporting municipal climate work. The Municipal Climate Change Solutions Programme is preparing an application procedure for projects through which regional parties would generally support all Finnish municipalities at the regional level. A specific aim is to provide small municipalities and those just getting started with their climate work with concrete expert assistance and support for seeking funding for climate work. Funding has also been allocated to ELY Centres for further preparation of the climate roadmap, with a view to introducing the climate work carried out within regional state administration as a visible and strategic activity.

Regional energy advice is an important way to promote achievement of energy and climate targets. These advisory services are funded by the Energy Authority and cover the entire Mainland Finland, reaching consumers, local authorities and SMEs at the local level. Regional advisory services were launched just over two years ago to provide objective information about energy, funding sources and subsidies. 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.

6.2 Public procurement

Finland spends between EUR 30 million and EUR 50 million on public procurement every year, depending on the calculation method. Finland has about 2,800 independent procurement units. The Finnish Environment Institute indicates that their purchases and investments account for almost one fifth of consumption-based greenhouse gas emissions generated in Finland. Purchases made by local authorities and joint municipal authorities account for the majority, nearly 80%, of these emissions while the remaining 20% come from central government procurement. The largest emissions arise from heat and electricity purchases, construction services, repair and maintenance of civil engineering works, and travel and transport services. Public procurement is an important way to promote both the achievement of the Sustainable Development Goals and a market for environmentally friendly products.

The National Public Procurement Strategy, 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 launch and promote measures to implement the strategy.

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.

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 network consortium 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 procurement units. As part of the National Public Procurement Strategy, it has launched a development programme for low-carbon public procurement to support Finland's carbon neutrality target. The development programme aims to help selected procurement units to achieve low-carbon targets through procurement and to share lessons and experiences with other procurement units. A currently ongoing experiment is testing ways to achieve low-carbon targets in six procurement processes relevant to climate targets.

Other KEINO initiatives include 15 regional change agents providing advice and acting as sounding boards for buyers operating in their own region, development groups in sectors such as construction and transport and for specific areas such as hospital districts, as well as the KEINO Academy, which is a development programme on strategic management of innovative public procurement provided free of charge for leaders and buyers.

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.

The Act on Public Procurement and Concession Contracts (1397/2016) encourages taking environmental aspects into account in public procurement, but does not impose it as an obligation. The Act on Consideration for the Energy and Environmental Impact of Vehicles in Public Procurement (1509/2011) provides that the energy and environmental impacts from vehicle use must be taken into consideration in procurement, including energy consumption and carbon dioxide, nitrogen oxide, hydrocarbon and particulate emissions. In addition, noise and local effects of emissions and other environmental impacts may also be taken into consideration in procurement. National implementation of the relevant EU Directive has been prepared and the implementing act is due to enter into force at the beginning of August 2021. The aim is to increase the percentage of zero- and low-emission vehicles in public procurement of vehicles and transport services.

Based on a Government Programme entry, 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 at the beginning of 2020. The University of Eastern Finland, the Institute for European Studies (VUB), 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. Based on the results, guidance on public procurement should focus on the following five themes: compiling and maintaining a list of product groups of highest environmental significance; developing combinations of tailored policy instruments for these groups; creating structures to support sustainable procurement; developing and resourcing knowledge-based support and measurement; and drawing up sustainable procurement strategies for procurement units.

Ministries and procurement organisations can sign voluntary agreements 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. Emissions from construction sites under the agreement include emissions from machinery, electricity and heating and, in stages, emissions from transport. 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 KEINO Competence Centre for Sustainable and Innovative Public Procurement supports the Ministry of the Environment in implementing the agreement.

6.3 Circular economy

A circular economy offers solutions to reduce greenhouse gas emissions and mitigate 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, increasing resource efficiency and introducing new business models.

Such circular economy operating models can reduce emissions from both consumption and production. Consumption can be influenced by means such as switching from products to services, renting, recycling and sharing, substituting durables for disposable products and repairing or servicing old products instead of buying new ones. Product design can, in turn, influence as much as 80% of a product's environmental impacts, including greenhouse gas emissions.

In a circular economy, 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 are recycled within the economy as long as possible, retaining or even adding to its value. The most significant emissions reductions are achieved in production through reducing virgin – i.e. primary – natural resources and developing energy efficient production processes. Production side streams are likewise put to use and any valuable materials are recovered from waste.

Circular economy operating models can reduce demand for primary raw materials and production volumes in many different ways. Such measures include promoting resource efficiency and use of recycled materials, extending product life cycles, and curbing over-consumption through repairs and a sharing economy. The operating models can support the transition from products to services and other new business models. Many of these circular economy measures are already in place, but significant emissions reductions can be achieved only when these operating models become mainstream. This development can be accelerated by promoting digitalisation.

Promoting a circular economy at national and EU levels in 2020

The process of drafting the Strategic Programme for Circular Economy started in January 2020 in accordance with the Government Programme. The programme was prepared in cooperation between the relevant ministries and research institutes, as well as the Finnish Innovation Fund Sitra and Business Finland. The programme proposal was published in January 2021 and the Finnish Government adopted a resolution based on the programme in April 2021.

The Strategic Programme for Circular Economy set out a vision and objectives for the circular economy, defined the necessary measures and monitoring indicators and proposed the resources required to promote the circular economy. Making this vision reality requires sustainable and efficient use of natural resources. The programme aims to 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. Natural resources used to manufacture export products are not included in this objective. At the same time, the strategy aims to double productivity by 2035 relative to 2015 levels while also doubling the circular material use (CMU) rate by 2035.

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. The previous EU Circular Economy Action Plan was from 2015 and it was implemented between 2015 and 2018. The new Action Plan aims to bring about a systemic shift towards sustainable production and consumption patterns. It contains 35 measures or legislative initiatives, which are already being implemented. The measures cover entire product value chains from design and production processes to consumption, repairs and reuse and further on to waste management and recycling.

The Circular Economy Action Plan emphasises that the circular economy offers solutions to reach climate targets and support biodiversity. The aim is for the circular economy to renew the EU's industrial base and improve competitiveness in a sustainable manner, taking the ecological framework conditions into account as the premises for operations.

Research on the emissions reduction potential of the circular economy in Finland

A report on the emissions reduction potential of the circular economy, entitled 'Circular economy promotes decarbonisation and protects biodiversity', was published in March 2021. The report explored the following key areas and material flows of the Finnish economy: construction and use of properties, the food and transport systems, the metal and forest industries, as well as plastics, electronics and textiles.

The circular economy measures examined in the project's specific analyses for each area were divided into demand-based measures and those related to material efficiency and recycling. However, the division has some overlap because circular economy measures are often interdependent. The availability of recycled raw materials for production processes, for example, always depends on the recycling rate of the raw material in question at the disposal stage, or the opportunities to repair or reuse a product at the end-use stage are often strongly dependent on the product design stage. It is therefore important that circular economy measures are carried out throughout the value chain to maximise

the impact of the following stage and achieve emissions reductions. This is also important to bear in mind when making an overall impact assessment to avoid double counting, for example.

The project's assessment of the greenhouse gas emissions reduction potential of circular economy measures was based on the following four elements: the deployment rate and potential identified for each circular economy measure in Finland, previous national and international research literature, expert assessments, as well as the project's workshops and own calculations based on tools such as the ENVIMAT model.

The results of the study are promising and help identify effective circular economy solutions in different sectors and materials chains. In general terms, positive impacts can be achieved by improving material efficiency, optimising material use, increasing reuse and extending life cycles, as well as introducing substitute materials and cascading material use. These measures can reduce environmental impacts of production activities and raw material extraction across sectors and production chains. The areas identified as the most important in terms of biodiversity were the forest industry, construction and the food system.

Climate and environmental strategy for the ICT sector

In November 2020, the working group preparing an ICT climate and environment strategy published its final report entitled 'Ecologically sustainable digitalisation contributes to climate targets'. A strategy based on the report was published in March 2021. The strategy measures promote a better understanding of challenges relating to energy consumption of data transmission and processing and materials consumption of ICT equipment and responses to these by businesses, public administration and consumers alike. The strategy also outlines measures to strengthen the role of digitalisation with a view to enabling economic wellbeing while reducing greenhouse gas emissions.

Digital solutions play a key role in intelligent energy systems, sustainable transport, improvement of the energy and material efficiency of industrial processes, and various circular economy solutions. Finnish ICT expertise, research, development and practical projects can play a key role in promoting a green transition.

7 Impact of climate action

According to Prime Minister Sanna Marin's Government Programme, the transition to carbon neutrality by 2035 should be carried out in a way that is fair from a social and regional perspective. When the transition is carried out in an intelligent and cost-efficient manner, its economic costs will remain low while it will also create financial opportunities for pioneers. This chapter provides an overview of the economic and social impacts of climate policy and its ambition, which are linked to aspects such as the legitimacy and fairness of climate action. The description of economic and social impacts mainly focuses on analyses based on recent studies, using Finland's carbon neutrality target and the measures required as input assumptions.

7.1 Economy

The impact of climate policy on the economy and economic players depends on the chosen policy instruments and their scale and focus as well as on how the additional general government revenue accrued by the instruments is used. Recent studies indicate that increasingly close attention should be paid to the economic impacts of climate action as part of the climate policy planning system, on the one hand, and the planning and management of central government finances, on the other.

Economic policy instruments have a bearing on public sector revenue and expenditure through tax and support measures. Emissions trading and CO₂-based tax are examples of economic policy instruments that generally improve the central government financial balance, whereas public investments and subsidies increase public sector expenditure. The effects of climate policy on the central government budgetary position are also indirectly dependent on the effects of other measures on economic activity and their feedback effects on central government finances.

According to a study carried out by the National Audit Office of Finland, climate change mitigation policy will play an increasingly significant role in central government finances over the next decade. However, the scenario modelling calculations made on current climate policy suggest that, should emissions reductions be carried out as cost-efficiently as possible, the overall economic costs and those incurred by central government as a result of climate policy would remain fairly low relative to GDP.

When assessing the economic impact of current climate policy, it should be noted that the model and other analyses currently involve considerable uncertainty. Many sectors are experiencing a very rapid and partially unpredictable transformation of the economic environment in some areas. As an open economy, Finland is closely linked as part of the global economy and value chains, which means that international trajectories will also reflect on the preconditions and impacts of Finnish climate policy. Climate policies carried out in the EU and other states also have effects on Finland and its policy.

In sectoral terms, the advantages and disadvantages of climate policy will vary in different sectors: for instance, some sectors may not be able to adjust production to rapidly changing conditions as easily as others, which will create additional costs. The need to offset the economic burdens of climate policy will also create costs to both central government finances and the national economy, but it is nevertheless possible to use income distribution policy and compensation measures to avoid unreasonable negative economic effects and promote the legitimacy of climate action.

Overall, the economic impact of current climate policy is estimated to be limited, but it should be noted that the analysis currently involves considerable uncertainty. However, the impact may be more substantial at the sectoral level. The potential negative effects of climate policy on some sectors or consumers can be prevented or mitigated through policy measures sensitive to such effects.

7.2 Employment

A study on the employment effects of climate policy published in the spring of 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 decline in employment can be partially attributed to Finland's climate policy, which is more ambitious than that of the EU, and its guiding effects on the use of low-emission and more costly production technologies. The higher costs of such production technologies may be reflected as a decline in international competitiveness, which in turn would affect labour demand and pay levels.

However, employment trends vary significantly from sector to sector. The study suggests that employment can be supported by means such as identifying the skills needs created by climate change as part of education and training policy or 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 solutions to the climate crisis can be supported by means such as raising the level of education. Employment trends can also be influenced by supporting innovation in production of 'green' products.

Between 2020 and 2021, the working group on peat appointed by the Ministry of Economic Affairs and Employment examined the economic and social impacts of halving the energy use of peat in keeping with the Government Programme. During its work, it became evident that the use of peat for energy would decline considerably faster than outlined in the Government Programme, with direct and indirect effects on regional and local employment. The overall employment impact will depend on how many new jobs are created and lost – no comprehensive impact assessments have thus far been conducted. The above-mentioned negative employment effects can be mitigated by offering peat industry operators consultancy and support for starting a new business or, alternatively, training for another field.

7.3 Income distribution

It is recognised that climate policy may have potential effects on income distribution, which are reflected in the legitimacy of policy measures and, in broader terms, in social sustainability. These income distribution effects are specifically related to the tax and support policies that guide towards emissions reductions. Emissions-based increases in the level of consumption taxes, for example, may reduce purchasing power among low-income households relatively more than among those with higher income. Possible effects on income distribution can, however, be balanced by shifting the focus of taxation and offsetting adverse effects elsewhere in taxation. Examples of such compensation include offsetting an increase in a consumption tax by lowering income taxes with focus on low- and middle-income households.

According to a study on the income distribution effects of climate policy published in the autumn of 2020, climate policy will affect income distribution through income generation (wages and salaries, capital income, direct payments, long-term growth potential) and consumption (emission tax, energy content in products). Households are also affected by

factors such as their position in income brackets, consumption patterns (e.g. proportion of transport in consumption), socio-economic status (e.g. occupation), stage in life and place of residence. Climate policy may have direct or indirect effects on household income distribution. Indirect effects may arise from emissions taxation of companies, for example, which may be reflected in product prices, pay levels and labour demand.

Analysis of scenarios for measures revealed that income distribution effects depended on the incidence of the taxes in place and the compensation mechanisms applied. Differences in the incidence of taxation were visible when comparing taxes on transport fuels and some of the heating fuels with a scenario where the electricity tax is reduced and the energy tax rebate system is abolished. Taxes on transport and heating fuels clearly fell on household consumption and services used by households. The effects of lowering the electricity tax and abolishing the energy tax rebate system, in turn, affected businesses and energy production.

The tax scenarios have direct or indirect effects on households. Households are directly affected by taxation of emissions from household energy consumption, which is progressive in terms of consumption in that high-income households consuming more energy and energy-intensive services pay more than households with lower income and consumption levels. Emissions-based taxation affecting businesses and energy production is reflected less directly in income distribution.

7.4 Health and wellbeing

Global warming affects human health through increasing heatwaves, new infectious diseases, epidemics, slip injuries, indoor air problems due to moisture damage, smoke from forest fires, non-indigenous species, or more intensive pollen exposure, etc. Increasing cloudiness and precipitation and shorter periods of snow cover may also increase symptoms of depression, especially in winter. Climate policy therefore plays an important role in promoting human wellbeing and preventing health hazards.

The impacts of climate change on wellbeing and adaptation to these are being studied in the CHAMPS project of the Finnish Environment Institute between 2020 and 2023. The project investigates health impacts from the perspectives of mental health, temperature-related stress, occupational health and labour productivity.

Climate change is known to impact most heavily on disadvantaged people. Groups identified as vulnerable include poor and marginalised people, older people, children and people with disabilities. In addition, people living in areas that have homogeneous business structures or are otherwise sensitive to climate change effects are also in

vulnerable situations. According to the Finnish Institute for Health and Welfare (THL), the progress of climate change increases the need for social support. Health and social services will also need to adapt to climate change.

An ambitious climate policy promotes human health and wellbeing by reducing the adverse health effects of global warming. At the same time, however, climate action can also have health-promoting effects through direct factors such as air quality or indirectly by increasing the attractiveness of walking and cycling. The effects of such measures on health and wellbeing are linked to the overall legitimacy and usefulness of climate policy.

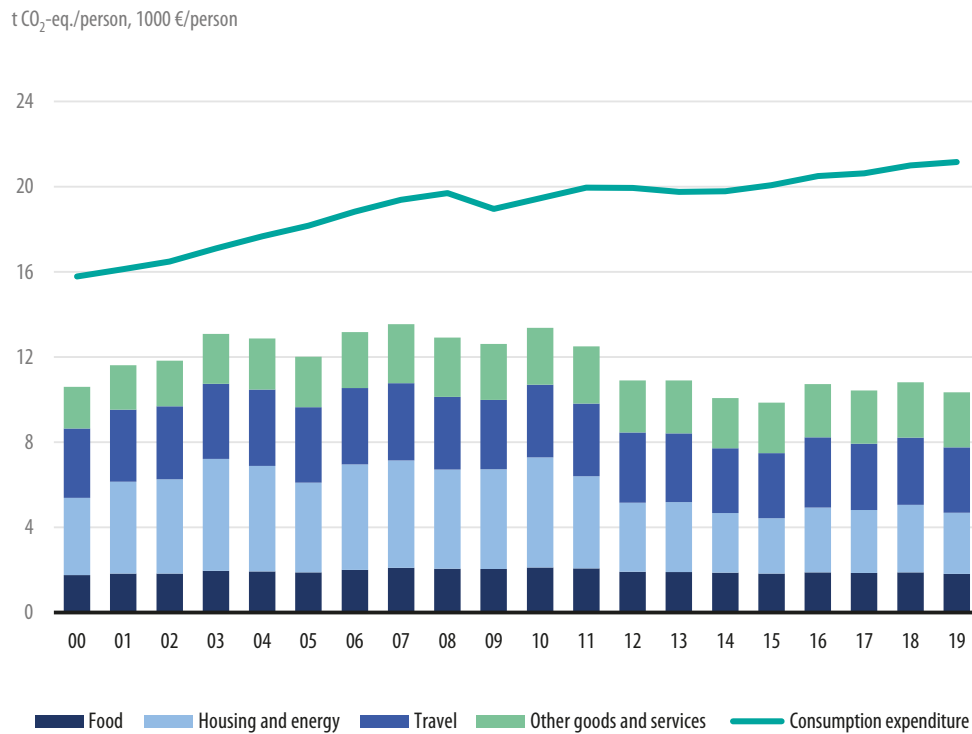
8 Carbon footprint of consumption

According to the Finnish Environment Institute (SYKE), household consumption accounted for about 66% of consumption-based greenhouse gas emissions in Finland in 2015. 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 emission 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.

The major role of people's everyday consumer and other choices in terms of emission trends was recognised in the first medium-term plan for climate change policy, which encouraged consumers to halve their carbon footprint by 2030. Nevertheless, the average household carbon footprint has not shrunk in recent years.

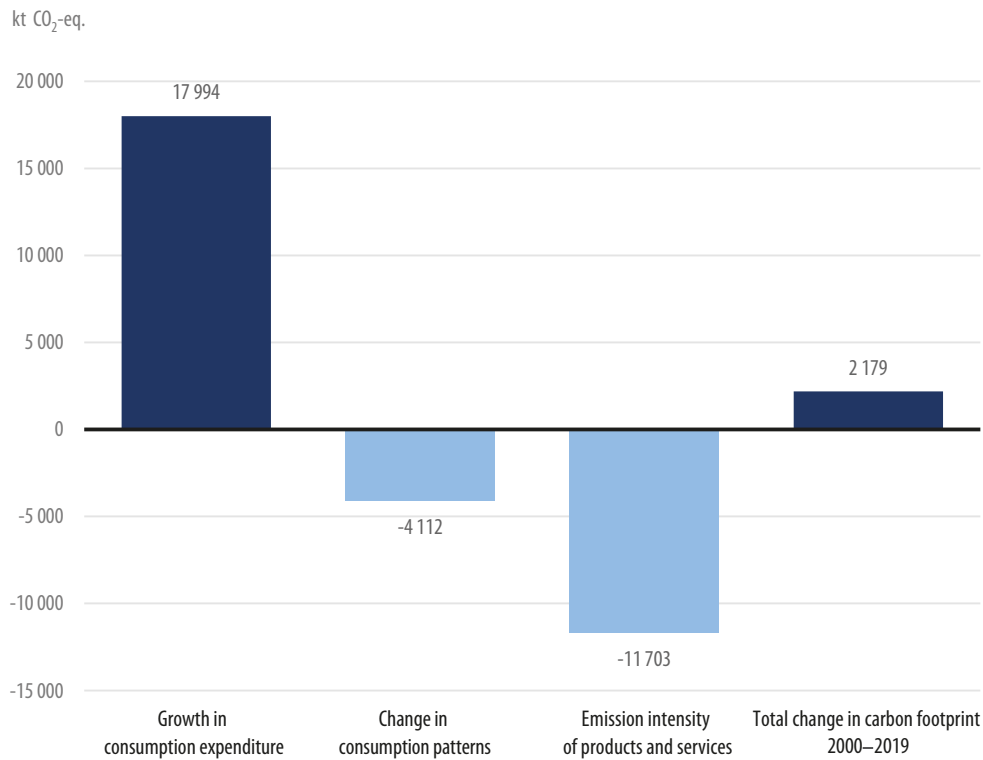
In 2021, the Finnish Environment Institute updated the time series for the carbon footprint of household consumption expenditure for the period from 2000 to 2019. The average annual per capita carbon footprint varied from 9.9 tonnes to 13.5 tonnes CO₂-eq, peaking in 2007 and 2010. In 2019, the carbon footprint amounted to 10.3 t CO₂-eq. Emissions remained at more or less the same level over the last four years under review (Figure 24). Taking account of population growth, the carbon footprint of aggregate household consumption expenditure rose by 4% since 2000. The accounting method accounts for changes in emissions from imported electricity, excluding any other imported products.

Figure 24. Average consumption expenditure (at 2015 prices) and carbon footprint of Finnish households in 2000–2019. The data is based on updated calculations from the Finnish Environment Institute’s ENVIMAT model.



The Finnish Environment Institute estimates that changes in the emissions intensities of consumption patterns and commodities helped shrink Finnish households’ carbon footprint over the 2000–2019 period, but these were surpassed by the impact of growth in consumption expenditure (Figure 25). Change in 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 33%), change in consumption patterns (-8%), and change in emissions intensity of products and services (-21%). The primary explanatory factor for the carbon footprint of household consumption is income level, which eclipses the role of all the other factors.

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.



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.

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.

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. Based on 2016 data, the Finnish Climate Change Panel estimates that

the carbon footprint in the highest income decile is almost triple that in the lowest. 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.

The megatrends contributing to consumption include urbanisation, the climate crisis and increasing scarcity of natural resources, digitalisation and technological advancements, as well as changing demographics, including ageing and migration. These trends will change our living environment and lifestyles in the long term. By way of example, society's electrification and digitalisation may have an effect on the number of commutes, day-to-day transactions, ease of buying or the social status of consumption in social media. During the coronavirus pandemic, remote work has affected transport emissions in particular. In 2020, coronavirus restrictions significantly reduced the number of flights made by Finns.

The policy instruments associated with consumption have traditionally been 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. In 2020, the Central Finland ELY Centre allocated about EUR 300,000 in grants to regional and national environmental education and awareness-raising projects. Overall, 61 projects applied for grants worth a total of about EUR 1.6 million. In 2020, grants were allocated to projects promoting biodiversity and active climate citizenship. Funding was also granted to climate education through the Municipal Climate Change Solutions programme, which supported climate education and training provided for different age groups at health clinics and schools, for example.

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. The Hiilihelppi ('Carbon Helper') website was launched in 2021, offering information on how to reduce the carbon footprint from housing in an easily understandable form. The website allows users to search targeted information for various types of housing.

9 Corporate carbon handprint

The concept of a carbon handprint has featured increasingly in climate policy debate in recent years, especially as one of the key elements of corporate climate action. The carbon handprint indicates how much a company's products and services help other parties reduce their carbon footprints. In other words, instead of an individual party's own emissions reductions, the handprint only includes emissions avoided as a result of using the company's products and services. The handprint can also be considered at the sectoral level, adding up the emissions avoided through products offered by all companies operating in a specific sector. The larger the handprint, the greater the impact achieved to mitigate global warming.

According to the Carbon Handprint Guide published by VTT Technical Research Centre of Finland and the LUT University, a carbon handprint can be created either by offering a solution with a lower carbon footprint than the baseline solution or by helping clients to reduce the footprint of their processes. In the first case, a party offers a new low-carbon alternative to the baseline solution used before, avoiding some of the carbon footprint normally generated by the latter. In the latter situation, a party helps a customer to create a new way of reducing emissions by developing the production process, resulting in a smaller carbon footprint than in the baseline solution.

In other words, in its simplest form, the calculation formula is: 'baseline carbon footprint minus carbon footprint from handprint product (CO₂-eq)'. Although the handprint can be calculated using life-cycle assessment, a particular challenge in the methodology is to assess the products or processes to be replaced in each specific case and the corresponding carbon footprint data. Due to the choices and knowledge gaps involved, corporate or sectoral handprints may differ considerably in different assessments; neither are the handprints reported by different sectors necessarily comparable. Despite methodological difficulties, it is fair to say that, as a general rule, companies operating at

the vanguard of low-carbon technological development have a higher handprint potential and probably also a significant export potential in a world pursuing a low-carbon future.

Parties have an opportunity to increase their carbon handprint by scaling innovations in the global market. The handprints estimated for different sectors in Finland are considerable relative to the whole country's total greenhouse gas emissions. The industrial sector has typically recognised the need to strengthen its handprint. Due to the uncertainty involved in determining handprints, numerical presentation of handprint results for an entire sector as part of official national greenhouse gas reporting is still premature. However, it is important that companies aim to strengthen their knowledge base on the topic and use it to develop their own climate action and in communications with their clients. Public communications about handprints should apply the same principles as those set out in international standardisation of life-cycle assessment, meaning that handprint results should be audited by a demonstrably qualified third party. Reporting on corporate and sectoral carbon handprints is therefore primarily an issue of communication, which is not as such related to calculating national emissions.

10 Climate change adaptation

Impacts of accelerating climate change call for stepping up adaptation measures

Global warming is accelerating as the latest research results indicate that the Arctic has already warmed up by more than 3 °C, triple the global average. Warming has significant effects on ecosystems and the prevalence of extreme weather events. The warming Arctic also further contributes to accelerating climate change due to greenhouse gas emissions released from soil and generated by forest fires as a result of melting permafrost. The ever accelerating pace of change highlights the urgency of adaptation measures and the need to step up broad action to prepare for change across different sectors of society. Adaptation is about the capacity of society to provide for and adjust to the impacts of a changing climate by systematically preparing for weather and climate risks and developing solutions to reduce and manage these.

In addition to unexpected and extreme weather and water conditions, rising temperatures and changing precipitation induced by climate change will also cause more slowly emerging phenomena. These include growing risks of disease and pests and spread of invasive alien and non-indigenous species, which are a threat to human, animal and plant health and sources of livelihood based on natural resources, such as agriculture and forestry as well as the game and fisheries sector. Besides direct and local effects, climate change impacts are also transmitted to Finland indirectly through global raw material, energy, money and human flows and logistics chains. The knowledge base on the economic costs related to impacts and risks and investments required for adaptation is still lacking. It is nevertheless clear that the costs of inaction would be substantial and that preparedness will be more cost-effective than repairing and compensating for damage.

Finland's National Climate Change Adaptation Plan 2022 was adopted as a Government Resolution in 2014. In keeping with the Climate Change Act, an update to the national plan will be launched under the leadership of the Ministry of Agriculture and Forestry in 2021. The new EU Adaptation Strategy was published in February 2021. The strategy is more ambitious than its predecessor and its objectives and actions cover a broad range

of different levels and sectors of society. Moving forward, strategy implementation in Member States will also be reinforced by the new European Climate Law, which obliges the Member States to take the EU strategy into account in national adaptation strategies and plans. The European Climate Law requires the Member States to develop national adaptation strategies and plans while also stressing their implementation and monitoring.

The aim of the implementation of Finland's national adaptation plan is to reduce the harmful effects of climate change on people's safety, health and living conditions, nature and other environments, livelihoods, infrastructure and society's critical functions. Its implementation is promoted and monitored by the monitoring group on climate change adaptation coordinated by the Ministry of Agriculture and Forestry, with a broad-based composition consisting of almost all ministries, various agencies and research institutes, regional and local government representatives, and other stakeholders. In keeping with the national adaptation plan, the ministries are responsible for implementing, monitoring and evaluating the plan in their respective administrative branches. Specific adaptation plans or programmes have been drawn up within the administrative branches of the Ministry of Agriculture and Forestry and the Ministry of the Environment and, as of spring 2021, within the administrative branch of the Ministry of Social Affairs and Health as well. Several ministries have also included adaptation in more extensive climate and environmental programmes within their respective branches. At the national level, it is necessary to ensure consistent development of policy instruments in order to systematically promote climate change adaptation in society. It is also necessary to develop methods for monitoring climate resilience in particular.

At the regional level, the Centres for Economic Development, Transport and the Environment (ELY Centres) play a key role in adapting to climate change, producing and managing relevant information, and translating national plans into practical action. The tasks of the ELY Centres currently include several measures promoting climate change adaptation, which were identified in the climate roadmap project carried out from 2019 to 2021. The project results were collected in an electronic tool and are being utilised to improve the effectiveness of climate action carried out by the ELY Centres. The climate cooperation network set up by regional councils in 2020 has also launched a situational awareness analysis of regional adaptation work. Regional and sub-regional climate strategies and roadmaps have thus far dedicated varying degrees of attention to the perspective of adaptation. About half the regions have examined climate change adaptation, most as part of broader efforts to develop a climate strategy or roadmap.

In 2020, municipal capacities to prepare for a changing climate were especially developed in a project run by the Association of Finnish Local and Regional Authorities and the National Emergency Supply Agency. The project report highlighted the statutory duty of local authorities to deliver critical day-to-day services in all conditions, which may change

quite suddenly as a result of climate change. The heatwaves in summer 2018 and floods in spring 2020, for example, put pressure on municipal healthcare and social welfare services, rescue services and transport. The project produced a guide to support municipal preparedness for climate change. Weather and climate risks are often regional and require regional and local action to manage. Strengthening adaptation at regional and local levels calls for better tools for climate resilience to support activities at both decision-making and operational levels.

Published in the spring of 2019, the mid-term evaluation of the national adaptation plan indicates that awareness of the importance of adaptation measures has especially increased in administration and data production, whereas regional, cumulative and interdependent climate risks and adaptation to these are not yet sufficiently identified. Continuous efforts are being made to develop a knowledge base of the impacts and risks of climate change and methods and tools to prepare for these, such as the following:

- New and more detailed weather and climate data has been produced for parties operating in the forest bioeconomy while also developing new forecasts related to risks such as snow and wind damage (Säätyö project, 2018–2020). Further development is still required to improve the practical applications of the forecast products.
- Southwest Finland's regional project has developed preparedness for drought risk, especially in agriculture and water management. The project developed a drought estimation service, piloted a drought risk management plan and worked on a drought risk management model to expand its usability (LOSSI project, 2019–2020). The tools develop in the project still require further development to improve their practical applications.
- Regionally accurate assessments of both current and future key risk factors related to climate change have been produced for Finland's land and sea areas on commission by the Finnish Climate Change Panel. At the same time, the project examined the costs and benefits of adaptation and the relevant policy instruments (SUOMI project, 2020–2022). The information collected by the project will be used to update the National Climate Change Adaptation Plan.
- The role of non-life underwriting in and its links to climate change mitigation and adaptation were explored in a study published by Finance Finland in 2021. The study also looked into the opportunities for cooperation between the non-life insurance business and the public sector, particularly in terms of sharing information on preparedness and risks.

The Government's analysis, assessment and research activities have helped meet the following information needs:

- The most significant economic risks posed by climate change and measures to reduce these risks are currently being studied. Assessments of economic risks are conducted based on literature and model calculations, especially for agriculture and forestry and energy infrastructure (KUITTI project, 2020–2021). The assessments due to be completed in late 2021 will be put to use in decision-making and in support of different parties in planning and implementing practical adaptation measures.
- The effects of climate change on security are currently being studied in a project that systematically assesses these effects from the perspective of Finnish foreign and security policy. The aim is to improve the conditions for understanding and preparing for the security implications of climate change across administrative boundaries based on an analysis of comprehensive security (Climate Change and Finland's Security project, 2020–2021).
- Various means of foresighting and managing climate migration have been studied and assessed particularly from the perspective of EU and Finnish activities and objectives, taking account of security and human rights aspects. The project has examined means to respond to the phenomenon of climate migration and support adaptability to change in risk areas, as well as in other areas where migrants are moving on a temporary or more permanent basis (ILMASI project, 2020–2021).

EU-funded research and innovation projects are also underway to support adaptation, while EU investments in data production will increase as a result of implementation of the new EU Adaptation Strategy. It is necessary to promote the opportunities of Finnish parties to participate in international research and development in order to enable Finland to make use of the information, services and business models produced by these in its national efforts to prepare for and adapt to a changing climate.

Climate change has wide-ranging impacts across society that also extend to people's daily lives. Understanding and awareness of adaptation action and its opportunities should be strengthened by means of both research and communications. The Strategic Research Council's new research programme entitled 'Climate change and humans (CLIMATE, 2020–2026)' seeks solutions to how people can make choices related to climate change mitigation or adaptation and how society can facilitate these choices in a sustainable and equitable manner. The programme includes four project consortia, which seek concrete ways of supporting various actors in society in their efforts to mitigate and adapt to climate change through new information, operating models and technological solutions

to the use of natural resources and other issues. Climate change impacts are already evident and will intensify in the future.

The considerable risks brought about by change do not recognise state borders. The kind of world and circumstances to which different parties will have to be prepared to adapt as the climate changes depends on how successful international climate change mitigation efforts will be. Finland also contributes to promotion of climate resilience as part of international development funding, including investments in climate work. In 2019, these investments amounted to EUR 147 million, with 36% dedicated to climate change adaptation. Finland aims to strike a balance between funding for climate change mitigation and adaptation.

It must also be recognised, however, that adaptation has its limits, which are especially manifested in concrete terms in Finland in changes to Arctic ecosystems. It is therefore of the utmost importance to strengthen a coherent climate policy, i.e. mitigate climate change, while also reinforcing society's climate resilience and preparedness for the impacts of climate change. Finland's ability to prepare for climate change will improve by strengthening broad-based cooperation, forging partnerships and developing climate-resilient solutions. At the same time, these will contribute to creating opportunities to promote export of Finnish expertise and technologies in order to address global challenges relating to food security, adequate access to clean water and sustainable use of natural resources.

APPENDICES

Appendix 1. Policy measures

Table 3. Climate change mitigation policies by sector. Actions listed in the Medium-term Climate Change Policy Plan (KAISU) are indicated by 'x' in the final column of the table. The table also contains measures decided after KAISU was completed and measures targeting the emissions of the emissions trading sector.

	Policy measure	Implementation status	Further information	KAISU (x)
Effort sharing sector				
Transport	Biofuel distribution obligation	<p>The Act on Promoting the Use of Biofuels in Transport entered into force in 2008. The legislation on the obligation to distribute biofuels was updated in 2019, setting the obligations to post-2020.</p> <p>In April 2021, the Government submitted a legislative proposal to Parliament on the inclusion of biogas and renewable liquid and gaseous transport fuels of non-biological origin (including e-fuels) in the distribution obligation.</p> <p>The levels of the distribution obligation will be assessed in the latter half of 2021 as part of the preparation of the climate and energy strategy.</p>	<p>The distribution obligation sets the biofuel distribution obligation at 18% in 2021, increasing it to 30% by 2029.</p> <p>Issued in April 2021, the legislative proposal extends the scope of the distribution obligation to biogas and renewable liquid and gaseous fuels of non-biological origin (RNFBO). The Government Proposal seeks to implement the regulations in the Renewable Energy Directive II (RED II) on the promotion of renewable energy in transport. The acts in the proposal are intended to enter into force in June 2021.</p> <p>The intention is to add biogas to the distribution obligation in 2022 and RNFBO fuels in January 2023.</p>	x
Transport	Examination of the obligation to distribute biogas	<p>The Ministry of Economic Affairs and Employment is preparing a legislative amendment in the context of the implementation of the RED II in 2020-2021.</p> <p>The corresponding Government Proposal was presented to Parliament in April 2021 (see above).</p>	See above.	

	Policy measure	Implementation status	Further information	KAISU (x)
Transport	Transport tax reform	<p>A reform of taxes and payments in sustainable transport will be launched in accordance with the Government Programme. The working group preparing the reform issued an interim report on employee benefits in August 2020, and the taxation of the employee benefits on transport was revised in January 2021. The group issued its final report on other transport taxes (current and new ones), including recommendations in May 2021.</p> <p>The decision on any changes to transport taxes will be made later during the budget negotiations</p>	<p>The taxable value of electric vehicles used as a company car was reduced at the start of 2021, and the charging of electric vehicles at the workplace or in public charging points was made tax-free for 2021–2025.</p> <p>The taxation of employer-subsidised commuter tickets was simplified and employer-subsidised bicycles were defined as a tax-free benefit up to a value of EUR 1,200.</p>	
Transport	Roadmap to fossil-free transport	<p>The Government Resolution on the mitigation of the emissions of domestic transport (Roadmap for fossil-free transport) was issued in May 2021.</p> <p>The Government also issued separate resolutions on the mitigation of the greenhouse gas emissions of air transport and maritime and inland waterways transport. The decisions on the financing of individual subsidies will be made in the budget negotiations.</p> <p>The implementation of the roadmap will be monitored in the Ministerial Working Group on Climate and Energy Policy.</p>		
Transport	Digitalisation of public transport services	<p>In the Budget for 2018, KAISU was given an annual appropriation of EUR 3.5 million for 2018–2021 for developing the public transport in major urban areas in order to promote digitalisation and servitisation of transport.</p> <p>The total amount of funding granted by now is approximately EUR 7 million. The funding is back-end weighted and may be granted up to 2022–2023 as carryover appropriations.</p>	<p>In 2018–2019, the Finnish Transport and Communications Agency granted funding for projects on account-based payment systems and contactless payments in urban areas.</p> <p>The themes in the call for government grant applications for 2020–2021 were the development of ticket and payment systems, automation of transport and other Transport as a Service projects. Based on the applications, the Finnish Transport and Communications Agency decided to grant a subsidy for 8 projects, a total of EUR 4.9 million. A new round of applications will probably be held in 2022–2023.</p>	X

	Policy measure	Implementation status	Further information	KAISU (x)
Transport	Support for climate measures in public transport	<p>Prime Minister Marin's Government Programme subsidises climate measures in public transport by EUR 20 million per year</p> <p>In March 2021, the Finnish Transport and Communications Agency Traficom launched a call for applications on these climate-based subsidies.</p>	<p>EUR 7 million of the climate subsidies in 2021 is tied to the agreements on land use, housing and transport (LHT agreements) in the major urban areas and EUR 3 million to similar agreements in medium-sized urban areas.</p> <p>A maximum of EUR 20 million will be granted as discretionary government transfers to projects that seek to increase ridership and its monitoring in public transport and promote clean motive power and fleets in bus and coach transport arranged by the authorities.</p>	
Transport	Subsidies for the construction of distribution infrastructure for electricity and biogas used in transport	<p>In 2018–2019, the public distribution infrastructure of electricity and gas for transport was subsidised by EUR 3 million per year. In 2020–2021 this subsidy was increased to EUR 5,5 million. The subsidy is proposed to be continued in 2022–2025 as part of the roadmap for fossil-free transport.</p> <p>In 2018–2021, ARA grants subsidies to housing associations in electrical renovations required by electric vehicle charging stations and in the construction of the charging stations.</p> <p>Funding for the subsidies of the distribution infrastructure in 2021–2023 will be sought from the EU Recovery and Resilience Facility.</p>	<p>Distribution infrastructure subsidy promotes investments in the public charging and distribution infrastructure of alternative motive powers of transport.</p> <p>ARA's subsidy is used to promote the spread of capabilities to charge electric cars at home and thereby increase the electric car fleet. The subsidy has been very popular and its amount has been increased significantly in the last few years from the 2018 baseline level. For 2021, the sum reserved for the subsidy is EUR 5.5 million, in addition to which the third supplementary budget for 2021 contains a decision for extra funding EUR 7.5 million for 2021.</p>	x

	Policy measure	Implementation status	Further information	KAISU (x)
Transport	Subsidising the purchase and conversions of electric vehicles and gas-powered lorries, and scrapping premium	<p>The budget of the Ministry of Transport and Communications in 2018–2021 contains a provision for an appropriation of EUR 24 million for the promotion of the purchase of electric vehicles and the conversion of old cars to ethanol or gas power. The Government Programme states that the conversion subsidy will continue at the present level also in 2022. The subsidy is proposed to be continued as part of the roadmap for fossil-free transport.</p> <p>The purchase subsidy for gas-powered lorries entered into force in December 2020. An appropriation of EUR 7 million has been reserved for the subsidy.</p> <p>The first scrapping premium campaign was carried out in 2018. The new Act on Scrapping Premiums entered into force in December 2020 and will be in force from 1 December 2020 to 31 March 2022. In April 2021, the Finnish Transport and Communications Agency reported that the entire subsidy allocated for scrapping premiums was already consumed.</p>	<p>A person who buys or leases an all-electric car for a long period of time is eligible for a purchase subsidy of EUR 2,000 from the central government.</p> <p>A person who converts an old petrol car to run on natural gas or ethanol may also receive state aid. The conversion subsidy is EUR 1,000 for a natural gas vehicle and EUR 200 for an ethanol-powered car. These subsidies are only granted to private individuals.</p> <p>In the 2020 scrapping premium campaign, the premium was granted for scrapping an old car and replacing it with a new car, an electrically-assisted bicycle, a season pass for public transport or connection service that contains a right to travel in public transport. The scrapping premium varies between EUR 1,000–2,000 depending on the target of the subsidy.</p>	x
Transport	Green Deal for the automotive sector	<p>The climate agreement (Green Deal) between the central government and the automotive sector was signed in November 2018. By April 2021, the agreement had been signed by 18 companies operating in the automotive sector.</p>	<p>The common goals of the automotive sector and the central government support the actualisation of the climate goals. The agreement will be in force until 2025.</p>	x

	Policy measure	Implementation status	Further information	KAISU (x)
Transport	Public procurement	<p>The Government Proposal for the Act on the environmental and energy efficiency requirements in vehicle and traffic services procurement was presented to Parliament in April 2021.</p> <p>The national implementation of the Directive on the promotion of clean and energy-efficient road transport vehicles will start in August 2021.</p>	The legislative proposal seeks to promote the mitigation of emissions in transport by increasing the proportion of zero- and low-emission vehicles in public procurement. The Act would also implement the Directive on the promotion of clean and energy-efficient road transport vehicles and would contain provisions on the minimum percentages of zero- and low-emission vehicles in public procurement. The minimum proportions for municipalities are to be adjusted based on the regional differences.	x
Transport	Agreements on land use, housing and transport and the development of public transport	<p>The agreements on land use, housing and transport (LHT) for 2020–2031 were made between the central government and the Helsinki, Tampere, Turku and Oulu urban regions in autumn 2020. The term of the agreements is 12 years.</p> <p>In summer 2020, the central government initiated LHT agreement negotiations with three new regions :Jyväskylä, Lahti and Kuopio. The negotiations were held in autumn 2020.</p>	The purpose of the LHT agreements is to improve the alignment of the development of the urban structure and the transport system to reach the goals of the national climate policy, among other things. The agreements create the preconditions for a sufficient and diverse offering of plots and housing production, a more compact urban structure and a functional, safe and sustainable transport system.	x
Transport	Rail-related purchases	EUR 2 million/year was reserved in LVM's budget for 2018–2021 for increasing purchases related to rail transport.	<p>The supplementary appropriation was used in 2018–2020 for purchasing supplementary rail transport around Finland, while utilising the rolling stock and infrastructure capacity efficiently.</p> <p>The previous agreement on purchased transport services and the decision on a public service obligation expired at the end of 2020. The agreement on purchased transport services for 2021 was made during the Covid-19 pandemic. Negotiations on the procurement of new passenger train services from the beginning of 2022 for up to 9 years have been continued.</p>	x

Policy measure	Implementation status	Further information	KAISU (x)	
Transport	Programme for the promotion of walking and cycling	<p>In March 2018, the Finnish government adopted a resolution to support promotion of walking and cycling.</p> <p>The central government's annual financial contribution for the promotion programme is set at EUR 30 million from 2019 to 2023.</p>	<p>In 2020, this level of central government funding was fully achieved for the first time. In the same year, the Finnish Transport and Communications Agency granted a subsidy to 51 projects supporting walking and cycling. The total amount of the subsidies was EUR 31.5 million. In early 2021, the Finnish Transport and Communications Agency granted EUR 891,000 in subsidies for 26 mobility management projects across Finland.</p> <p>In the autumn of 2020, the Finnish Transport and Communications Agency implemented for the first time a call for government grant applications for programmes that seek to promote walking and cycling in municipalities and regions.</p> <p>Measures to be taken in the state transport infrastructure network were granted EUR 10 million in 2020, half of which will be allocated to municipalities in the regions of Helsinki, Oulu, Tampere and Turku in line with the agreements concerning land use, housing and transport.</p>	x
Transport	Bicycle park-and-rides at transport nodes	<p>Some of the projects that received the government grant through the investment programme for walking and cycling also promote the development of bicycle parking at public transport nodes.</p> <p>In 2020, the basic transport infrastructure management for walking and cycling will focus on bicycle parking at railway stations and nodal public transport stops.</p>	The Finnish Transport Infrastructure Agency develops bicycle park-and-rides in cooperation with municipalities.	x

	Policy measure	Implementation status	Further information	KAISU (x)
Transport	Development of transit station areas	In 2020, transit station areas were developed, for example, in the Fiksu Assa (Smart Station) project and the Action Plan for Cooperation towards Sustainable Stations.	Transit station areas are developed through the cooperation of many parties. The central government bodies involved in the development of station areas are the Finnish Transport Infrastructure Agency and Senaatin Asema-alueet Oy. In addition, the Finnish Transport and Communications Agency Traficom promotes the development of passenger and freight transport nodes, such as transit station areas, as part of the development of the entire transport system, public transport and other transport services.	x
Transport	Looking into congestion charges	Congestion charges were investigated in the LHT2019 planning of the Helsinki region. Progress in the matter requires legislative changes as well as active measures by the central government and urban regions. In line with the Government Programme, the aim is to introduce legislation enabling traffic congestion charges to be introduced in city regions, with the aim of managing traffic.	The Ministry of Finance is responsible for developing the legislation on congestion charges.	x
Agriculture	Perennial cultivation of organic soil without soil preparation	Rural Development Programme for Mainland Finland, 2014–2020.	A five-year commitment at the beginning of the programme period. Amount of aid EUR 50/ha/year. Renewal of the EU's Common Agricultural Policy for the next financing period is currently underway, and the measures will be re-examined in conjunction with the process. This measure will end in 2022. Renewal of the EU's Common Agricultural Policy for 2023–2027 is currently underway, and the measures will be re-examined in conjunction with the process.	x
Agriculture	Afforesting organic soil and wetlands	The Act on Temporary Subsidy for Afforestation was approved in December 2020.	A new financial support scheme for afforestation of wastelands was prepared in 2020. The fixed-term Act governing the support scheme came into effect at the beginning of 2021 and will remain in force until the end of 2023.	x

	Policy measure	Implementation status	Further information	KAISU (x)
Agriculture	Raising the groundwater level with controlled subsurface drainage	Rural Development Programme for Mainland Finland, 2014–2020.	Investment support can be granted for setting up controlled subsurface drainage for the amount of 40 per cent of the eligible costs. Additionally, agri-environment payments can be granted for controlled subsurface drainage, controlled irrigation and recycling of runoff water. This measure will be re-investigated during the revision of the EU's common agricultural policy.	x
Agriculture	Promoting biogas production	Rural Development Programme for Mainland Finland, 2014–2020. A national biogas programme was prepared under the direction of the Ministry of Economic Affairs and Employment. In accordance with the Government Programme, the Ministry of Agriculture and Forestry prepared a nutrient recycling pilot programme 2020–2022 and an investment subsidy for biogas and advanced manure processing methods. The preparation of a subsidy for the production of biogas based on nutrient cycles is still in progress.	Farms can be granted investment subsidy for renewable energy investments. Small rural enterprises and SMEs that process agricultural products may apply to the Rural Development Programme for a rural business subsidy provided for business activities other than agriculture and forestry. Investment support is also granted for the purchase of gas components for tractors. In addition to subsidies, state guarantees can also be granted for funding investments in energy production that utilises renewable energy sources. The stimulus package contains a proposal to increase the biogas investment subsidies for farms to 50% of the approved total costs. This measure will be re-investigated during the revision of the EU's common agricultural policy.	x
Agriculture	Promoting the increased sequestration and storage of carbon in soil and the implementation of the 4per 1000 initiative through research projects and experiments	Rural Development Programme for Mainland Finland, 2014–2020. The preparation of a comprehensive climate plan for the land use sector has been started in accordance with the Government Programme.	Measures already in place: recycling nutrients and organic matter, disposing of slurry in fields, planting winter cover crops, maintaining environmental grasslands and adjusting water levels (controlled subsurface drainage). This measure will be re-investigated during the revision of the EU's common agricultural policy. Several related research and development projects are underway.	x

	Policy measure	Implementation status	Further information	KAISU (x)
Agriculture	Climate Food Programme	The climate food programme is being prepared in accordance with the Government Programme.	The goal of the programme is to support the society's transition towards a climate-sustainable food system that takes into account all dimensions of sustainability: social, economic, cultural and ecological.	
Building-specific heating	Promoting energy repairs with subsidies, 2020–2022.	Government issued the Decree in December 2019. ARA has accepted applications for the subsidy since January 2020.	Subsidies are granted for repairs projects designed to improve the energy efficiency of residential buildings; the preliminary appropriation is EUR 20 million for the year 2020 and EUR 40 million per year in 2021 and 2022.	
Building-specific heating	Subsidy for discontinuing the use of oil heating in residential buildings.	Launched in September 2020, this subsidy scheme applies to detached houses. The subsidy is applied for from the Pirkanmaa Centre for Economic Development, Transport and the Environment.	A total of EUR 28.67 million was allocated to the subsidy scheme for detached houses in 2020; EUR 9.44 million in the 2021 budget and EUR 10 million in the 2021 supplementary budget.	
Building-specific heating	Action plan that encourages oil-heated properties to shift to other forms of heating in the 2020s.	The process of drafting an action plan for phasing out fossil fuel oil in heating 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 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 available, 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.	
Building-specific heating	Obligation to distribute biofuel oil	The Act on the Promotion of Biofuel Oil entered into force in April 2019.	Starting from 2021, some of the light fuel oil intended for heating, mobile machinery and fixed engines must be replaced with biofuel oil so that the proportion of biofuel oil will be at least 3% in 2021 and, increasing thereafter by one per cent per year, up to at least 10% in 2028.	x
Building-specific heating	Taxation of heating fuels	The tax was increased in January 2019. In January 2021, the price of light fuel oil was increased by a separate tax increase.	The tax on light fuel oil was raised by about 2%. In the beginning of 2021, the price of light fuel oil was increased to EUR 2.7 per megawatt-hour.	x

	Policy measure	Implementation status	Further information	KAISU (x)
Building-specific heating	Discontinuing the use of oil heating in the public sector	The Finnish Defence Administration has continued the process of discontinuing the use of oil heating as planned. Discontinuation of oil heating and switching to other forms of heating in municipally owned buildings has been expedited by grants since October 2020.	A key measure has been switching to the use renewable energy sources in conjunction with the tender process for district heating plants. In 2020, EUR 14.9 million was allocated for the subsidy for discontinuing the use of oil heating in municipally owned buildings.	x
Mobile machinery	Obligation to distribute biofuel oil	The Act on the Promotion of Biofuel Oil entered int force in April 2019.	Starting from 2021, some of the light fuel oil intended for heating, mobile machinery and fixed engines must be replaced with biofuel oil so that the proportion of biofuel oil will be at least 3% in 2021 and, increasing thereafter by one per cent per year, up to at least 10% in 2028.	x
Mobile machinery	Taxation of heating fuels	The tax was increased in January 2019. In January 2021, the price of light fuel oil was increased by a separate tax increase.	The 2019 tax increase on light fuel oil was approximately 2%. In the beginning of 2021, the price of light fuel oil was increased to EUR 2.7 per megawatt-hour.	x
Mobile machinery	Measures for reducing carbon dioxide emissions from mobile machinery	The Green Deal agreement on the mobile machinery sector was made in October 2019	The Ministry of the Environment and the Association of Finnish Technical Traders made a Green Deal agreement on the mobile machinery sector, i.e. a voluntary agreement on the reduction of emissions in the sector. The agreement encourages the sector to seek measures that reduce carbon dioxide emissions from mobile machinery.	
Mobile machinery	Improving the quality of data on emissions from machinery	A project funded by Ministry of the Environment for the development of the TYKO model was completed in May 2019. The Ministry of Transport and Communications leads the investigation into the revision of the LIPASTO calculation system for traffic exhaust emissions and energy use (including the TYKO model) and transfer of the calculation to Statistics Finland.	The aim of the project was to improve the quality of the baseline data in the TYKO model. The Ministry of Transport and Communications initiated the preparation of the investigation project in spring 2021.	x

	Policy measure	Implementation status	Further information	KAISU (x)
Mobile machinery	Increasing the percentage of energy-efficient and low-emission machinery through public procurement	Emission-free worksites – Green Deal agreement on sustainable procurement in September 2020.	Ministry of the Environment, Senate Properties and the city of Espoo, Helsinki, Turku and Vantaa. The first version of the emission-free worksite was published in April 2021. Among other things, it contains the procurement criteria for mobile machinery used on worksites created under the direction of KEINO Competence Centre.	x
Mobile machinery	Promoting energy-efficient use of machinery with information guidance	Needs relating to instruction in the use of machinery have been identified.	Motiva and the Association of Finnish Technical Traders will cooperate to design a training programme on energy efficient use of mobile machinery. The Ministry of the Environment has committed to funding the training project by EUR 50 thousand.	x
Mobile machinery	Promoting the electrification of mobile machinery	The base forecast for mobile machinery emissions and the impact of electrification on the emissions was completed in March 2021.	VTT Technical Research Centre of Finland assessed for the first time the impact of the electrification trend of mobile machinery on their emissions, limiting the investigation on the types of machinery with the highest emissions. The Ministry of the Environment funded the investigation by EUR 12,000.	
Waste management	Investigate the possibilities of reducing emissions by voluntary agreements and taxation of waste incineration	The investigation on the possibility of taxation of waste incineration is suspended until further notice.	The intention is to start Green Deal negotiations in the waste management sector in order to reduce the emissions from waste incineration and to promote circular economy.	
Waste management	Reform of the Waste Act, increasing separate collection and recycling	The reformed Waste Act and associated decrees will enter into force in 2021.		
F-gases	Avoiding equipment containing F-gases in public procurements	The criteria for sustainable public procurement in order to reduce emissions and the use of F gases was published in January 2020. The communications effort to increase awareness of this is ongoing.	The criteria are intended to guide municipalities and other parties responsible for public procurement, as well as private sector operators, to purchase equipment that uses low-GWP refrigerants. It will take some time before the published criteria are put to practice in procurement, resulting in a delay in their impact on emissions.	x

	Policy measure	Implementation status	Further information	KAISU (x)
F-gases	Promoting the adoption of alternative technologies and enhancing the recovery of F-gases by means of education and communication	The adoption of qualification requirements for persons who handle natural refrigerants is being looked into in order to secure a safe transition to alternative substances to F-gases. SYKE has enhanced communication and guidance concerning alternative substances.		x
F-gases	Looking into and demonstrating alternative technologies suited for local conditions	Scheduled to complete in the summer of 2021, the preliminary study of the project investigates refrigeration devices in professional kitchens.	The project will identify a sector in which F-gases are used, in which the transition to the use of natural refrigerants is starting and in which the transition will help improve the energy efficiency of equipment. The sector should also include Finnish equipment production. The aim is to develop new equipment that uses natural refrigerants and adopt it at chosen sites. The project's realisation depends on whether funding is obtained for it.	x
Cross-cutting measures				
Municipalities	Speeding up the climate work of municipalities and regions	Municipalities and regions are aided in their own projects, and national projects supporting the climate work of municipalities are funded. Interaction between the national and regional levels is taken care of.	Climate work of municipalities and regions has been expedited by EUR 1 million per year from 2018 to 2021. In addition, the government granted a supplementary appropriation of EUR 4 million for 2021. Individual funding have been coordinated through the Municipal Climate Change Solutions programme (2018–2023) of the Ministry of the Environment. During 2018–2021, the programme has funded approximately 110 local, regional and national climate projects by grants and procurements.	x
Municipalities	Cost estimates of measures to support decision-making	The Ministry of the Environment is funding a project that is looking into the possibility to prepare a tool for municipalities to assess the impacts of their climate work.		x

	Policy measure	Implementation status	Further information	KAISU (x)
Municipalities	Ensuring that municipalities provide unbiased regional advice on energy for various groups of consumers.	Regional energy advice is supported with project funding in 2018–2021.	Regional energy advice includes advising consumers in energy-related matters as well as promoting energy audits and energy efficiency agreements among municipalities and SMEs.	x
Consumption	Cost estimates of measures to support decision-making	<p>At the end of 2018, the government launched a new service for sustainable lifestyle (sitoumus2050 [commitment2050]).</p> <p>The Hiilihelppi (Carbon Helper) website was launched in 2021, offering concrete instructions for citizens on how to reduce their carbon footprint in their form of housing. The site is funded by the Ministry of the Environment and Sitra.</p> <p>Consumers can get support for energy overhauls, discontinuation of oil heating and forms of traffic that support the halving of the carbon footprint. Additionally, measures that promote cycling and walking have been implemented, which also has an impact on the citizens' carbon footprint.</p>	<p>The Commitment2050 service (Sitoumus2050) contains a sustainable lifestyle test, and with the test results, the service displays hints and tips on how to reduce your carbon footprint in everyday life.</p> <p>Several new studies are currently in progress, for example on consumer nudging and digital solutions.</p> <p>The Municipal climate solutions project funded projects that are associated with the halving of consumption.</p>	
Public procurement	Developing a 'one-stop-shop model' for speeding up sustainable and innovative procurements	Competence Centre KEINO has been set up. Among other things, it has launched development groups and is currently preparing to pilot Green Deals in public procurement.	There are development groups for the promotion of low-carbon construction and autonomous public transport, for example. Green Deals are being prepared, such as the Green Deal for low-emission construction sites.	x
Public procurement	A Green Deal for low-emission construction sites.	In September 2020, the Ministry of the Environment, Senate Properties and the cities of Espoo, Helsinki, Turku and Vantaa signed a voluntary Green Deal agreement to reduce emissions at construction sites.	The aim of the agreement is that construction sites of the cities and Senate Properties will be fossil-free by the end of 2025.	x

Policy measure	Implementation status	Further information	KAISU (x)
Emissions trading sector			
Energy production	Competitive tendering on the production subsidy for renewable energy (so-called premium system)	The competitive tendering process was held between 15 November 2018 and 31 December 2018 and the Energy Authority made the decisions in November 2019.	Subsidies were granted for a total of 7 wind power projects with a combined annual production of 1.36 TWh.
Energy production	Act on Discontinuing the Use of Coal in Energy Production	The Act will enter into force in April 2019.	Using coal for the production of electricity and heat will be banned from May 2029 onwards.
Energy production	Investment support for projects to replace coal as an energy source, 2020–2025.	Government issued the Decree in March 2020. The Decree will be in force until December 2025.	The aid is intended to promote voluntary phase-out of coal use by the end of 2025. A total of EUR 90 million is allocated to the support programme in the General Government Fiscal Plan. Four projects were granted support in 2020, with a total sum of EUR 7.7 million.
Energy production	Tax increase of heating fuels (including the reduction of tax subsidy for combined production)	The Act entered into force in December 2020.	Taxes were increased and the tax subsidy for combined production was reduced starting from January 2021.
Industry	Reduction of electricity tax category II (including the industry) to the minimum EU level	The Act entered into force in December 2020.	The tax was reduced in January 2021.
Industry	Abolishment of the energy tax return of energy intensive companies.	The Act entered into force in December 2020.	The tax return system will be phased out gradually, until no returns are paid in 2025.

	Policy measure	Implementation status	Further information	KAISU (x)
Industry	Data centres and heat pumps that generate heat for the district heating network will be moved to electricity tax category II.	The implementation proposal of the Government Programme is being prepared in the Ministry of Finance.		
Industry	Sector-specific low-carbon roadmaps will be created in cooperation with the operators of the sector.	The roadmaps are complete.	The roadmaps will be used in the preparation of new climate measures. Summary of sectoral low-carbon roadmaps (Ministry of Economic Affairs and Employment Publications 52/2020)	
Industry	Tax increase of heating fuels (including the reduction of tax subsidy for combined production)	The Act entered into force in December 2020.	Taxes were increased and the tax subsidy for combined production was reduced starting from January 2021.	
Companies and associations	Energy efficiency agreements	Agreement period 2017–2025 is underway	The agreement activities involve more than 600 companies and their 6,600 sites and nearly 120 municipalities and joint municipal authorities.	

Appendix 2. Sector-specific indicators

Energy production and consumption

Figure 26. Emissions from combustion in the energy industry, construction and industry in 2005–2020. The 2020 data is a proxy estimate. Most of the emissions shown in the chart are generated in the emissions trading sector. Source: Statistics Finland.

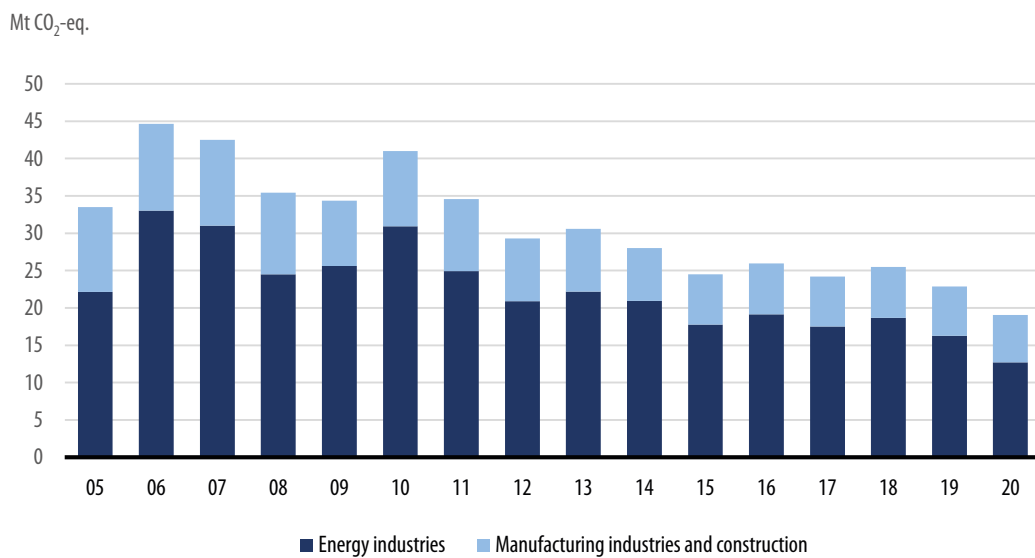


Figure 27. Emissions from industrial processes in 2005–2020. The 2020 data is a proxy estimate. Most of the emissions shown in the chart are generated in the emissions trading sector. Source: Statistics Finland.

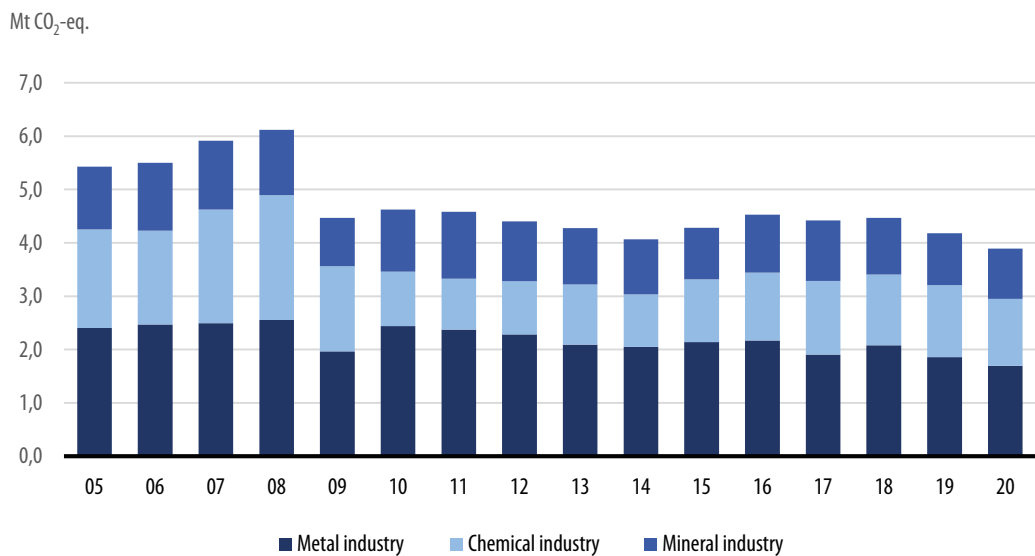


Figure 28. Total energy consumption by energy source in 2005–2020. The 2020 data is a proxy estimate. The chart is missing the fossil share of recycling and waste fuels (approx. 3 TWh in 2020), reaction heat and hydrogen from the industry (2 TWh) and net import of electricity (15 TWh). Source: Statistics Finland.

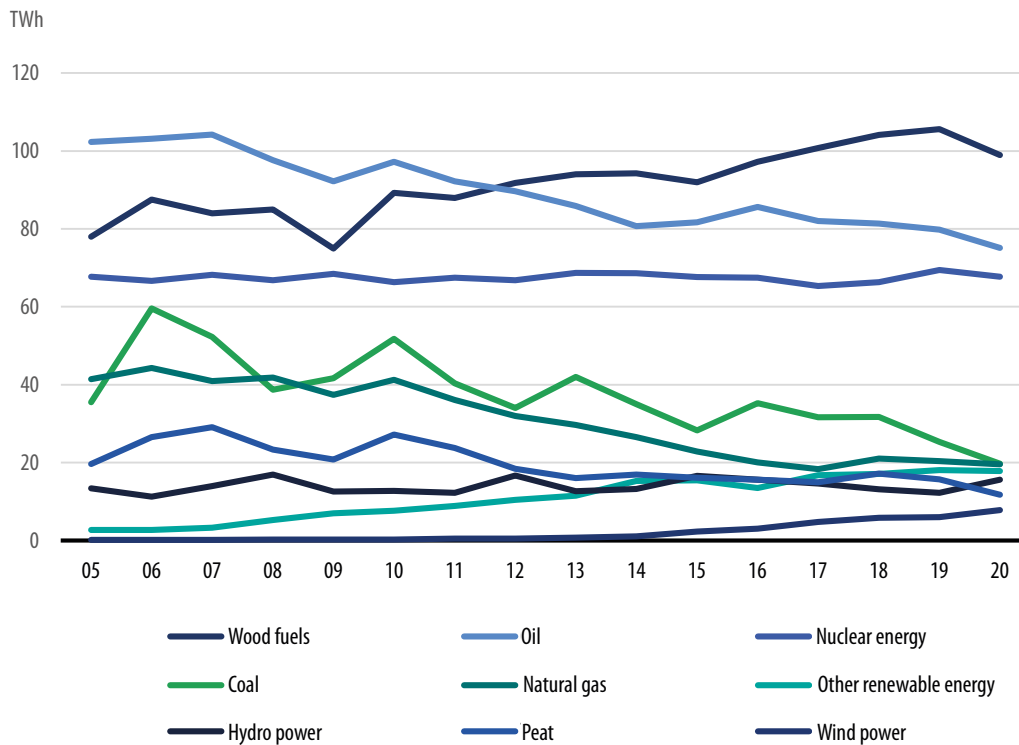
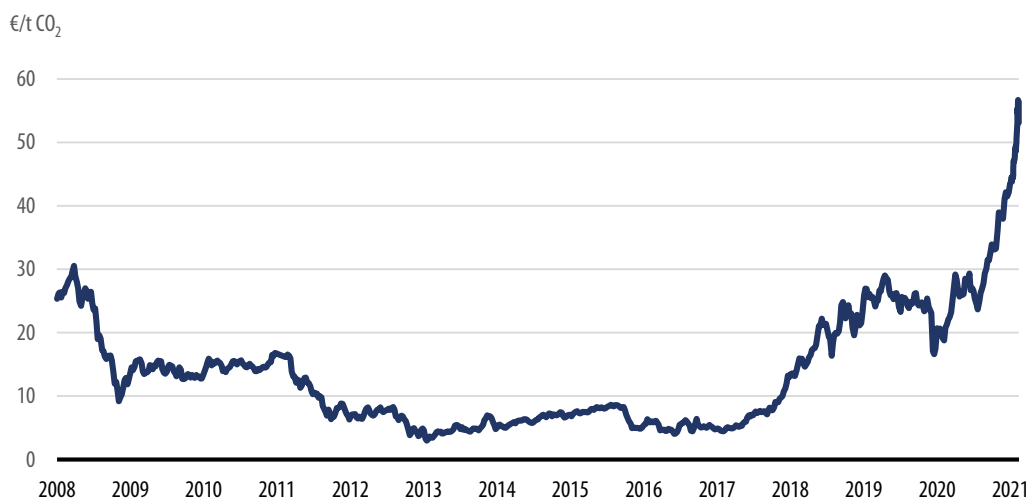


Figure 29. The price of an emission allowance (EUA Futures DEC 2021) in the EU emission trade from April 2008 to May 2021. Source: Ember.



Transport

Figure 30. Energy consumption in road transport by energy source in 2005–2019. Source: Statistics Finland.

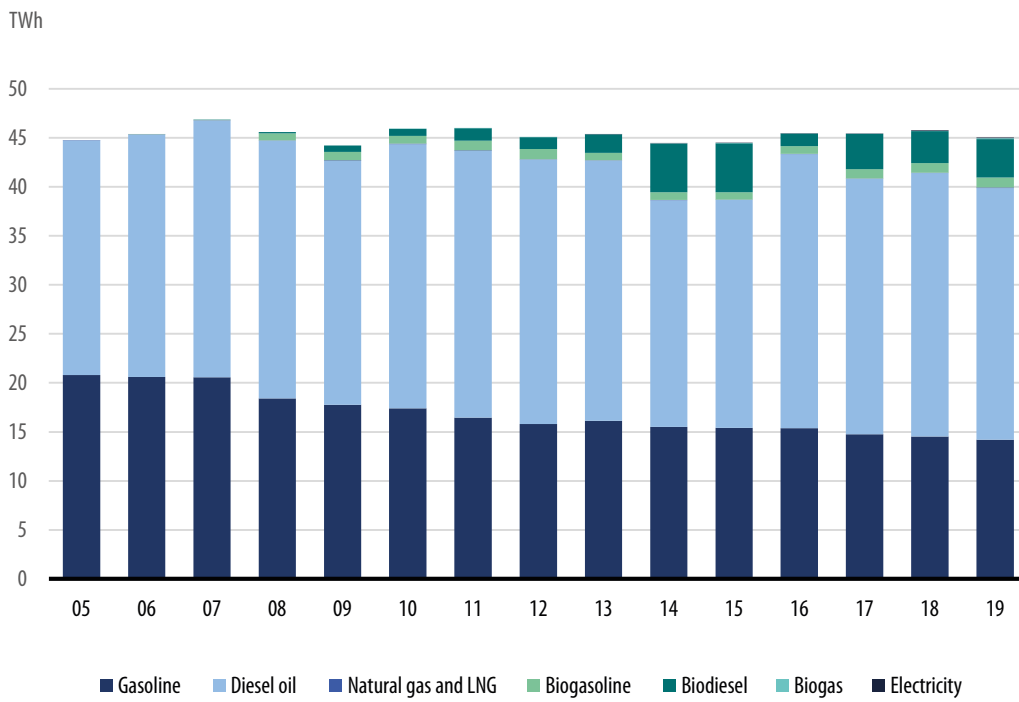


Figure 31. Road traffic performance (million km) in 2000–2020. The statistical method for calculating road performance changes in 2016. Source: Statistics Finland.

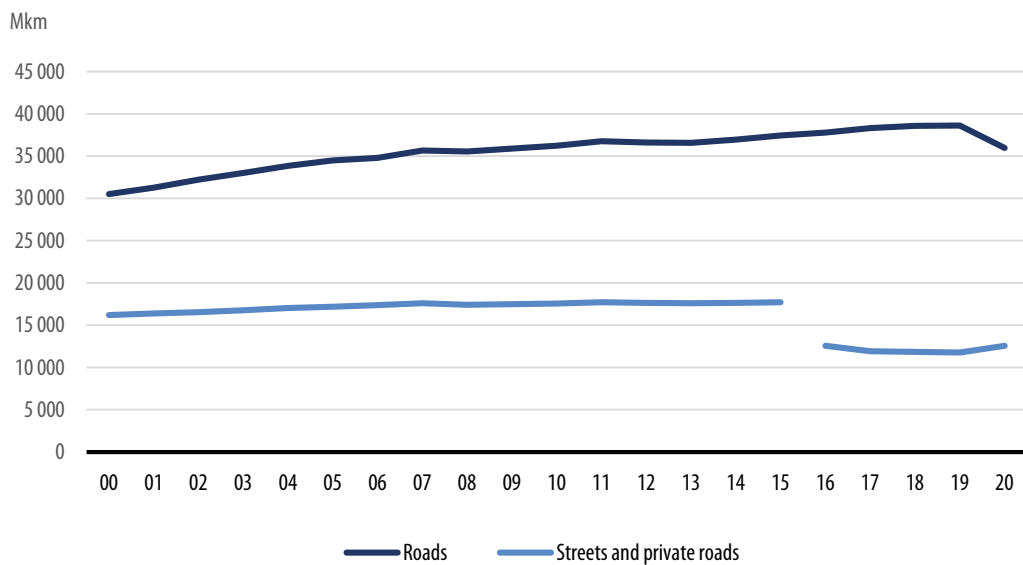


Figure 32. Proportion of biofuels in transport fuels (%). Double counting is taken into account in the targets for 2008–2020. In contrast, the target for 2021–2030 does not include double counting. The 2020 data is preliminary and only contains the physical share of biofuels. Source: Statistics Finland and Eurostat.

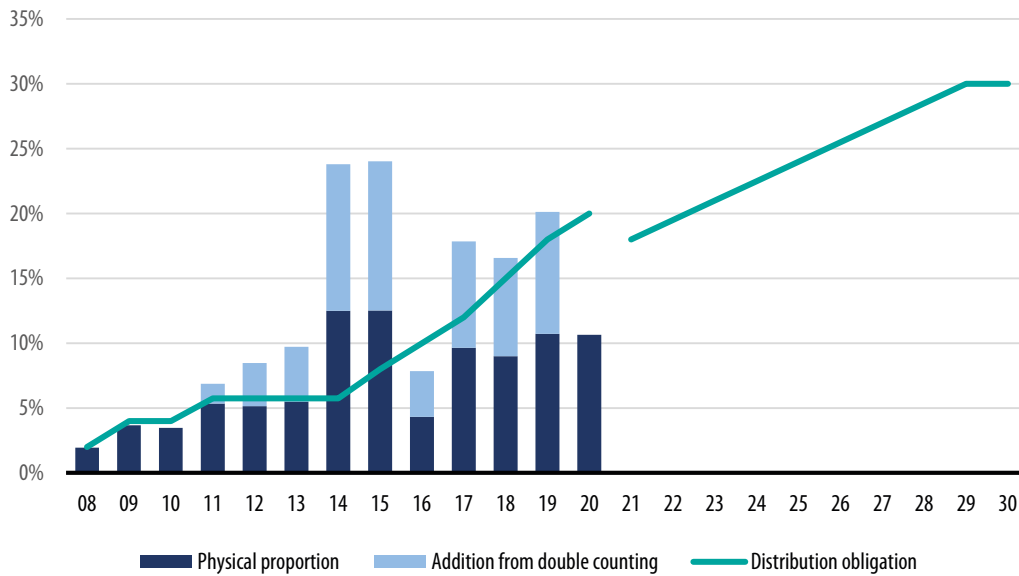


Figure 33. First registrations of passenger cars in 2005–2020 and imported used passenger cars in 2014–2020. Source: Finnish Transport and Communications Agency.

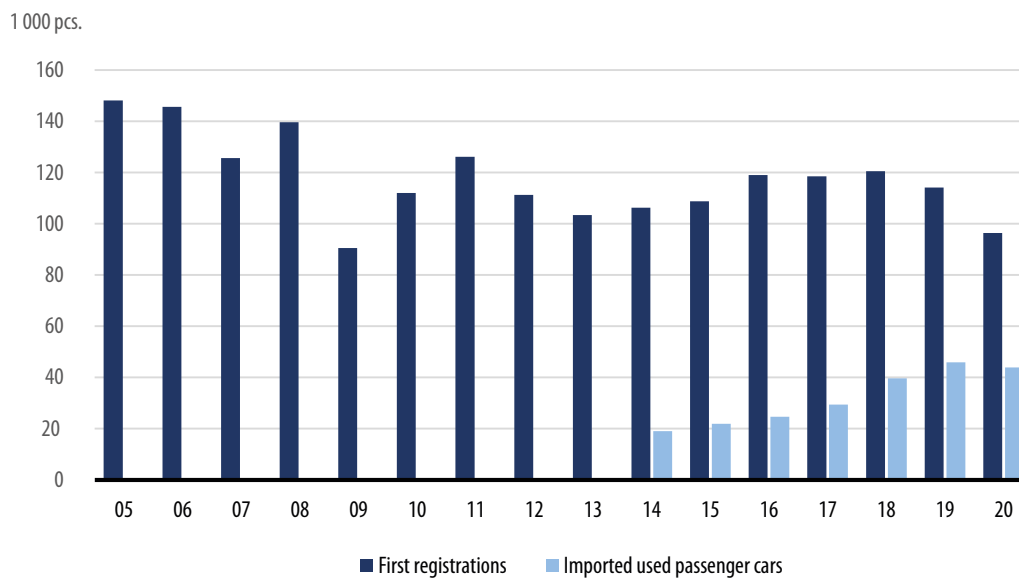


Figure 34. CO₂ emissions (g/km) from passenger cars registered for the first time. Source: Statistics Finland.

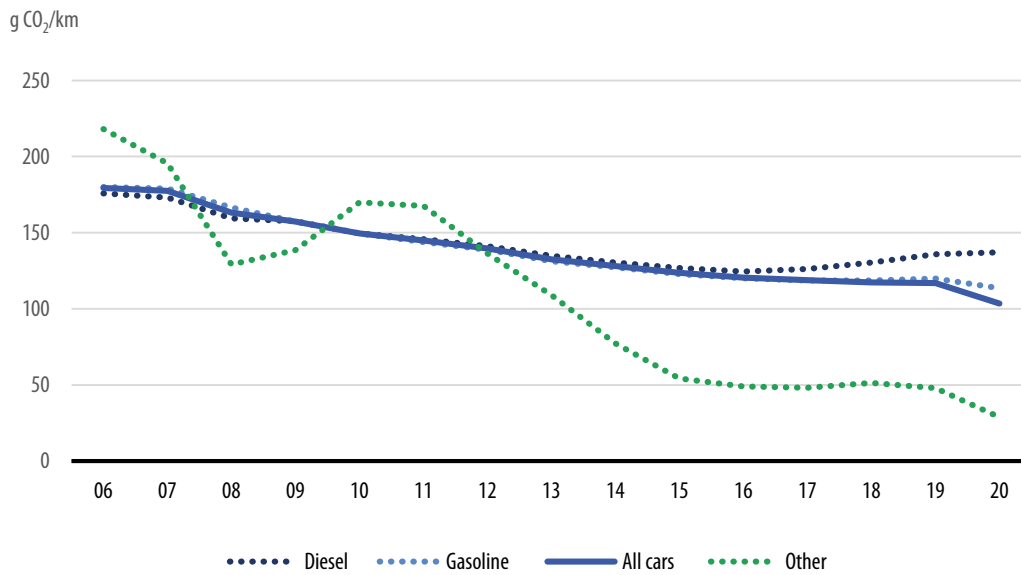


Figure 35. Number of electric cars and natural gas vehicles in Finland in 2010–2020. Source: Statistics Finland.

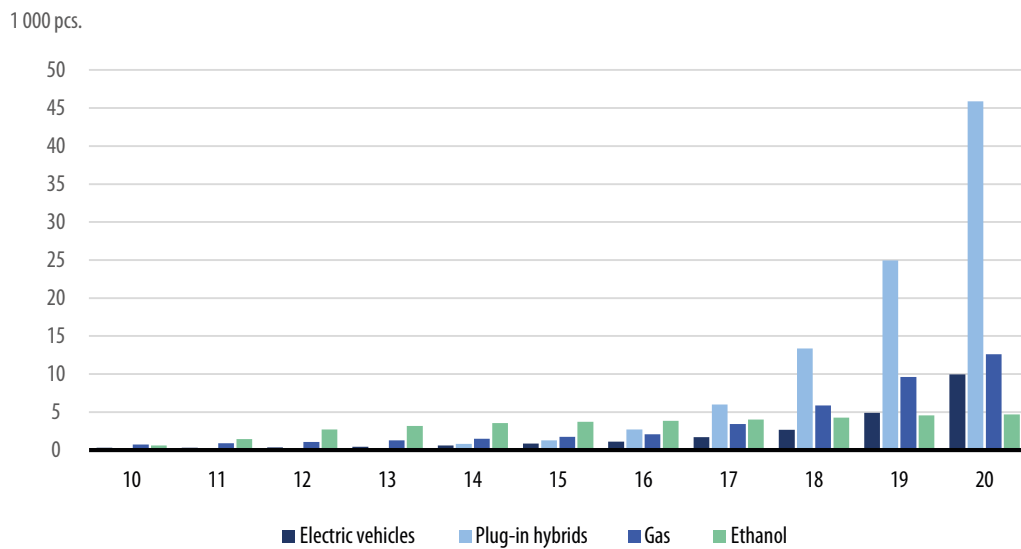


Figure 36. Average age of passenger cars in traffic in 1990–2020. Source: The Finnish Transport and Communications Agency and the Finnish Information Centre of Automobile Sector.

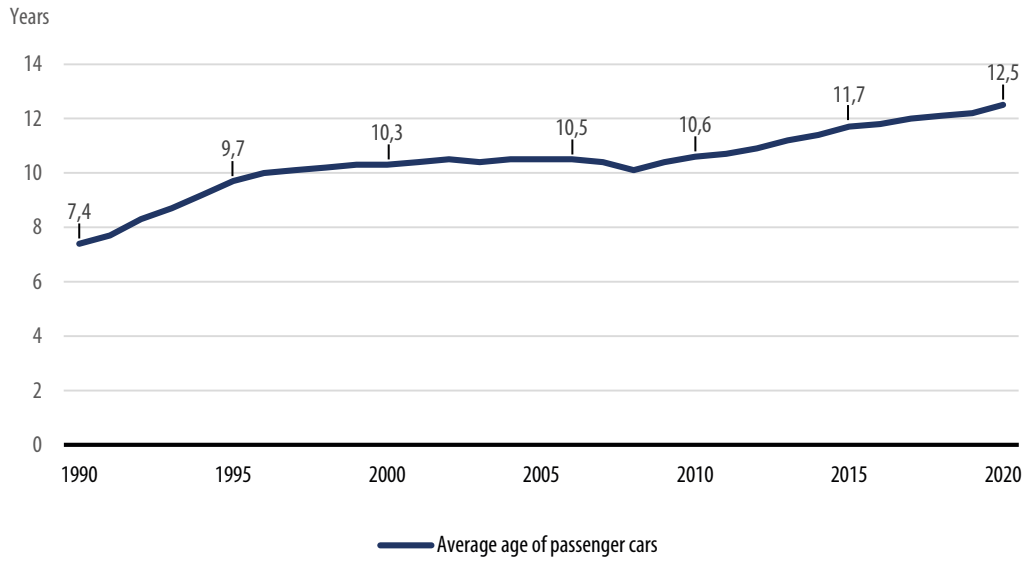


Figure 37. Use of conversion and procurement subsidies in 2018–2020. Source: Finnish Transport and Communications Agency.

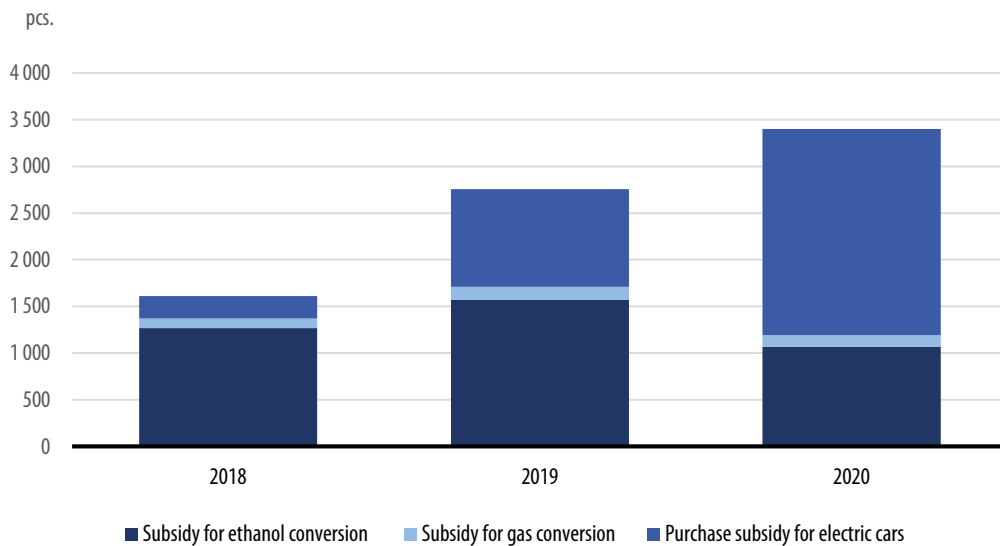
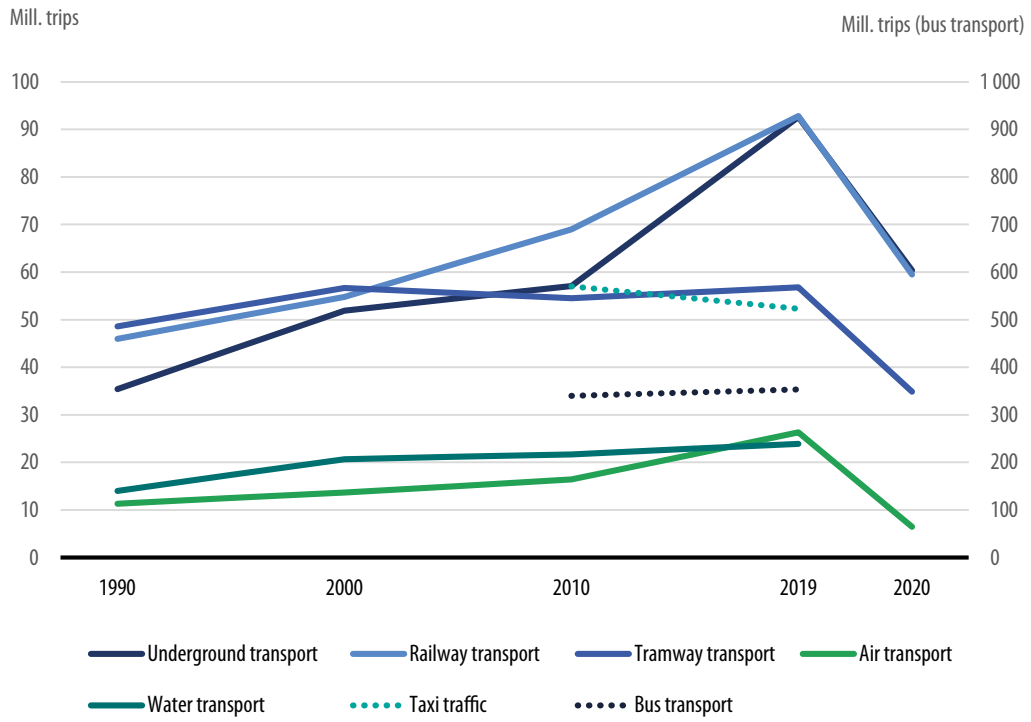


Figure 38. Passengers by mode of transport. Source: Statistics Finland.



Agriculture

Figure 39. GHG emissions from agriculture reported in the effort sharing sector in 2005–2020. The 2020 data is a proxy estimate. Source: Statistics Finland.

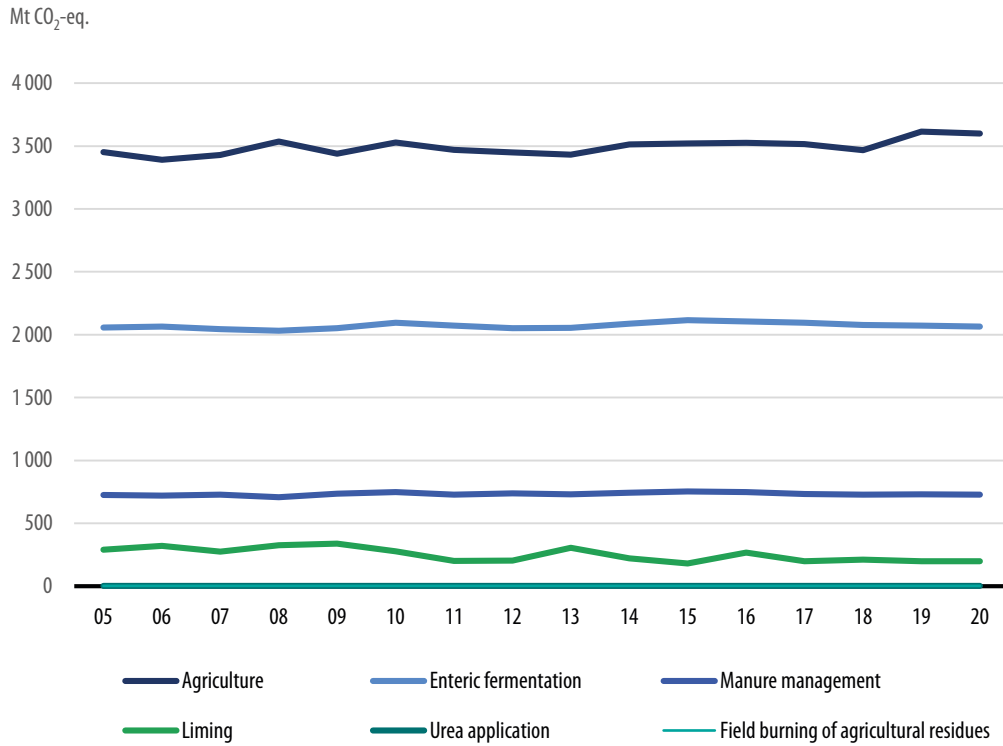


Figure 40. Numbers of animals on farms in 2005–2020. Source: Natural Resources Institute Finland.

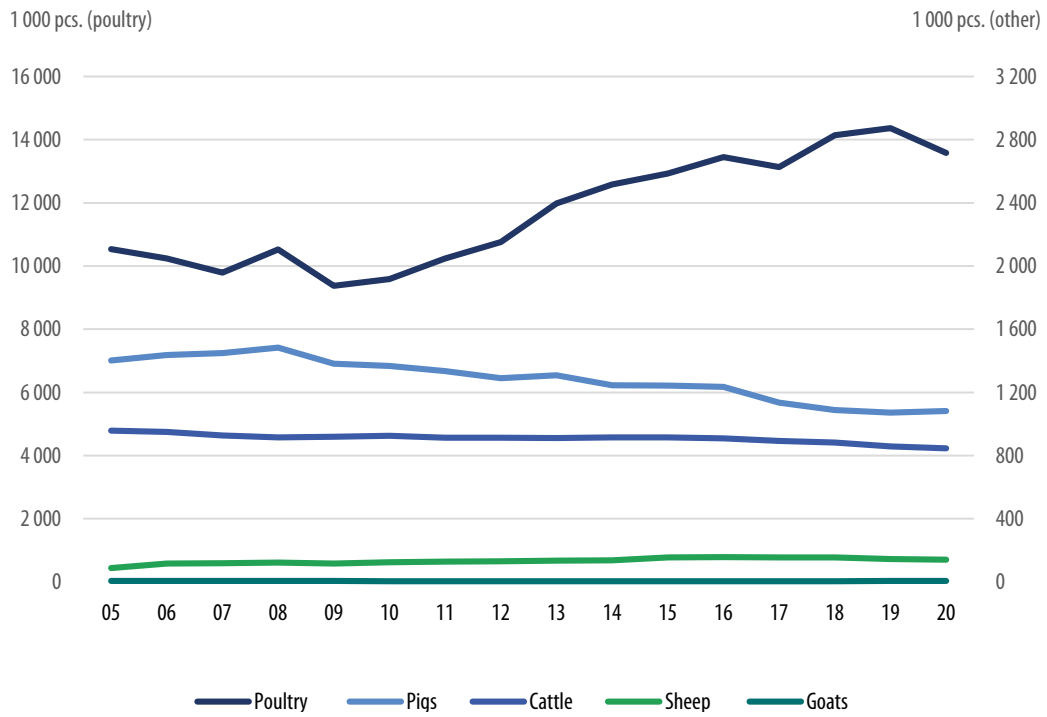
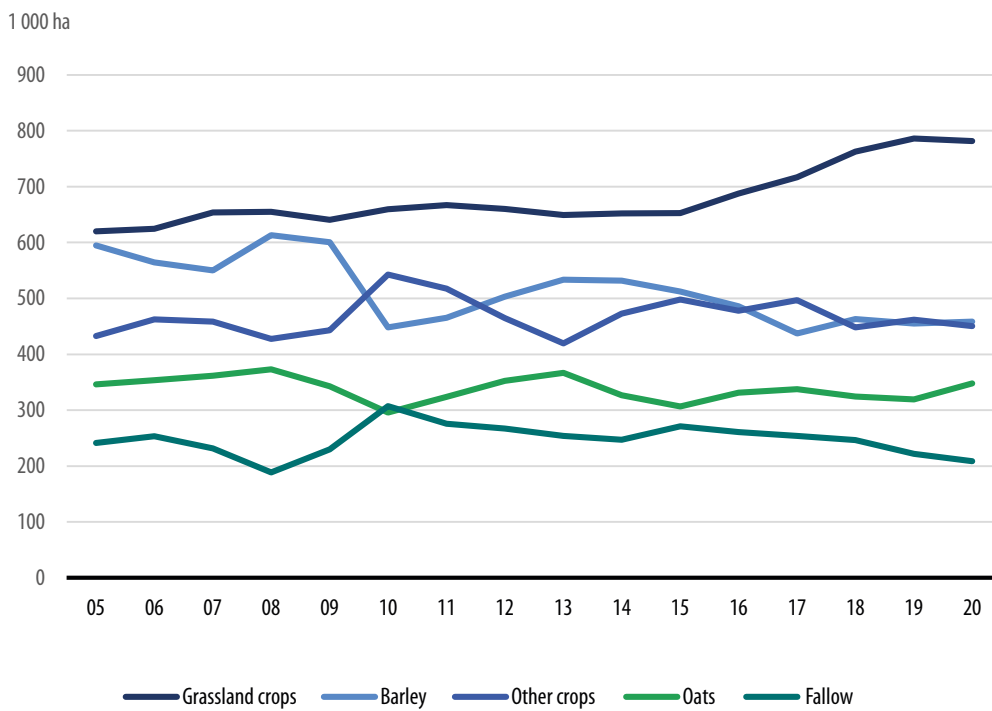
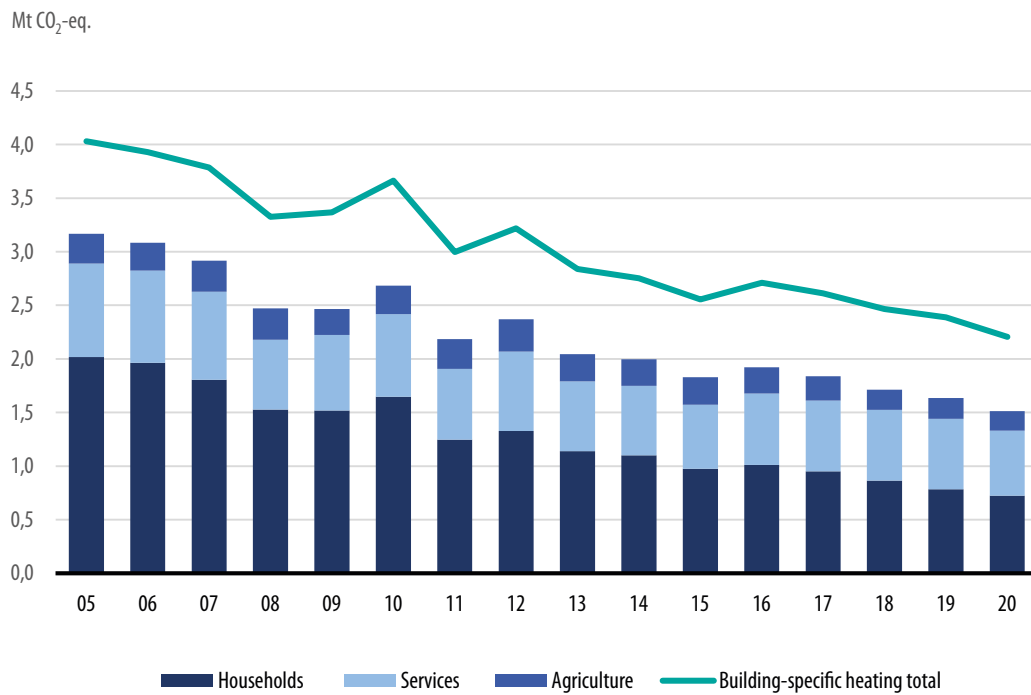


Figure 41. Use of arable land in 2005–2020. Source: Natural Resources Institute Finland.



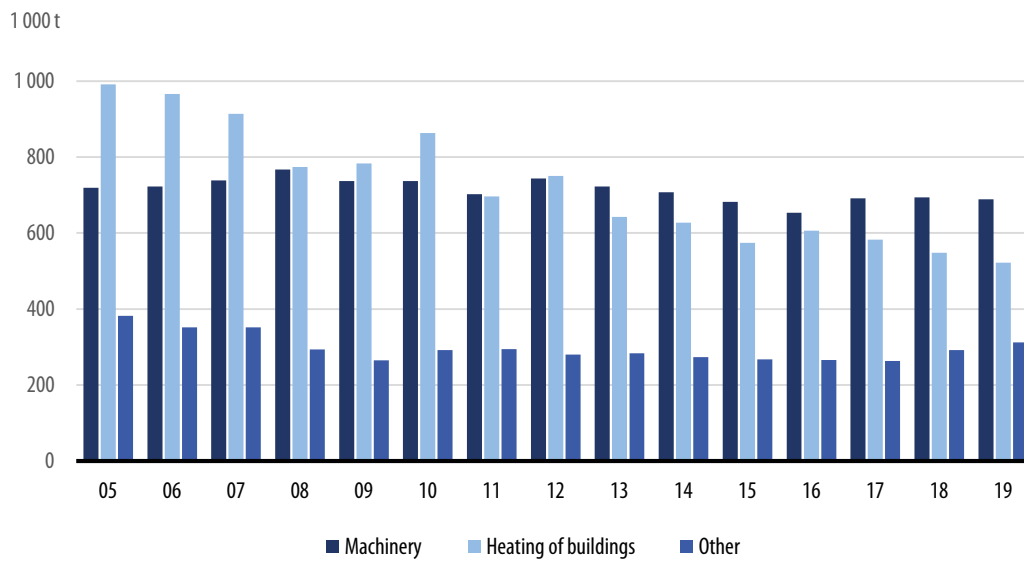
Building-specific heating

Figure 42. Emissions from light fuel oil by sector in building-specific heating and total emissions from building-specific heating in 2005–2020. Emissions for 2020 are a preliminary estimate based on the need for heating. Agriculture includes grain dryers. Source: Statistics Finland (data from 2005–2019).



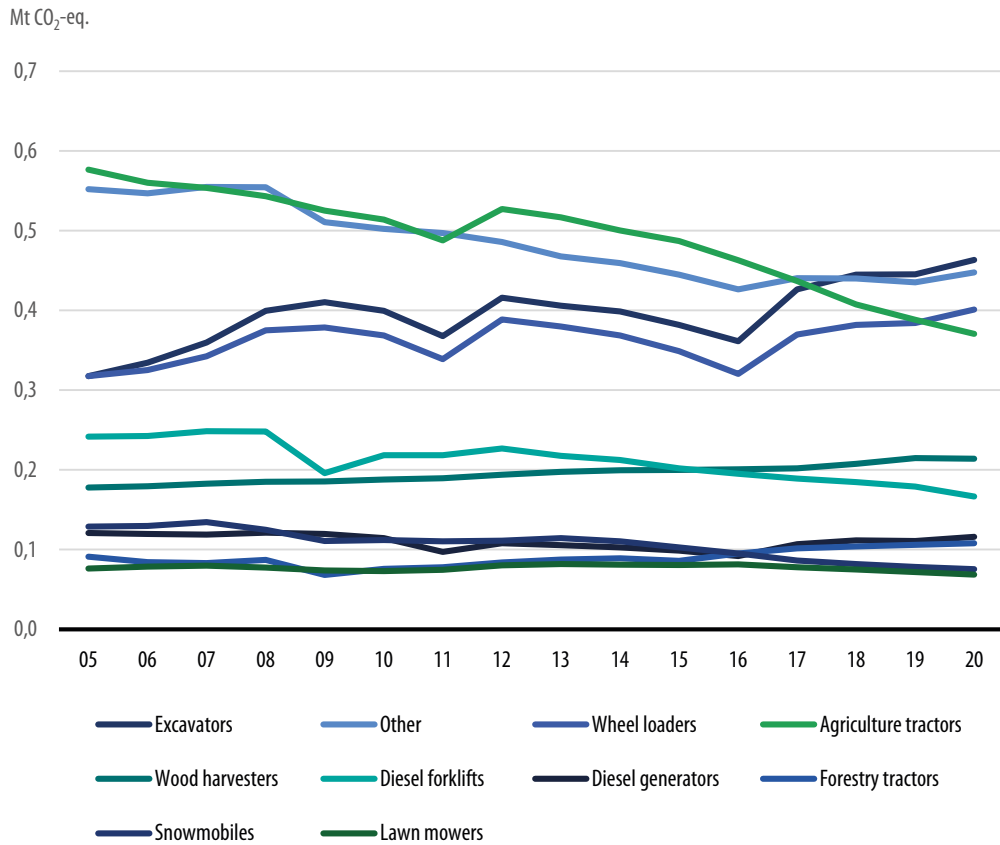
Use of light fuel oil

Figure 43. Consumption of light fuel oil in the effort sharing sector, broken down into machinery, heating of buildings and other use in 2005–2019. Other use includes things such as oil use in industry for purposes other than machinery, and oil use in rail transport, water transport and fishing vessels. Source: Statistics Finland.



Machinery

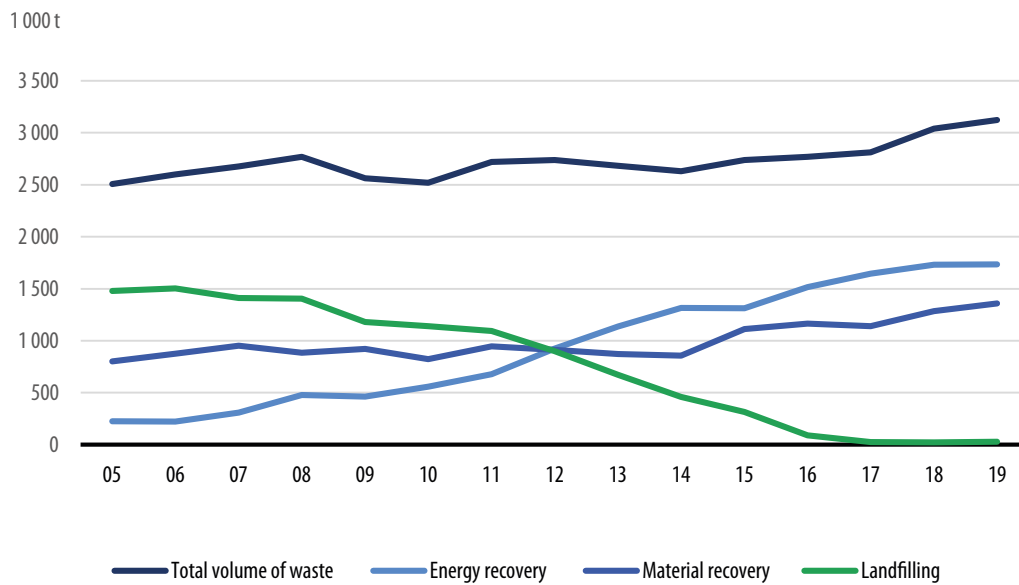
Figure 44. GHG emissions from mobile machinery by machine category in 2005–2020. The 2020 data is a proxy estimate. Source: Statistics Finland/VTT Technical Research Centre of Finland.



Waste management

Figure 45. Amount of municipal waste in Finland by processing method in 2005–2019.

Source: Statistics Finland.



F-gases

Figure 46. Emissions of F-gases by emission source in 2005–2020. The 2020 data is a proxy estimate.
Source: Finnish Environment Institute.

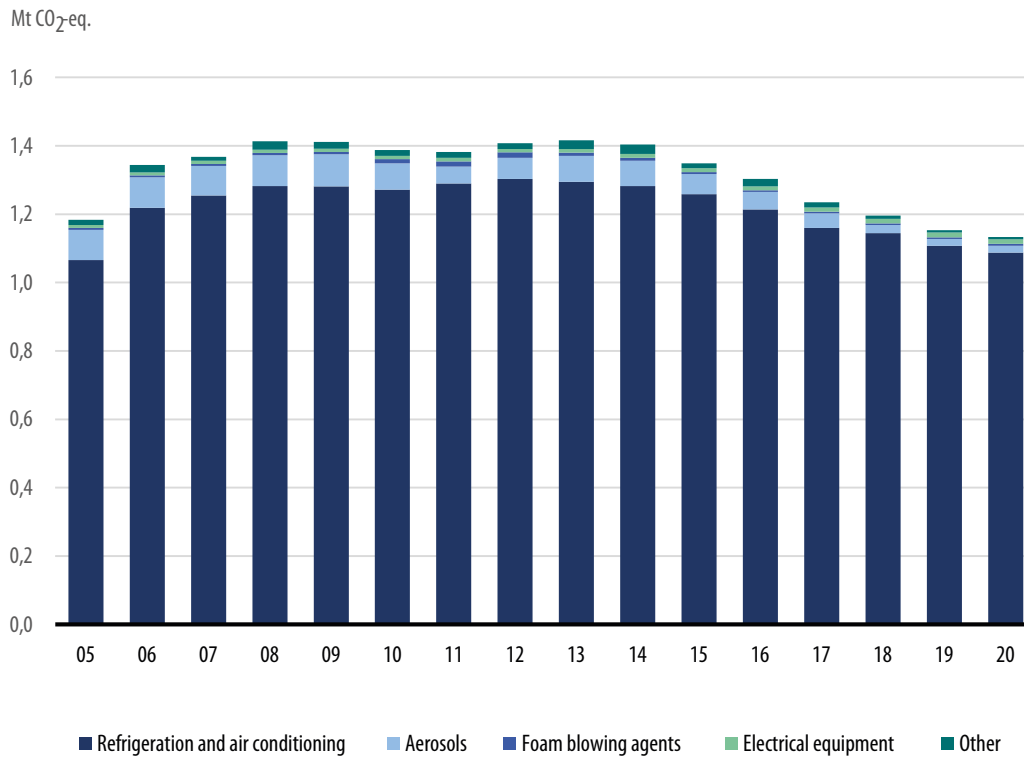


Figure 47. The proportion of carbon dioxide and other low-GWP non-HFC refrigerants in the remote cabinet refrigeration units used in retail shops and professional kitchens. Source: Finnish Environment Institute.

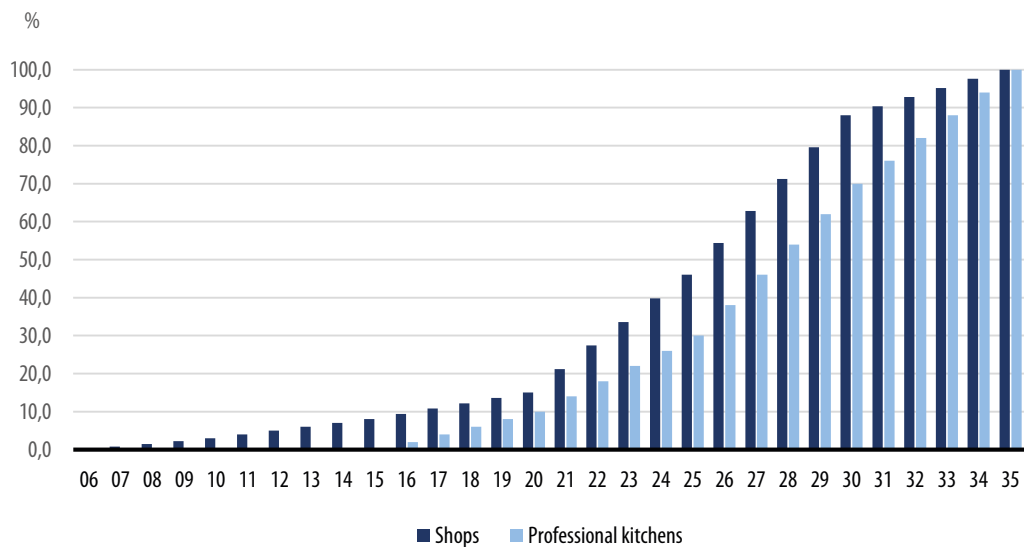
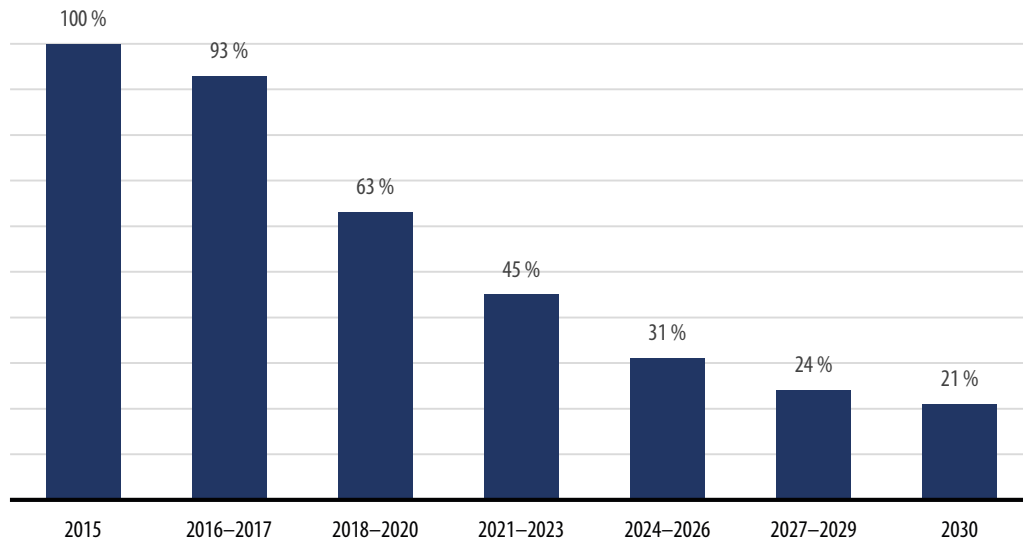
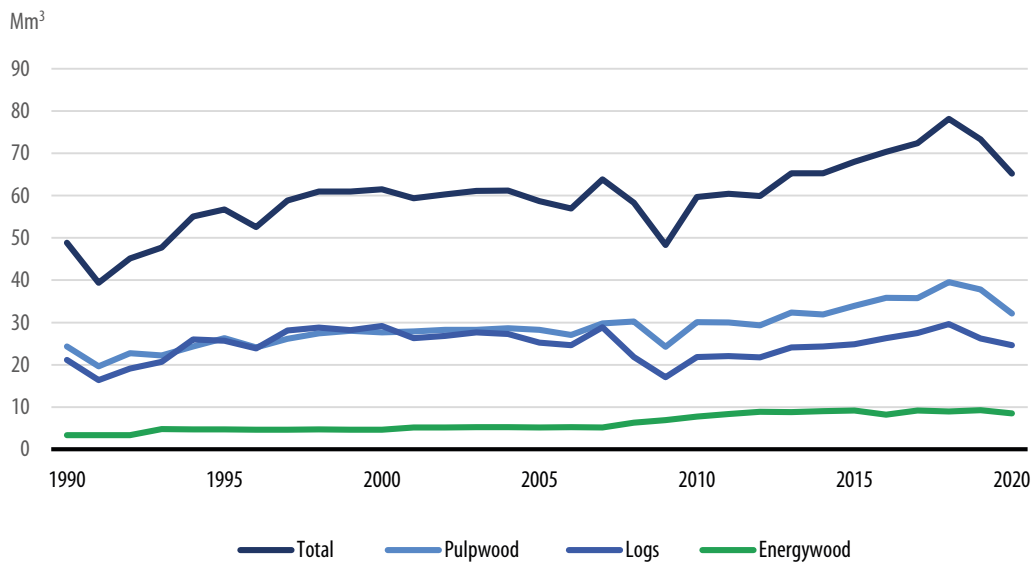


Figure 48. The quota of HFCs to be placed on the market within the EU in 2015–2030 as a percentage of the 2009–2012 level. Source: F-gas Regulation (EU) 517/2014.



Roundwood removal

Figure 49. Roundwood removal in Finland 1990–2020. Source: Natural Resources Institute Finland.



Appendix 3. Statistics and scenarios used

The emissions data presented for 2005–2019 in the report is in accordance with Finland’s official greenhouse gas inventory and was calculated according to IPCC Guidelines. The descriptions of the methods used in reporting emissions data are included in the emissions data releases by Statistics Finland. Statistical methods are constantly being developed, and emissions data can also be changed retroactively based on new developments. These changes are usually very small. The emissions and sinks in the land use sector vary considerably from year to year. In addition, the knowledge base and impact of the measures in the land use sector involve greater uncertainties compared with other sectors.

The 2020 data is a proxy estimate. A proxy estimate is calculated at a rougher level than the actual inventory calculation. The proxy estimate is therefore not final, and emissions data will be specified when all the data used in the calculation is completed. The figures used in monitoring the obligation imposed by the Effort Sharing Decision are fixed in conjunction with annual inspections and are not updated retroactively. The data presented for 2013–2018 in the figures and table in chapter 3.3 of this Annual Report is based on emissions data fixed in conjunction with EU inspections. The emissions data in the most recent release and inventory submission by Statistics Finland for these years deviates from what is presented here. The data for 2020 is a proxy estimate, and the estimate of emissions and the overshoot/undershoot of the emission allocation is therefore not final.

The estimates presented in the report on the meeting of the emissions reduction targets are partly based on scenario calculations. The emission scenarios were prepared by compiling sector-specific estimates of emission trends in the next few years. A scenario is a calculated estimate of how emissions will develop if the assumptions that formed the basis for the calculation come true. Scenario calculation is subject to continuous updating and development, and the aim is to complement and specify the knowledge base for the scenarios. Scenario calculation typically utilises mathematical models that are used to create the necessary projected emission trends. The basic emissions trend scenario used in this Annual Climate Report includes the measures implemented by the end of 2019. The scenario is based on calculations made in the Carbon Neutral Finland 2035 –measures and impacts of the climate and energy policy (HIISI) in early 2021.

The EU climate law is currently based on sector-specific regulations, which are the Emissions Trading Directive, the Effort Sharing Regulation and the Land Use, Land Use Change and Forestry Regulation (LULUCF). As a result, the monitoring of the meeting of the emissions obligations follows the same division into sectors.

SOURCES

Introduction and climate goals

Climate Change Act 609/2015

<https://www.finlex.fi/en/laki/kaannokset/2015/en20150609.pdf>

Kyoto Protocol 1997. Kyoto Protocol to the United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf

LULUCF Regulation 2018. Regulation (EU) 2018/841 of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework.

<https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32018R0841>

Paris Agreement 2015. Paris Agreement.

https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Programme of Prime Minister Sanna Marin's Government, 2019 Inclusive and competent Finland – a socially, economically and ecologically sustainable society.

<https://valtioneuvosto.fi/en/marin/government-programme>

Emissions Trading Directive 2003. Directive 2003/87/EC of the European Parliament and of the Council of establishing a scheme for greenhouse gas emission allowance trading within the Community.

<https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32003L0087>

Effort Sharing Decision 2009. Decision No 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

<https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex%3A32009D0406>

Effort Sharing Regulation 2018. Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement.

<https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex%3A32018R0842>

The Climate Action Tracker 2021. Temperatures. Addressing global warming.

<https://climateactiontracker.org/global/temperatures/>

United Nations Framework Convention on Climate Change 1992. United Nations

Framework Convention on Climate Change (UNFCCC). https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf

Discussion paper of the Environment Committee YmVM 1/2020 vp.

Ilmastovuosikertomus 2019. [*Annual Climate Report 2019.*]

https://www.eduskunta.fi/FI/vaski/Mietinto/Sivut/YmVM_1+2020.aspx

Discussion paper of the Environment Committee YmVM 10/2020 vp.

Ilmastovuosikertomus 2020. [*Annual Climate Report 2020.*]

https://www.eduskunta.fi/FI/vaski/Mietinto/Sivut/YmVM_10+2020.aspx

Greenhouse gas emissions and future developments

Ember 2021. Daily EU ETS carbon market price. <https://ember-climate.org/data/carbon-price-viewer/>

Energy Authority 2021. Suomen päästökauppasektorin laitosten päästöt 2020. [*Emissions*

of the installations in the Finnish emissions trading sector in 2020.] <https://energiavirasto.fi/-/suomen-paastokauppasektorin-laitosten-paastot-pienenivat-3-6-miljoonaa-tonnia-vuonna-2020>

Government Proposal HE 167/2020 vp. Hallituksen esitys eduskunnalle laeiksi

energiaverotusta koskevan lainsäädännön muuttamisesta. [*Government Proposal for the Parliament for acts amending the legislation on energy taxation.*]

<https://www.finlex.fi/fi/esitykset/he/2020/20200167>

Hallituksen linjaukset puoliväli- ja kehysriihessä 2021. [*Government*

policy positions in the mid-term policy review and spending limits

discussion in 2021.] <https://vnk.fi/documents/10616/56906592/>

Hallituksen+linjaukset+puoliv%C3%A4liriihess%C3%A4+29.4.2021.pdf/
fe9617f8-a257-90ea-2ade-9d9afe5284da?t=1620136120152

Government roadmap for achieving the carbon neutrality target 2020. A fair transition

towards a carbon neutral Finland. <https://valtioneuvosto.fi/documents/10616/20764082/>

hiilineutraaliuden+tiekartta+03022020+en.pdf/e791931c-90e1-f74b-3be4-3dc0994f67f1/
hiilineutraaliuden+tiekartta+03022020+en.pdf?t=1580807787000

Finnish Meteorological Institute 2021. Lämmitystarveluvut. [*Heating need figures.*]

<https://www.ilmatieteenlaitos.fi/lammitystarveluvut>

Natural Resources Institute Finland 2021. Statistical database. Total roundwood removals in Finland by forest ownership category. http://statdb.luke.fi/PXWeb/pxweb/en/LUKE/LUKE__04%20Metsa__02%20Rakenne%20ja%20tuotanto__10%20Hakkuukertyma%20ja%20puuston%20poistuma/01c_Hakkuukertyma_koko_maa.px/

Suomen kestävän kasvun ohjelma 2021. Elpymis- ja palautumissuunnitelma. [*Sustainable Growth Programme for Finland. Recovery and Resilience Plan.*]

<https://julkaisut.valtioneuvosto.fi/handle/10024/163176>

Statistics Finland 2021. Finland's greenhouse gas emissions 2019 to the EU and the UNFCCC. https://www.stat.fi/til/khki/2019/khki_2019_2021-03-19_tie_001_en.html

Statistics Finland 2021. Finland's Greenhouse gas emissions 2020. Instant preliminary data. https://www.stat.fi/til/khki/2020/khki_2020_2021-05-21_tie_001_en.html

VTT Technical Research Centre of Finland 2021. Hiilineutraali Suomi 2035 – ilmasto- ja energiapolitiikan toimet ja vaikutukset (HIISI). [*Carbon neutral Finland 2035 – measures and impacts of climate and energy policy (HIISI), in Finnish.*] <https://www.hiisi2035.fi/>

Ministry of the Environment 2017. Valtioneuvoston selonteko keskipitkän aikavälin ilmastopolitiikan suunnitelmasta vuoteen 2030 – Kohti ilmastoviisasta arkea. [*Government Report on Medium-term Climate Change Plan for 2030 – Towards Climate-Smart Day-to-Day Living.*] <https://julkaisut.valtioneuvosto.fi/handle/10024/80703>

Transport

Laki biopolttoaineiden käytön edistämisestä liikenteessä annetun lain muuttamisesta (419/2019). [*Act amending the Act on Promoting the Use of Biofuels in Transport (419/2019).*]

<https://www.finlex.fi/fi/laki/alkup/2019/20190419>

Liikenteen kasvihuonekaasupäästöjen perusennuste 2021. [*Base forecast of greenhouse gas emissions from transport 2021.*] https://api.hankeikkuna.fi/asiakirjat/d99a3ae3-b7f9-49df-afd2-c8f2efd3dc1d/65e2db9c-883c-4a65-8444-59c5101502c5/LAUSUNTOPYYNTO_20210115060016.PDF

Statistics Finland 2021. Finnish Road Statistics. https://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__lii__tiet/statfin_tiet_pxt_12jx.px/

Finnish Transport and Communications Agency 2021. Autokannan keski-ikä ilman museoautoja. Ajoneuvokannan tilastot. [*Average age of cars on the roads, excluding vintage cars. Cars on the roads statistics.*]

<https://www.traficom.fi/fi/tilastot/ajoneuvokannan-tilastot>

Valtioneuvoston periaatepäätös LVM/2021/62 kotimaan liikenteen kasvihuonekaasupäästöjen vähentämisestä 2021. [*Government resolution LVM/2021/62 on the reduction of greenhouse gas emissions in domestic transport in 2021.*]

<https://valtioneuvosto.fi/paatokset/paatos?decisionId=0900908f807239ad>

Agriculture

Kansallinen biokaasuohjelma 2020. [*National biogas programme 2020.*]

<https://tem.fi/hankesivu?tunnus=TEM079:00/2019>

Natural Resources Institute Finland 2021. Ruokahävikkitiekartta. [*Food waste roadmap.*]

<https://www.luke.fi/ruokahavikkiseuranta/keihaankarjet/>

Ministry of Agriculture and Forestry 2014: Rural Development Programme for Mainland Finland 2014–2020. <https://mmm.fi/en/rural-areas/rural-development-programme>

Ministry of Agriculture and Forestry 2021. Climate-friendly Food Programme.

<https://mmm.fi/en/climatefriendlyfoodprogramme>

Statistics Finland 2021. Production and consumption of biogas by plant type.

https://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__ene__ehk/statfin_ehk_pxt_127t.px/?rxid=9de9d471-f0fd-4b1e-9ee6-bc374fba143f

Building-specific heating

Laki biopolttoöljyn käytön edistämisestä (418/2019). [*Act Promoting the Use of Biofuel Oil (418/2019).*] <https://www.finlex.fi/fi/laki/alkup/2019/20190418>

Rakennustutkimus 2019. (*Building Survey 2019*). Suomi asuu 2019 -tutkimus. (*Finnish Dwellings Study 2019*).

Ministry of the Environment 2021. Luonnos fossiilisesta öljylämmityksestä luopumisen toimenpideohjelmaksi. [*A draft for an action plan for abolishing fossil oil heating.*]

<https://www.lausuntopalvelu.fi/FI/Proposal/DownloadProposalAttachment?attachmentId=15521>

Mobile machinery

Valtioneuvoston asetus maatalan investointituen kohdentamisesta (241/2015). [Government Decree on the Targeting of Investment Subsidies for Farms (241/2015).] <https://www.finlex.fi/fi/laki/alkup/2015/20150241>

VTT Technical Research Centre of Finland 2019. Suomen työkoneiden päästömalli TYKO2019. [Calculation model for non-road mobile machinery in Finland TYKO2019.] <http://lipasto.vtt.fi/tyko/index.htm>

VTT Technical Research Centre of Finland 2021. Työkoneiden nopean sähköistymisen ja jakeluvuorituksen noston skenaariot. [Scenarios for the rapid electrification of mobile machinery and an increase in the distribution obligation.]

Ministry of the Environment 2019. Työkonealan green deal -sopimus. [Green Deal agreement for the mobile machinery sector.] <https://sitoumus2050.fi/tyokone#/>

Other sectors

Energiatehokkuuslaki (1429/2014). [Energy Efficiency Act (1429/2014)]. <https://finlex.fi/fi/laki/alkup/2014/20141429>

EU 2018. Waste regulation package. <https://www.consilium.europa.eu/en/press/press-releases/2018/05/22/waste-management-and-recycling-council-adopts-new-rules/>

F-gas Regulation 2014. Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases. <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32014R0517>

Laki hiilen energiakäytön kieltämisestä (416/2019). [Act on the Prohibition of Using Coal for Energy (416/2019).] <https://www.finlex.fi/fi/laki/alkup/2019/20190416>

Laki metsityksen määräaikaisesta tukemisesta (1114/2020). [Act on Temporary Subsidy for Afforestation (1114/2020).] <https://www.finlex.fi/fi/laki/alkup/2020/20201114>

Ministry of Agriculture and Forestry 2021. Hiilestä kiinni – Catch the carbon research and innovation programme. <https://mmm.fi/en/-/hiilesta-kiinni-catch-the-carbon-research-and-innovation-programme-to-produce-climate-sustainable-land-use-solutions-extensive-call-for-applications-now-open>

Ministry of Agriculture and Forestry 2021. New state ownership policies for Metsähallitus 2020–2024.

Valtioneuvoston asetus kaatopaikoista (331/2013). [*Government Decree on Landfills (331/2013)*]. <https://www.finlex.fi/fi/laki/alkup/2013/20130331>

Cross-cutting measures

Hiili- ja ympäristöjalanjälki hankinnoissa – lainsäädäntö ja mittaaminen (HILMI). [*Carbon and Environmental Footprint in Procurement – Legislation and Measurement (HILMI)*]. <https://tietokayttoon.fi/-/hiili-ja-ymparistojalanjalki-hankinnoissa-lainsaadanto-ja-mittaaminen-hilmi->

Kestävien ja innovatiivisten julkisten hankintojen verkostomainen osaamiskeskus KEINO [*A Network-Based Competence Centre for Sustainable and Innovative Public Procurement (KEINO)*]. <https://www.hankintakeino.fi/fi/mika-osaamiskeskus>

Laki julkisista hankinnoista ja käyttöoikeussopimuksista (1397/2016) [*Act on Public Procurement and Concession Contracts (1397/2016)*]. <https://www.finlex.fi/fi/laki/alkup/2016/20161397>

Laki ajoneuvojen energia- ja ympäristövaikutusten huomioon ottamisesta julkisissa hankinnoissa (1509/2011) [*Act on Consideration for the Energy and Environmental Impact of Vehicles in Public Procurement (1509/2011)*]. <https://www.finlex.fi/fi/laki/alkup/2011/20111509>

Material Economics 2018. The Circular Economy – A powerful force for climate mitigation. <https://materialeconomics.com/publications/the-circular-economy-a-powerful-force-for-climate-mitigation-1>

Ojala, T. & Oksanen, P. (ed.). 2021. Climate and Environmental Strategy for the ICT Sector Publications of the Ministry of Transport and Communications 6/2021. <http://urn.fi/URN:ISBN:978-952-243-595-8>.

Ruokamo, Enni., Savolainen, Hannu., Seppälä, Jyri., Sironen, Susanna., Räisänen, Milja., Auvinen, A. & Antikainen, R. 2021. Kiertotalous vähähiilisuuden edistäjänä ja luonnon monimuotoisuuden turvaajana (*Circular economy promotes decarbonisation and protects biodiversity*), Finnish Environment Institute, Publications of the Ministry of the Environment 6/2021. <http://urn.fi/URN:ISBN:978-952-361-205-1>

Finnish Environment Institute 2021. Canemure - Towards Carbon Neutral Municipalities and Regions. [https://www.hiilineutraalisuomi.fi/en-US/Canemure/Canemure__Towards_Carbon_Neutral_Municip\(50456\)](https://www.hiilineutraalisuomi.fi/en-US/Canemure/Canemure__Towards_Carbon_Neutral_Municip(50456))

Finnish Environment Institute 2021. Municipalities' and regions' greenhouse gas emissions https://www.hiilineutraalisuomi.fi/fi-FI/Paastot_ja_indikaattorit/Kuntien_ja_alueiden_kasvihuonekaasupaastot

Ministry of Finance 2020. Kansallinen julkisten hankintojen strategia 2020. [*National Public Procurement Strategy 2020.*] <https://julkaisut.valtioneuvosto.fi/handle/10024/162418>

Ministry of the Environment 2021. Municipal climate change solutions programme (2018–2023). <https://ym.fi/en/municipal-climate-change-solutions-programme-2018-2023>

Impact of climate action

Alimov et al. 2020. Ilmastopolitiikan tulonjakovaikutukset. [*Income distribution effects of climate policy.*] <https://julkaisut.valtioneuvosto.fi/handle/10024/162536>

Kuusi et al. 2021. Vihreät toimet – ilmastopolitiikan vaikutuksia työllisyyteen. [*The effects of climate policy on employment: a Finnish perspective.*] <https://julkaisut.valtioneuvosto.fi/handle/10024/163008>

Tamminen et al. 2019. Kestävän kehityksen verouudistus. Kohti päästötöntä Suomea. [*Tax reform for sustainable development. Towards an emissions-free Finland.*] Sitra memo. <https://media.sitra.fi/2019/04/11153727/kestavan-kehityksen-verouudistus.pdf>

Finnish Institute for Health and Welfare 2019 Ilmastonmuutos vaikuttaa eniten heikompiosaisiin. Hyvinvointi- ja terveyserot. [*Climate change affects the disadvantaged the most. Well-being and health differences.*] <https://thl.fi/fi/web/hyvinvointi-ja-terveyserot/eriarvoisuus/hyvinvointi/ilmastonmuutos>

Finnish Institute for Health and Welfare 2020 Ilmastonmuutos. Ympäristöterveys. [*Climate change. Environmental health.*] <https://thl.fi/en/web/environmental-health/climate-and-weather/climate-change>

National Audit Office of Finland (2020). Ilmastotavoitteet ja valtiontalouden kestävyys [*Climate goals and the sustainability of public economy.*] <https://www.vtv.fi/app/uploads/2020/10/VTV-Selvitys-3-2020-Ilmastotavoitteet-ja-valtiontalouden-kestavyys.pdf>

Carbon footprint and carbon handprint of consumption

Hiilihelppi – Everyman's climate tips. <https://hiilihelppi.fi>

Lettenmeier et al. 2019. 1.5-degree lifestyles Targets and options for reducing lifestyle carbon footprints. Sitra. <https://www.sitra.fi/en/publications/1-5-degree-lifestyles/>

Linnanen et al. 2020. The sufficiency perspective in climate policy: How to recompose consumption. Report 4/2020 of the Finnish Climate Change Panel. https://www.ilmastopaneeli.fi/wp-content/uploads/2020/09/Sufficiency-in-climate-policy_2020-09-25.pdf

Nissinen et al. 2017. Tavoitteista toiminnaksi – kestävä kulutuksen ja tuotannon visio ja tärkeimmät toimenpiteet. [*From goals to action – Vision and most important measures for sustainable consumption and production.*] https://helda.helsinki.fi/bitstream/handle/10138/228339/SYKEra_31_2017.pdf?sequence=1&isAllowed=y

Nissinen & Savolainen (ed.) 2019. Julkisten hankintojen ja kotitalouksien kulutuksen hiilijalanjälki ja luonnonvarojen käyttö. ENVIMAT-mallinnuksen tuloksia. [*Carbon footprint and raw material requirement of public procurement and household consumption in Finland – Results obtained using the ENVIMAT model.*] Finnish Environment Institute reports 15/2019. <https://helda.helsinki.fi/handle/10138/300737>

Salo et al. 2019. Erialaisten kotitalouksien hiilijalanjäljet. [*Carbon footprints of different types of households.*] Finnish Environment Institute reports 15/2019. pp. 39–48. <https://helda.helsinki.fi/handle/10138/300737>

Salo et al. 2021. Drivers of household consumption expenditure and carbon footprints in Finland. *Journal of Cleaner Production* 289, 125607. <https://doi.org/10.1016/j.jclepro.2020.125607>

Savolainen et al. 2021. Kotitalouksien kulutuksen kasviuonekaasupäästöt 2000–2019. [*Greenhouse gas emissions from households 2000–2019.*] Unpublished worksheet and associated manuscript.

Finnish Environment Institute 2019. Climate diet. <https://ilmastodieetti.ymparisto.fi/ilmastodieetti/>

VTT Technical Research Centre of Finland 2018. Carbon Handprint Guide. https://cris.vtt.fi/ws/portalfiles/portal/22508565/Carbon_Handprint_Guide.pdf

Adaptation

AMAP, 2021. Arctic Climate Change Update 2021. Key Trends and Impacts.

Summary for Policy-makers. Arctic Monitoring and Assessment Programme.

<https://www.amap.no/documents/doc/arctic-climate-change-update-2021-key-trends-and-impacts.-summary-for-policy-makers/3508>

EU 2021. EU Strategy on Adaptation to Climate Change.

https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/eu_strategy_2021.pdf

Ministry of Agriculture and Forestry 2014: Kansallinen ilmastonmuutokseen sopeutumissuunnitelma 2022. [*National Climate Change Adaptation Plan 2022.*]

<https://mmm.fi/documents/1410837/5120838/>

Kansallinen+ilmastonmuutokseen+sopeutumissuunnitelma+2022.
[pdf/1716aa76-8005-4626-bae0-b91f3b0c6396?t=1501159291000](https://www.mmm.fi/documents/1410837/5120838/pdf/1716aa76-8005-4626-bae0-b91f3b0c6396?t=1501159291000)

Mäkinen et al. 2019. Implementation of Finland's National Climate Change

Adaptation Plan 2022 – A Mid-term Evaluation. Ministry of Agriculture and Forestry.

<https://julkaisut.valtioneuvosto.fi/handle/10024/162461>



Ministry of the
Environment Finland

ISBN: 978-952-361-396-6 PDF
ISSN: 2490-1024 PDF

Aleksanterinkatu 7, Helsinki | P.O. Box 35, FI-00023 Government | ym.fi