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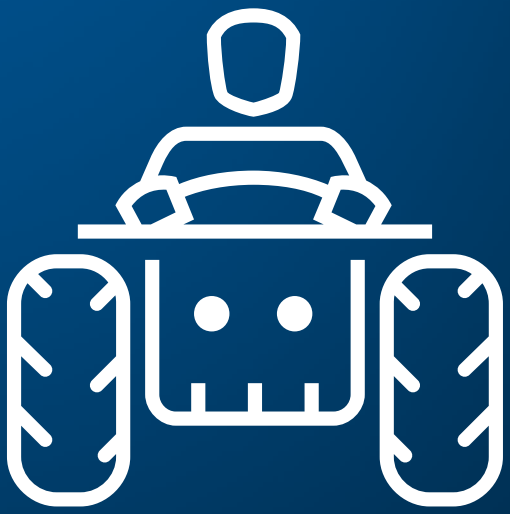
Annual Climate Report 2019



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Abstract

According to the Climate Act, the Council of State submits once a year an Annual Climate Report to the Parliament. The Annual Climate Report provides a tool for monitoring the implementation of the Medium-term Climate Change Policy Plan (KAISU). This means especially the monitoring of the emission development of the effort sharing sector in relation to the emission reduction targets included in the KAISU. The Annual Climate Report also presents an analysis of the emission development on the sectoral level. Every other year a survey of policy measures implemented in line with the KAISU is included in the Annual Climate Report. Additionally, an assessment of the implementation of the adaptation plan is included in the Annual Climate Report in every fourth year. This Annual Climate Report covers all above mentioned parts.

In the Annual Climate Report, the achieving of the emission reduction obligation both for the period 2013–2020 and 2021–2030 is examined. The obligations are based on member-state level emission reduction targets decided by the EU. At the moment it seems likely that Finland is going to achieve the 2013–2020 target. In addition, the policy measures for the period 2021–2030 are planned in a way, which ensures the fulfilment of the obligation with sufficient safety margin.

The sectoral analysis shows that individual sectors are making progress towards deeper emission reductions with different pace. With regard to total emissions, the development for the transport sector is decisive, although emission reductions are needed in all sectors. The survey of policy measures demonstrates that in order to promote the implementation of KAISU a number of policy measures have already been deployed and more are under planning. The need for additional measures is under continuous scrutiny.

The adaptation measures also needs enforcement in order to keep the risks caused by climate change under control.

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Tiivistelmä

Ilmastolain mukaan valtioneuvosto toimittaa kerran vuodessa ilmastovuosikertomuksen eduskuntaan. Ilmastovuosikertomuksella seurataan keskipitkän aikavälin ilmastopolitiikan suunnitelman (KAISU) toteutumista. Tämä tarkoittaa erityisesti taakanjakosektorin päästökehityksen (päästökaupan ulkopuoliset sektorit) seurantaa suhteessa KAISU:ssa asetettuihin päästövähennystavoitteisiin. Vuosikertomuksessa tarkastellaan myös sektorikohtaista päästökehitystä. Joka toinen vuosi Ilmastovuosikertomukseen sisältyy myös kartoitus keskipitkän aikavälin ilmastopolitiikan suunnitelman mukaisesti käyttöön otetuista politiikkatoimista ja lisäksi joka neljäs vuosi arvio sopeutumissuunnitelman toimeenpanotilanteesta. Tähän ilmastovuosikertomukseen sisältyvät kaikki yllä mainitut osa-alueet.

Ilmastovuosikertomuksessa tarkastellaan sekä jaksolle 2013–2020 että jaksolle 2021–2030 asetetun päästövähennysvelvoitteen saavuttamista. Velvoitteet perustuvat EU-tasolla sovittuihin jäsenmaakohtaisiin tavoitteisiin. Tällä hetkellä vaikuttaa todennäköiseltä, että saavutetaan jaksolle 2013–2020 asetettu vähennysvelvoite. Myös jakson 2021–2030 päästövähennystoimet on suunniteltu siten, että velvoite täytetään riittävällä varmuusmarginaalilla.

Sektorikohtainen tarkastelu osoittaa, että yksittäiset sektorit etenevät eri tahdissa päästövähennysten osalta. Kokonaisuuden kannalta liikennesektorin päästökehitys on ratkaisevaa, vaikka päästövähennyksiä tullaan tarvitsemaan jokaisella sektorilla. Politiikkatoimikartoitus osoittaa, että KAISU:n toimeenpanemiseksi on jo otettu käyttöön useita uusia ohjauskeinoja ja lisää on suunnitteilla. Lisätoimien tarve tulee olla jatkuvan arvioinnin kohteena.

Ilmastovuosikertomuksessa todetaan, että ilmastonmuutokseen sopeutumista on tarpeen vahvistaa ilmastonmuutoksen aiheuttamien riskien hallitsemiseksi.

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Referat

I enlighet med klimatlagen tillställer statsrådet årligen riksdagen en klimatårsberättelse. Uppföljningen av verkställandet av klimatplanen på medellång sikt (KAISU) sker med hjälp av klimatårsberättelsen. Detta innebär särskilt uppföljning av ansvarsfördelningssektorns utsläppsutveckling i förhållande till de mål för utsläppsnedskärningar som har uppställts i KAISU. I årsberättelsen granskas också den sektorvisa utsläppsutvecklingen. Vartannat år ingår i klimatårsberättelsen även en kartläggning av de åtgärder som har vidtagits i enlighet med klimatplanen på medellång sikt. Dessutom ingår vart fjärde år en översikt av hur verkställandet av planen för klimatanpassning har framskridit. I denna årsberättelse ingår samtliga ovan nämnda delar.

I klimatårsberättelsen granskas utsikterna att uppnå de utsläppsförpliktelser som har fastställts för perioderna 2013–2020 och 2021–2030. Förpliktelserna baserar sig på utsläppsmål som på EU-nivån har beslutats för de enskilda medlemsländerna. För närvarande förefaller det sannolikt att Finland kan uppnå den utsläppsförpliktelse som gäller för perioden 2013–2020. Också för perioden 2021–2030 gäller att åtgärderna för att skära ned utsläppen är dimensionerade så så att förpliktelsen uppfylls med tillräcklig säkerhetsmarginal.

Den sektorvisa analysen visar, att de enskilda sektorerna framskrider i olika takt med avseende på utsläppsutvecklingen. Med tanke på helheten är transportsektorns utsläppsutveckling avgörande, trots att utsläppsminskningar kommer attt krävas på samtliga sektorer. Kartläggningen av åtgärder visar, att ett flertal nya styrmedel redan har tagits i bruk och flera planeras för att verkställa KAISU. En kontinuerlig utvärdering av nödvändiga tilläggsåtgärder behövs.

I klimatårsberättelsen konstateras, att anpassningen till klimatförändringen bör förstärkas för att behärska de risker som förorsakas av klimatförändringen.

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Contents

1 The Annual Climate Report examines the realisation of emissions reduction targets

The first Annual Climate Report is submitted to Parliament in June 2019, after which one will be submitted to Parliament every calendar year. The Annual Climate Report monitors the realisation of the Medium-term Climate Change Policy Plan (KAISU). The first Medium-term Climate Change Policy Plan was completed in 2017. It includes the actions for achieving the emissions reduction targets for the effort sharing sector (non-emissions trading sector) by 2030. Due to this, the Annual Climate Report does not include information on the emissions trading sector or land use sector (land use, land use change and forestry). The effort sharing sector covers emissions for example in transport, agriculture, building-specific heating and waste management.

Both the Medium-term Climate Change Policy Plan and the Annual Climate Report are based on the Climate Change Act, which came into effect in June 2015. The Act specifies the parts of the national climate change policy planning system as well as the schedules and responsibilities related to it. In compliance with the Climate Change Act, the planning system comprises three parts: a long-term plan, a Medium-term Climate Change Policy Plan and an adaptation plan.

In accordance with the Climate Change Act, the Finnish Government submits an Annual Climate Report to Parliament on an annual basis, containing details of emissions trends in the effort sharing sector, the realisation of the emissions reduction targets included in the Medium-term Climate Change Policy Plan, and further actions required to meet the targets. Every other year, the report includes details of the policy measures included in the Medium-term Climate Change Policy Plan. Additionally, every four years the report includes details of the sufficiency and efficiency of the adaptation measures taken according to the adaptation plan. This Annual Climate Report for 2019 includes all of the information mentioned above.

Finland's national climate policy has traditionally been based on Government programmes and plans. In the future, the planning system complying with the Climate Change Act will work side by side with the process for preparing the National Energy and Climate Strategy. National Energy and Climate Strategies cover the emissions trading, effort sharing and land use sectors. 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 accordance with the Regulation on the Governance of the Energy Union, Finland must also submit an integrated National Energy and Climate Plan (NECP) for 2030 as well as a long-term strategies for 2050 to the EU by the end of 2019.

2 Finland's emission reduction obligations in the effort sharing sector are based on EU obligations

The EU is committed to reducing greenhouse gas emissions by 20% by 2020 compared to 1990 levels. The emission reduction obligation is divided between the emissions trading sector and the effort sharing sector so that the reduction obligation for 2020 is 21% for emissions trading and 10% for the effort sharing sector compared to 2005 levels. The EU is also committed to the 20 per cent emissions reduction target by 2020 compared to 1990 levels as part of the obligations for the Kyoto Protocol's second commitment period.

The Effort Sharing Decision defines Member State-specific emission reduction obligations for the effort sharing sector. The decision also includes opportunities to utilise flexibilities to make it easier to achieve the targets. Member States may utilise temporal flexibilities so that the emissions are evened out between individual years. If necessary, emissions units can also be purchased from other Member States to meet the emission reduction obligation, or previously purchased international emission reduction units can be utilised.

After this, the EU is committed through the 2030 package to reduce greenhouse gas emissions by 40% by 2030 compared to 1990 levels. The emission reduction obligation is enforced by a legislative package concerning the emissions trading and effort sharing sectors, as well as the land use sector as a new addition. The reduction obligation in emissions trading is 43% by 2030 compared to 2005. Correspondingly, the total emission reduction in the effort sharing sector is 30%. The Effort Sharing Regulation sets out emission reduction obligations for each Member State for 2021–2030.

During the period from 2021 to 2030, Member States may utilise similar flexibilities as during the ongoing period, with the exception of international emission reduction units. Two new flexibilities have also been added. The one-off flexibility allows a limited amount of emission allowances to be transferred from emissions trading sector to cover emissions in the effort sharing sector. Additionally, it is possible, under certain conditions and to

a very limited degree, to utilise possible credits from the land use sector to meet the obligation in the effort sharing sector. On the other hand, if the target set for the land use sector (balance of calculated emissions and sinks) is not met, the calculated emissions in the land use sector may have to be compensated with additional emission reductions in the effort sharing sector.

3 Finland will most likely achieve its target for 2013–2020

Finland's aim is to reduce emissions in the effort sharing sector by 16% by 2020 compared to 2005. In addition, an annual emission allocation has been set for each year between 2013 and 2020. Between 2013 and 2015, Finland's emissions in the effort sharing sector fell below the annual emission allocations (see Figure 1 and Table 1). In contrast, the annual emission allocation for 2016 was exceeded by 1.0 Mt CO_2-eq. In 2017, emissions again decreased compared to the previous year, falling 0.1 Mt CO_2-eq. below the target. The main reason for the increase in emissions in 2016 is the decrease in the proportion of biofuels compared to the previous years. The proportion of biofuels decreased because the distribution obligation have been applied in a frontloaded manner. The high emissions in 2016 compared to the previous years are also explained by the exceptionally warm weather in 2014 and 2015, which decreased the need for heating energy during these years.[1] According to the 2018 proxy estimate, emissions exceeded the emission allocation by 0.4 Mt CO_2-eq. According to the proxy estimate, emissions remained almost at the same level in 2018 as in 2017. In 2018, emissions continued to decrease in agriculture and waste management, whereas emissions from transport and machinery increased. According to the baseline scenario[2], emissions in Finland's effort sharing sector will decrease in 2019 and 2020, but they are still expected to slightly exceed (0.2 Mt CO_2-eq.) the allocation set for 2020.

1 2016 emissions were 0.6 Mt CO_2-eq. higher in the monitoring of the EU obligation than in the most recent greenhouse gas inventory due to changes in the statistical method. This difference is caused by an update to emissions calculations in the transport sector. Emissions data is not updated retroactively in the monitoring of the EU obligation.

2 The baseline scenario, i.e. the WEM (with existing measures) scenario, describes emissions trends, taking the measures already implemented at the time the scenario was prepared into account. It does not take any policy measures decided upon and implemented later into account. The national baseline scenario used in the Medium-term Climate Change Policy Plan is from 2016 and contains measures implemented prior to summer 2016.

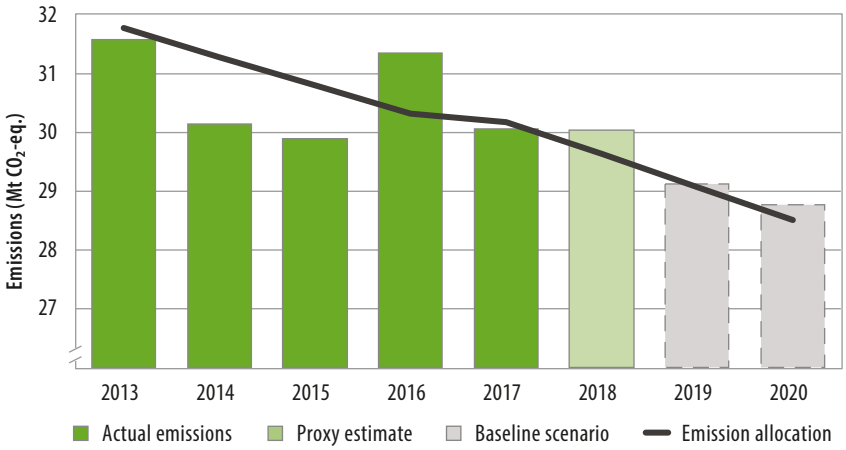

Figure 1. Emissions in the effort sharing sector in 2013–2018 , annual emission allocation for 2013–2020 and emissions according to the baseline scenario in 2019–2020. The 2013–2016 emissions are those verified in the monitoring of effort sharing obligation. The information on 2018 emissions is based on proxy a estimate.

Table 1. Finland's emission allocation for 2013–2020, actual emissions in 2013–2018, emissions in the baseline scenario (WEM) and the difference between emissions and the allocation. The data for 2013–2016 is based on emissions verified in the monitoring of effort sharing obligation. The emissions data for 2018 is based on 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	30,0		
Emissions (WEM)		30,2	29,3	29,9	29,7	29,5	29,1	28,8
Difference between emissions and the allocation	0,2	1,1	0,9	-1,0	0,1	-0,4	0,0	-0,2
Cumulative difference	0,2	1,3	2,2	1,2	1,3	0,9	0,8	0,6

When assessing whether the emission reduction obligation for the effort sharing sector is being met, we need to compare the total emissions in 2013–2020 with the total emission allocation (all annual emission allocations in total) set for these years, as units can be transferred between years. If emissions fall below the annual emission allocation in any one year, the surpluses can be banked and used in later years to compensate for any exceeding of the emission allocations. Finland used the surpluses from 2013–2015 to compensate for the exceeding of the 2016 emission allocation, thus meeting the target for 2016. There are still enough surpluses left to also compensate for the overshoots estimated in the proxy estimate for 2018 and the baseline scenario for 2020. Furthermore, Finland still has international units available if necessary. It is therefore probable that Finland will also meet its obligation for 2020. All in all, if the emissions trends follow the

baseline scenario for 2019–2020, Finland will be left with approximately 0.6 Mt CO_2-eq. in surplus in the period 2013–2020, which would mean that Finland has fulfilled its obligation for effort sharing sector (see Table 1 and Figure 2). Any surpluses remaining from 2013–2020 cannot be banked for the period 2021–2030.

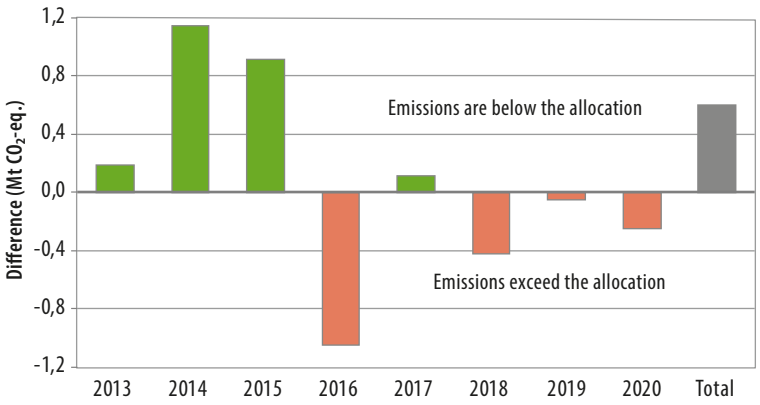

Figure 2. The difference between the emission allocation and emissions per year and in total in 2013–2020. The target is met if emissions fall below the emission allocation set for the period.

The emissions data presented for 2005–2017 in this 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 data for 2018 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 2013–2016 in the figures and table in this chapter is based on emissions data fixed in conjunction with EU inspections. Thus, the emissions data in the most recent release and inventory submission by Statistics Finland for these years deviates from what is presented here.

The estimates presented in this 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 emissions trends in the coming 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 emissions trends. The estimates of emissions and the overshoot/undershoot of the emission allocations for 2019 and 2020 are based on a baseline scenario prepared in 2016

4 The 2030 target can be reached with the planned measures

Finland's emission reduction obligation for 2030 is 39% compared to 2005, which equals an emission allocation of approximately 20.8 Mt CO2-eq. for 2030. The annual emission allocations will be confirmed definitively when the emissions data on 2018 is verified in 2020. This is due to the fact that emissions in 2016–2018 affect the calculation of the emission allocations for 2021–2030. In this report, the estimate of emission allocations is based on data provided on emissions in 2005, 2016 and 2017 in the most recent inventory as well as the proxy estimate of emissions in 2018. Inter-annual flexibilities can also be used in 2021–2030, i.e. surpluses from the previous years can be used to compensate for deficits in later years as necessary.

According to the baseline scenario, current actions will not be sufficient to meet the target set for 2021–2030 (see Figure 3), and additional emission reductions will be needed throughout the period for a total of approximately 23.8 Mt CO_2-eq. Measures for covering this deficit have been identified in the Medium-term Climate Change Policy Plan. If these measures are realised in full, they should be sufficient to fulfil Finland's emission reduction obligation for 2021–2030. More measures have been identified than is necessary for meeting the target, as there are uncertainties involved in the schedule for implementing the measures and the emission reductions that they will yield. According to an estimate, the emission reduction during the period will be 6.8 Mt CO_2-eq. higher than required by the emission allocation. Furthermore, Finland can use the one-off flexibility that entitles it to transfer a limited number of units from emissions trading to the effort sharing sector. Finland's one-off flexibility amounts to a maximum of approximately 0.7 Mt CO_2-eq. per year, i.e. approximately 7 Mt CO_2-eq. for the whole period. Use of the flexibility must be decided upon in 2019, before the start of the new period. Finland will most likely utilise the flexibility in full, which will also help it prepare for the uncertainties involved in emission reductions. If necessary and depending on the situation, the amount of the flexibility can be adjusted downwards twice during the period (in 2024 and 2027).

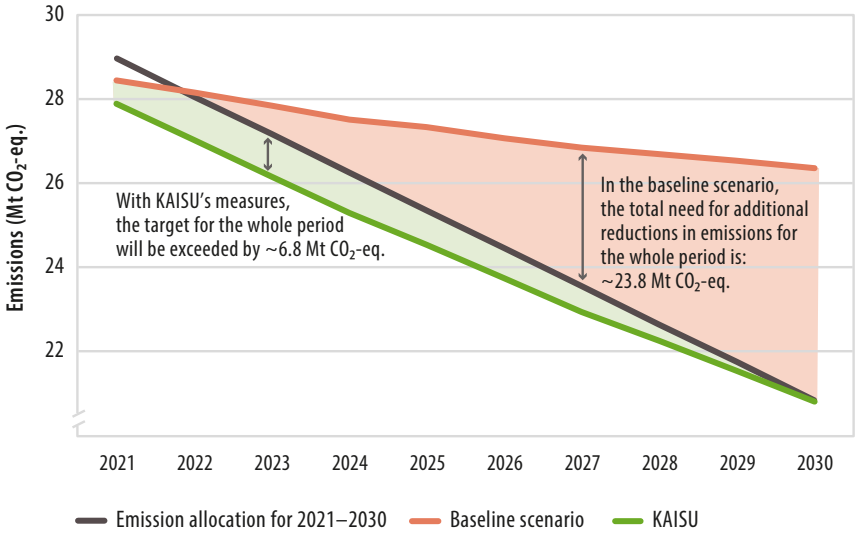

Figure 3. **The emission allocation for 2021–2030, an estimate of emissions trends according to the baseline scenario and an estimate of emissions trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The distance of the projections from the emissions target path represents how much the annual emissions are below / exceed the emission allocation, while the area between the lines represents the how much the total emissions during the whole period are below / exceed total emission allocation set for the period.**

Table 2. **The emission allocation for 2021–2030, an estimate of emissions trends according to the baseline scenario, an estimate of emissions trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU), and the difference between these estimates and the allocation.**

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Emission allocation	29,0	28,1	27,2	26,3	25,4	24,4	23,5	22,6	21,7	20,8
Emissions										
WEM	28,5	28,2	27,8	27,5	27,3	27,1	26,8	26,7	26,5	26,4
KAISU	27,9	27,0	26,2	25,3	24,5	23,7	22,9	22,2	21,5	20,8
Difference between emissions and the allocation										
WEM	0,5	-0,1	-0,7	-1,3	-2,0	-2,6	-3,3	-4,1	-4,8	-5,5
KAISU	1,1	1,0	1,0	1,0	0,8	0,7	0,6	0,4	0,2	0,0
Cumulative difference										
WEM	0,5	0,4	-0,2	-1,5	-3,5	-6,1	-9,4	-13,5	-18,3	-23,8
KAISU	1,1	2,1	3,1	4,1	4,9	5,6	6,2	6,6	6,8	6,8

5 New measures to be introduced across the effort sharing sector

The Medium-term Climate Change Policy Plan defines measures for reducing emissions in each sector so that the total reductions in emissions are sufficient for meeting the 2030 target for the effort sharing sector. This section examines emissions trends in each sector relative to the targets set in the Medium-term Climate Change Policy Plan. Transport accounts for the highest proportion of emissions in the effort sharing sector (see Figure 4), which is why the most significant measures for reducing emissions target the transport sector.

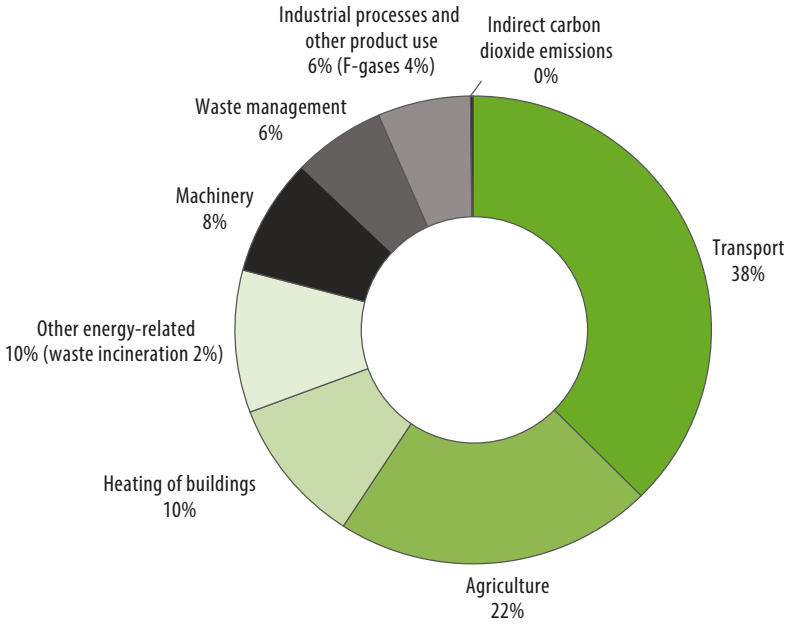

Figure 4. A sectoral breakdown of total emissions in the effort sharing sector in 2017.

In 2017, emissions decreased in almost all sectors of the effort sharing sector compared to the previous year, with emissions increasing slightly only in the machinery sector (see Table 3). The highest absolute reduction was achieved in the transport sector, whereas the highest relative reductions were achieved in waste management and F-gases. Compared to 2005, the most significant relative reductions were achieved in emissions from building-specific heating and waste management. In contrast, F-gas emissions have increased compared to 2005, while emissions from agriculture have remained almost the same.

The emissions trends in each sector are presented in more detail below. Additionally, Annex 2 presents sector-specific indicators that contribute to the emissions trends. The data presented in this chapter is in accordance with the most recent greenhouse gas inventory. The proxy estimate data on emissions in 2018 is presented for the sectors for which data was available. The scenarios presented here are in line with the scenarios presented in the Medium-term Climate Change Policy Plan. The scenarios were prepared in 2016, and they differ from the actual emissions trends in recent years with regard to some sectors.

Table 3. Emissions in each sector in 2005, 2016 and 2017 as well as changes from 2016 and 2005 to 2017. The table shows emissions for the sectors for which measures have been specified in the Medium-term Climate Change Policy Plan, and it therefore does not cover all emissions in the effort sharing sector.

	2005	2016	2017	Change 2016–2017 (Mt CO_2-eq.)	Change 2016–2017 (%)	Change 2005–2017 (%)
Transport, excl. domestic air transport	12,6	11,9	11,3	-0,6	-5,0 %	-10,2 %
Agriculture	6,5	6,6	6,5	-0,1	-0,9 %	-0,3 %
Building-specific heating	4,0	2,7	2,6	-0,1	-3,9 %	-35,2 %
Machinery	2,6	2,3	2,4	0,1	4,5 %	-6,3 %
Waste management	2,8	2,0	1,9	-0,1	-5,3 %	-33,1 %
F-gases	1,2	1,4	1,3	-0,1	-5,5 %	12,9 %

5.1 The transport sector aims for reductions in emissions with an extensive measure package

Emissions from transport increased until 2007 due to the increasing of vehicle-kilometres travelled, after which the trend has, for the most part, been downward (see Figure 5). The downward trend in emissions is caused by the slowing down of the increase in vehicle-kilometres travelled as a result of the recession, as well as an increase in the proportion of biofuels (see Figure 12 and Figure 13). However, in 2016 emissions from transport clearly

increased compared to the previous year. The increase in emissions from transport also explains most of the increase in total emissions in the effort sharing sector in 2016, when the emission allocation was exceeded for the first time. In 2017, emissions from transport once again decreased, but they were still higher than in 2014 and 2015. In 2018, according to the proxy estimate, emissions increased to some extent compared to the previous year. The annual fluctuation in emissions in the transport sector in recent years is particularly explained by the annual fluctuation in the proportion of biofuels. The proportion of biofuels was at its highest in 2014 and 2015. In 2016, the proportion of biofuels decreased compared to previous years, whereas in 2017 the proportion of biofuels more than doubled compared to 2016. According to the proxy estimate for 2018, the proportion of biofuels in liquid fuels decreased to some degree from the previous year. This fluctuation in the proportion of biofuels is a result of the legislation on the distribution obligation that enables frontloaded implementation of the distribution obligation. There may be further fluctuation in emissions in the effort sharing sector in the future as a result of changes in the quantities of biofuels used. However, the distribution obligation will increase gradually until 2020, which will further decrease emissions from transport. In 2017, the biofuel content in petrol was 5.9% and 12.1% in diesel (without double counting)

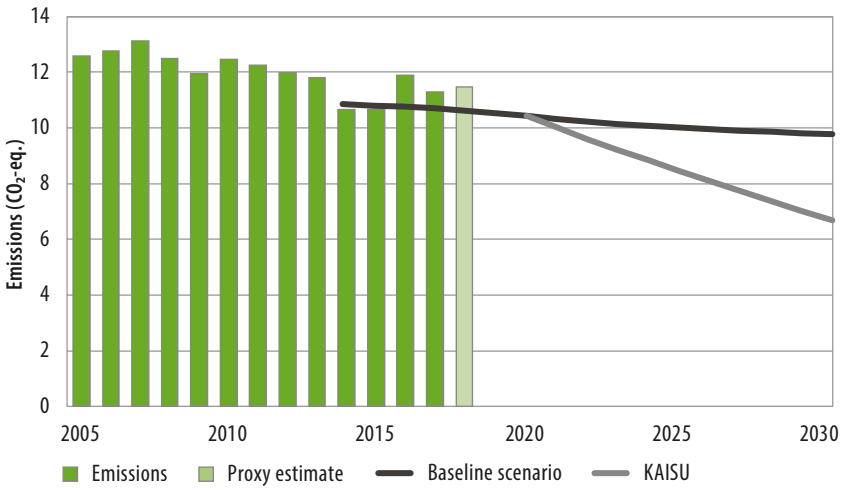

Figure 5. Emissions from transport (excl. CO_2 emissions from domestic air transport) in 2005–2018, an estimate of emissions trends according to the baseline scenario and an estimate of trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The 2018 data is a proxy estimate.

The reductions in emissions from the transport sector also play a key role in achieving the 2030 target for the effort sharing sector, and a significant number of the measures in the Medium-term Climate Change Policy Plan (more than half when measured in reductions

in emissions) are targeted at the transport sector. The trends in greenhouse gas emissions from transport are essentially affected by three factors: 1) the trends in vehicle-kilometres travelled, 2) the energy efficiency of modes of transport and 3) the fuels used. The Medium-term Climate Change Policy Plan includes targets and measures concerning all of these factors.

One target set in the Medium-term Climate Change Policy Plan is that 30% (physical proportion) of all liquid fuel sold for transport should be biofuel in 2030. Because the obligation to distribute biofuels has been incorporated into legislation, it is probable that this target will be achieved. An act on tightening the distribution obligation by 30% was approved in February 2019.

With regard to the vehicle-kilometres travelled by passenger cars, the aim is to bring the growth to a halt in urban regions in the 2020s. In urban regions, vehicle-kilometres travelled by passenger cars have increased by a total of approximately 10% in the 2000s (see Figure 12). In 2016–2017, the vehicle-kilometres travelled by passenger cars in the street network of cities appears to have dropped (by approx. 5%), but assessing the real change is difficult due to a change made to the statistical method for recording vehicle-kilometres travelled on streets in 2016. The next few years will most likely tell us whether the increase in the vehicle-kilometres travelled by passenger cars is truly coming to a halt or whether this recent trend is simply a dip related to the statistical method. The vehicle-kilometres travelled by passenger cars on roads have continued to increase.

The target set in the Medium-term Climate Change Policy Plan is that there is a total of at least 250,000 electric cars (all-electric cars and plug-in hybrids), as well as at least 50,000 natural gas vehicles, in Finland in 2030. The interim goals for 2020 can be found in Finland's national programme for a distribution network for alternative power sources. The targets set for 2020 (5,000 natural gas vehicles and 20,000 electric cars) have already been achieved with regard to natural gas vehicles and will probably also be achieved with regard to electric cars (see Figure 16). The challenge in increasing the number of electric cars, however, has been that all-electric vehicles account for a smaller percentage of all new electric cars every year. The contribution of plug-in hybrids to the reduction of emissions is not as high as the contribution of all-electric cars, particularly if petrol or diesel are used frequently for driving long distances.

Other targets set in the Medium-term Climate Change Policy Plan include renewing the Finnish car fleet significantly more quickly than at present and reducing emissions from new cars to near the average limit value (95 g/km) set for car manufacturers in the EU by 2020. However, the current rate of decline is not sufficient for reaching the target (see Figure 15). Over the course of 2016–2018, we have fallen increasingly behind the target path. The average age of passenger cars on the road has continued to increase in recent years. In order to decrease their

average age, the sale of new cars would have to increase compared to the previous years (see Figure 14). Another problematic characteristic in the renewal of the car fleet is the fact that the quantities of used cars imported to Finland have been increasing in recent years. Imported used cars are often larger than cars sold in Finland and have higher emissions, which makes it even more difficult to achieve the emissions reduction targets set for transport.

The implementation of MAL agreements (on land use, housing and transport) between the state and the largest urban regions has continued, and negotiations have been initiated regarding a new agreement period. The objective of MAL agreements is to achieve a harmonious urban structure for the entire functional urban region, a housing policy based on shared responsibility and a functional transport system, thereby supporting the development of the region towards a sustainable structure with lower emissions. A programme for the promotion of walking and cycling is underway, but funding is not yet at the level estimated to be necessary.

The attractiveness of transit station areas has been promoted with the help of a pilot project in which low-carbon services have been brought to transit stations, making them accessible to users of public transport during their everyday commutes.

5.2 New measures also in agriculture

Only a part of the emissions from agriculture are reported in the effort sharing sector, with the rest being reported in the land use sector. This Annual Climate Report only examines the emissions reported in the effort sharing sector. They mainly comprise methane and nitrous oxide emissions from agricultural land, the digestion of production animals and treatment of manure as well as, to a limited degree, CO_2 emissions from liming and the use of urea fertilisers (see Figure 17). The CO_2 emissions from arable land (7.3 million tonnes in 2017) are reported in the land use sector. The emissions from agriculture that are reported in the effort sharing sector remained relatively even between 2005 and 2017 (see Figure 6). In 2017, emissions decreased by one per cent, being approximately 6.5 Mt CO_2-eq. This small decrease is mainly due to the decreased liming of fields. According to a proxy estimate, emissions from agriculture continued their small decline in 2018 compared to the previous year. The decrease in emissions was due to the year having a low crop yield, which resulted in a lower amount of vegetation waste, as well as a decrease in the number of animals. With the measures currently in place, emissions from agriculture are expected to remain relatively even until 2030. If the measures specified in the Medium-term Climate Change Policy Plan are implemented as planned, emissions from agriculture should decrease from current levels by approximately 10% by 2030.

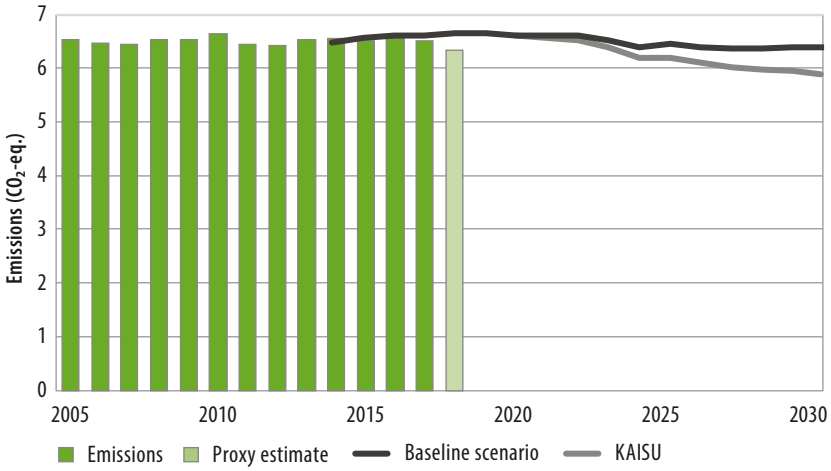

Figure 6. Emissions from agriculture in 2005–2018, an estimate of emissions trends according to the baseline scenario and an estimate of the trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The 2018 data is a proxy estimate.

The Medium-term Climate Change Policy Plan presents measures related to the perennial cultivation of organic soils without soil preparation and raising the groundwater level with the help of controlled subsurface drainage. These measures are already in place in the Rural Development Programme for Mainland Finland 2014–2020. 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. Forestation measures laid out in the Medium-term Climate Change Policy Plan are currently being looked into.

The Medium-term Climate Change Policy Plan also provides for the promotion of biogas production in the agricultural sector, which is estimated to yield additional emission reductions of 0.31 Mt CO_2-eq. 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. According to the Finnish national biogas statistics, the total amount of biogas produced in 2017 was 172 million m^3, which is almost 10% more than the previous year. Agricultural facilities produced 1.4 million m^3 in biogas in 2017. There was no growth compared to the previous year, and agricultural facilities continue to account for a small percentage (less than 1%) of the total amount of biogas produced. Almost all biogas produced by agricultural facilities was utilised in the generation of electricity and heat (the amounts of energy produced were 1.5 and 5.5 GWh).

Another measure presented by the Medium-term Climate Change Policy Plan for reducing emissions from agriculture is for soil carbon stocks to be increased and preserved, including implementation of the 4 per 1000 initiative. The Rural Development Programme for Mainland Finland 2014–2020 includes measures that impact waters and contribute to

increasing and preserving soil carbon stocks. The resulting reduction in emissions affects 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 (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 the consumption of food include reducing food waste and eating according to nutrition recommendations. Food waste campaigns have been carried out. Between 2016 and 2018, Natural Resources Institute Finland (Luke) carried out a project for developing a tool for measuring and assessing food waste. At present, Luke is engaged in monitoring food waste and developing it in different parts of the food chain as well as building a national roadmap for reducing food waste. A project called 'Assessment of climate and environmental impacts of reduction of food waste and eating according to nutrition recommendations' (FoodMinimum) seeks to create an overall picture of how following a diet based on nutrition recommendations, reducing food waste and doubling food export will affect the climate impacts of diets and agricultural production as well as Finnish agricultural production and its profitability and operating environment. Changes to food waste and dietary habits do not directly reduce emissions reported in the agricultural and land use sectors in Finland, but they must influence the production of Finnish food in order to result in a reduction in emissions.

5.3 Gradual discontinuation of the use of oil in building-specific heating

Emissions from building-specific heating have seen a downward trend in recent years, but there is annual fluctuation due to reasons such as the weather (see Figure 7). For example, the weather was exceptionally warm in 2014 and 2015, which is why emissions were lower compared to 2016. The downward trend is due to a decrease in the use of oil heating (see Figure 17) and improvement in the energy efficiency of buildings. Most emissions from building-specific heating are caused by oil heating. In 2017, emissions from building-specific heating amounted to approximately 2.6 Mt CO_2-eq., which is almost 5% less than the previous year. The energy efficiency of oil-heated properties has also been improved with an energy efficiency agreement (HÖYLÄ), which has influenced emissions trends. In the baseline scenario, emissions are expected to continue decreasing as a result of the renewal and renovation of the building stock and changes to heating systems. The measures set out in the Medium-term Climate Change Policy Plan are expected to reduce emissions further. The most significant contribution to the reduction of emissions comes from the obligation

to distribute biofuel oil. The act on the distribution obligation was approved by Parliament in February 2019. In accordance with the act, the share of biofuel oil will increase gradually from 2021 until 2028, from which point onwards it must be at least 10%.

The Medium-term Climate Change Policy Plan specifies that the state administration will discontinue the use of oil heating in its premises by 2025. All public operators are also encouraged to do the same. With regard to the state administration, both Senate Properties and the Construction Establishment of Finnish Defence Administration are in charge of the majority of the state administration's oil-heated buildings. According to a preliminary estimate and based on current plans, oil heating in the Finnish Defence Administration's buildings is set to decrease by approximately 80% from the current level by 2025. The switch from oil to biomass has been rapid in recent years. With regard to the state administration, the plan is to determine the boundary conditions and impacts of the discontinuation of oil heating more closely in 2019.

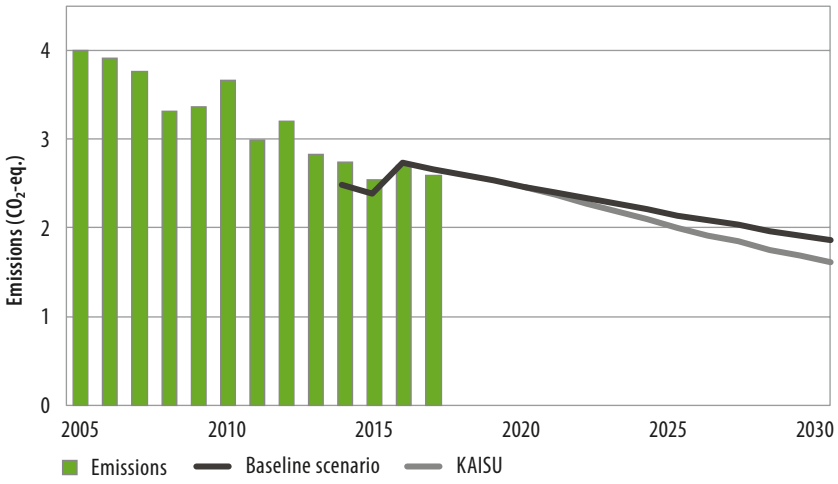

Figure 7. Emissions from building-specific heating in 2005–2017, an estimate of emissions trends according to the baseline scenario and an estimate of the trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The emissions data provided by the inventory includes all greenhouse gases, whereas the scenario curve only includes CO_2 emissions. Thus, the scenarios lack e.g. methane emissions from small-scale use of wood, and the curves slightly underestimate emissions from building-specific heating. However, the difference is relatively small. All emissions are included in total emissions in KAISU.

5.4 First specific measures for reducing emissions from machinery

The trend in emissions from machinery was slightly downward between 2005 and 2018 (see Figure 8). Machinery is considered to include machinery used in industry (e.g. construction and extractive operations), agriculture and forestry as well as households and the service sector. There is annual fluctuation in emissions, which is caused by the level of activity in construction and industry, among other things. In 2017, emissions increased by approximately 5% compared to the previous year, but they were approximately 6% lower compared to 2005 This increase was due to an increase in emissions from industrial machinery, which was a result of increased industrial production. Among energy-intensive sectors, forestry and the chemical industry in particular grew in 2017. Based on the proxy estimate, emissions also increased slightly in 2018 compared to the previous year.

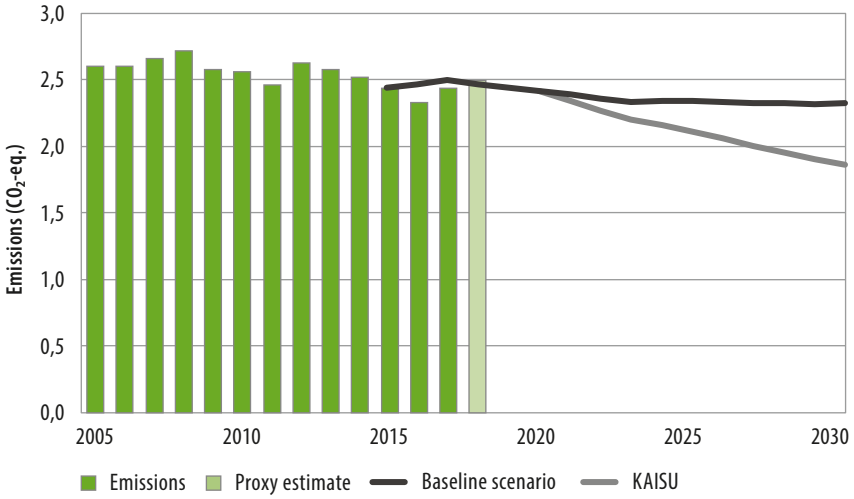

Figure 8. Emissions from machinery in 2005–2018, an estimate of emissions trends according to the baseline scenario and an estimate of the trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The 2018 data is a proxy estimate.

Most of the emissions from machinery (90%) are caused by the use of light fuel oil, while a smaller percentage (10%) is caused by the use of petrol. The trends in emissions caused by the use of light fuel oil in machinery have also developed in different directions in different sectors between 2005 and 2017 (see Figure 18). Emissions from industrial machinery (construction, mining and other industry) have remained at almost the same level, while emissions from agricultural machinery have decreased and emissions from forestry machinery have increased. Emissions have also increased in other machinery sectors (trade, services, public sector machinery, households), but the absolute growth has not been particularly significant.

The Medium-term Climate Change Policy Plan has now specified emission reduction measures for the machinery sector for the first time. Because no measures have previously been specified for the machinery sector, emissions from machinery will remain relatively even in the baseline scenario until 2030, decreasing only slightly from current levels. With the measures specified in the Medium-term Climate Change Policy Plan, emissions are estimated to be approximately 0.6 Mt CO_2-eq. (24%) lower in 2030 compared to emissions in 2017. The Medium-term Climate Change Policy Plan presents several measures for reducing emissions from machinery.

The most significant individual measure is the distribution obligation of biofuels set for light fuel oil, which applies equally to light fuel oil used both in machinery and the construction sector. According to the distribution obligation, the obligation to distribute biofuel oil will be 3% in 2021. This obligation will increase linearly to 10% in 2028.

The obligation to distribute light fuel oil affects emissions from building-specific heating and machinery as well as emissions from the use of oil in industry. However, most (90%) of the light fuel oil used by industry is used in machinery. In the sectoral breakdown used in this annual report, emissions from industrial machinery are included in the emissions figures for the machinery sector. The distribution obligation also affects other uses of light fuel oil, but the impact on emissions is minor due to the relatively small quantities used.

The principle of calculating taxation on heating fuel was changed at the beginning of 2019 so that life cycle emissions from fuel are taken into account as carbon dioxide emissions. The taxation of light fuel oil was simultaneously raised by approximately 2%, which may also affect the use of machinery fuel.

One of the measures intended to promote the reduction of emissions from machinery is converting tractors to run on biogas, a change that can be supported under the Rural Development Programme as a measure for improving the state of the environment on farms. Funding can be granted as investment support for purchasing a gas component for a tractor.

Additionally, steps have been taken to improve the knowledge base on emissions from machines by developing the quality of the baseline data in the TYKO model developed by VTT. This project, completed on 15 May 2019, was funded by the Ministry of the Environment and implemented by VTT.

In autumn 2018, the preparation of a Green Deal agreement concerning the public procurement of machinery and machine contracting was launched within the Competence Centre for Sustainable and Innovative Public Procurement (KEINO). However, the project first ended up founding a machinery and machine contracting development group that focuses on maintenance contracting.

The Ministry of the Environment and the Association of Finnish Technical Traders have also started negotiations regarding another Green Deal agreement relating to machinery. The project also seeks to promote the energy-efficient use of machinery by identifying needs related to user training. The Ministry of the Environment is prepared to fund a possible information guidance project related to the aforementioned project in 2019.

5.5 Strong decline in landfill emissions, emissions from waste incineration increasing

Emissions from waste management have decreased relatively evenly in 2005–2017 (see Figure 9). In 2017, emissions decreased by approximately 5% compared to the previous year, being approximately 1.9 Mt CO_2-eq. Compared to 2005, emissions decreased by as much as 33% by 2017. In 2018, emissions continued to decline. Reasons for decreasing emissions include decreased landfilling of municipal waste and increased use of waste to generate energy as a result of stricter waste legislation, among other things (see Figure 19). The methane produced by landfills is the most significant source of emissions in waste management. Other sources of emissions include biological treatment of waste (composting and anaerobic digestion) and wastewater treatment (see Figure 20).

The downward trend in emissions is expected to continue in the future as a result of a decree enacted in 2016 that limits the landfilling of organic matter. It will reduce greenhouse gas emissions from landfills and lead to old landfills producing less gas. The Medium-term Climate Change Policy Plan states that the enforcement of the Government Decree on Landfills will be overseen and monitored. However, the reductions in emissions produced by the Government Decree on Landfills are already taken into account in the baseline scenario, and no new emission reduction measures have been specified.

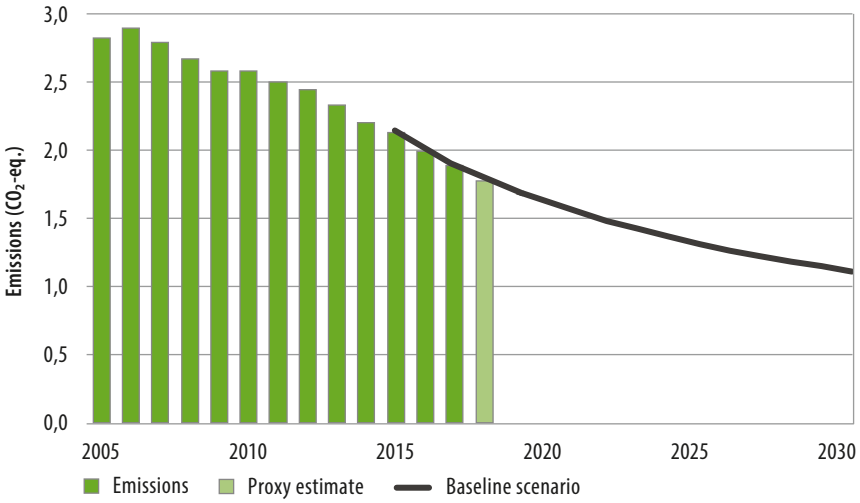

Figure 9. Emissions from waste management in 2005–2018, an estimate of the emissions trends according to the baseline scenario and an estimate of the trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The 2018 data is a proxy estimate.

Emissions caused by the recovery of energy from waste (i.e. waste incineration) are reported in the energy sector, and therefore they are not included in the data on emissions from waste management presented above. Only emissions from plants that incinerate municipal waste are included in the effort sharing sector emissions, whereas co-incineration plants belong in the emissions trading sector. Emissions from waste incineration in the effort sharing sector have increased in the period 2005–2017 (see Figure 10). In 2017, emissions increased by approximately 9% compared to the previous year. In the baseline scenario, emissions from waste incineration will continue increasing towards 2030. The Medium-term Climate Change Policy Plan states that transferring waste incineration to emissions trading will be looked into. However, based on an investigation carried out in 2018, it was decided that the transfer would not be carried out, at least for the time being. Other policy measures applied to emissions from waste incineration will be considered in 2019.

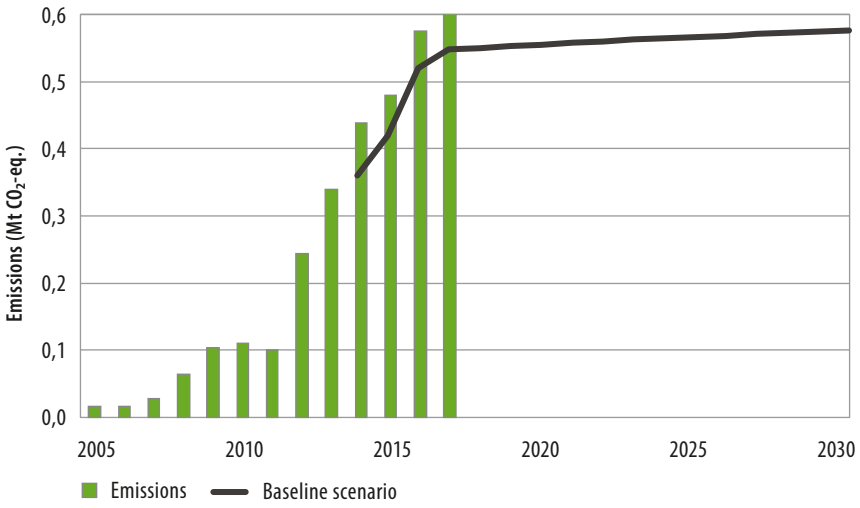

Figure 10. Emissions from waste incineration in the effort sharing sector 2005–2017. Emissions have increased strongly as a result of increased recovery of energy from waste.

5.6 The increase in F-gas emissions must be reversed

Emissions caused by the use of F-gases increased from the 1990s up to 2013, since when there has been a slight decline (see Figure 11). Among other uses, F-gases are used in refrigeration and air conditioning equipment and aerosols. The most significant reason for the increase in F-gas emissions, starting from the 1990s, is the replacement of ozone-depleting compounds with F-gases in refrigeration and cooling equipment. In 2017, emissions decreased by approximately 5% compared to the previous year, but they were still approximately 13% higher compared to 2005 and over 25 times what they were in 1990. According to the proxy estimate, emissions remained at practically the same level in 2018 as the previous year. The main reasons for the reduction in emissions included reduced emissions from the use of commercial refrigeration equipment and air conditioning equipment in vehicles. The largest decline occurred in the emissions from air conditioning equipment in vehicles. In this sector, F-gas emissions are being reduced by the use of alternative refrigerants in the air conditioning equipment in passenger cars, which started a few years ago. Carbon dioxide is becoming a common refrigerant in large commercial refrigeration facilities, which is starting to be reflected in a decrease in F-gas emissions from the refrigeration sector.

The regulation of F-gases has increased at the EU level with a regulation on greenhouse gas emissions, for example, the purpose of which is to gradually reduce the quantity of F-gases placed on the market. With the measures currently in place, F-gas emissions are expected to decrease in 2020–2030. According to the baseline scenario, F-gas emissions

will be approximately 43% lower in 2030 compared to 2016. If the measures included in the Medium-term Climate Change Policy Plan are realised as planned, F-gas emissions will be approximately 64% lower in 2030 compared to 2016.

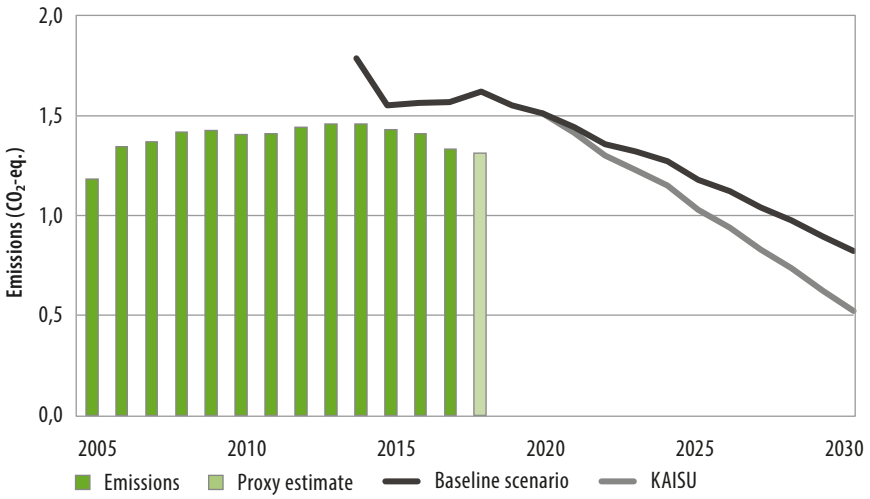

Figure 11. F-gas emissions in 2005–2018, an estimate of the emissions trends according to the baseline scenario and an estimate of the trends achievable in 2021–2030 with the measures of the Medium-term Climate Change Policy Plan (KAISU). The 2018 data is a proxy estimate. The difference between emissions and the scenario in 2014–2017 is due to recalculations carried out as a result of changes made to the calculation of F-gas emissions in the greenhouse gas inventory. Since the preparation of the scenarios in KAISU, recalculations have been carried out for the UNFCCC inventory submissions in spring 2018 and 2019.

6 Besides sector-specific measures, cross-sectional measures are also needed

In addition to sector-specific measures, the Medium-term Climate Change Policy Plan also presents a group of cross-sectional measures that affect several sectors. These measures include climate work by municipalities, measures relating to consumption and public procurement.

6.1 Attempts to speed up the climate work of municipalities and regions

Finnish municipalities, particularly the largest cities, have largely committed to ambitious climate targets. More than half of all Finns live in municipalities that engage in active climate work. Municipalities can be characterised as trendsetters in Finland's climate change policy. Municipalities make decisions that significantly affect national emissions trends in land use policy and zoning, traffic planning, energy generation, use of energy, ownership steering of municipal enterprises and Group companies, public procurement, promotion of industrial policy and the use of economic instruments, for example. Municipalities have very different profiles and varying capabilities to influence emissions in their region. The climate work carried out by municipalities and regions is hindered by the scarcity of personnel and investment resources as well as a lack of predictable long-term incentives.

One goal of the Medium-term Climate Change Policy Plan is to speed up the climate work of municipalities and regions. In 2018, a municipal climate change solutions programme was set up by the Ministry of the Environment in order to reach this goal. An annual appropriation in the amount of EUR 1 million is reserved for speeding up the climate work of municipalities, joint municipal authorities and regions in 2018–2020. The programme focuses on funding climate actions with wide-reaching impacts and cooperating and interacting with local and regional operators, and it has invested in communicating

climate solutions. The municipal climate change solutions programme works in close cooperation with national climate programmes and networks, such as the Finnish Environment Institute's HINKU forum, municipalities that have signed the municipal energy efficiency agreement and the IlmastoKunnat network of the Association of Finnish Local and Regional Authorities.

In spring 2019, the municipal climate change solutions programme held the first call for grants, in which municipalities and regions could apply for a grant for projects aimed at reducing emissions in the effort sharing sector. A total of EUR 0.5 million was available in grants, and a total of 12 projects were granted funding.

In autumn 2019, there will be a call for grants that will also be suitable for the various interest groups involved in the climate work by municipalities and regions. The call will be looking for the most efficient and effective ways to disseminate the best climate solutions within the Finnish municipal and regional sector, among other things.

As of the beginning of 2019, the appropriation for the municipal climate change solutions programme has also been used to fund several national projects, the results of which will be utilised extensively across Finland in the climate work of municipalities. The projects that have received funding include 1) a model for leading low-carbon approaches in municipalities through peer learning (Motiva), 2) development of regional emissions calculations (Finnish Environment Institute), 3) a preliminary study on a tool for assessing the ancillary effects of climate measures by cities, 4) a roadmap for speeding up the climate work of the regional administration at the level of official activities (ELY Centre for Pirkanmaa) and 5) a renewed version of the Climate Diet calculator intended for citizens.

Climate work by municipalities and regions has also been carried out with additional funding allocated to the Energy Authority. In 2018, pilot projects on regional energy and climate work that lasted from six months to a year were launched in 12 regions. The pilots focused on providing advice on energy to residents of municipalities as well as advice to municipalities and SMEs. In winter 2018–2019, based on the pilot projects, the Energy Authority prepared an EU-wide tender process for the implementation of advice on energy in municipalities (excl. Ahvenanmaa) for four years, from May 2019 to May 2023. The call attracted a total of 34 tenders, and the operators chosen for each region were announced on 3 April 2019. The purpose of the energy advice provided in regions is to increase the energy efficiency of municipalities and SMEs and the proportion of renewable energy used by them by increasing knowledge and systematic activities with the help of energy efficiency agreements, energy audits and municipal renewable energy audits. Residents are provided with advice on energy savings and the use of renewable energy. The Energy Authority has allocated approximately EUR 2.8 million to regional energy advice.

6.2 Carbon footprint of households on the rise, several measures for curbing emissions from consumption

In the Medium-term Climate Change Policy Plan, the most important measure related to consumption is encouraging citizens to reduce their own carbon footprint by an average of 50% by 2030. In recent years, the carbon footprint of households has been growing in Finland. The plan highlights the participation of citizens, peer learning and the significance of local pilots in increasing the effectiveness and acceptability of climate actions as well as the role of citizens as developers of solutions, among other things.

As part of the implementation of the policy, a workshop on reducing the carbon footprint of citizens by half was held in autumn 2018. The workshop was attended by approximately 100 interested active NGO members, education professionals, researchers, officials and interest groups in different fields. Based on the workshop, three themes were chosen for small-scale pilots that will implemented on the Place to Experiment platform. The themes of the 15 small-scale pilots to be implemented over the course of spring and summer 2019 are everyday mobility, promotion of energy efficiency solutions for homes and sustainable local consumption. Each pilot will receive EUR 5,000 in funding, and the most successful pilots will be granted funding for further development in autumn 2019.

The knowledge base between consumption and climate change has also been strengthened. The FoodMinimum project funded by the Government's analysis, assessment and research activities (VN TEAS) calculates how diets that follow nutrition recommendations compiled in different ways affect citizens' carbon footprints, as well as how much reducing food waste would reduce emissions. The Climate Diet calculator developed by the Finnish Environment Institute has been updated to correspond to current technical requirements and to provide suggestions for changing the lifestyles of those who use the calculator. Additionally, the KUHIMA project of the Finnish Environment Institute has studied the carbon footprint of public procurements and the change in the carbon footprint of consumers between 2005 and 2016.

The energy efficiency measures by consumers are being considered by the energy efficiency working group set up by the Ministry of Employment and the Economy for 2018–2019. In the interim report published by the Ministry of Employment and the Economy on 29 March 2019, the expert working group on consumers raised three main themes requiring further study: the servitisation of energy efficiency, such as housing and mobility services; changes and challenges related to technology and funding; and changes and challenges related to consumers' habits, skills and capabilities to act.

6.3 Public procurement supports the mitigation of climate change

There is no data available on the impacts of public procurement on greenhouse gas emissions. According to a study by the Finnish Environment Institute (2017), more than half of the examined municipalities considered sustainability goals in their procurement strategy or other procurement instructions. However, these sustainability goals are set at a fairly general level, and only around a quarter of the municipalities defined more detailed sustainability criteria. These pertained to the procurement of devices belonging to the best energy efficiency categories, for example. Steps have been taken to promote the energy efficiency of vehicle and transport service procurements with both applicable legislation and instructions produced by the state administration. The directive concerning the public procurement of vehicles will be amended in 2019, and strict minimum requirements will be imposed on the procurement of clean vehicles.

Municipalities have also set sustainability targets concerning food and its procurement, such as increasing the use of vegetarian food and vegetable protein and reducing the availability of meat dishes. It is possible to highlight the energy efficiency of food production and food processing and the use of renewable energy in the procurement of food, but these procurement criteria are not yet in common use.

In recent years, steps have been taken to lead public procurements and improve effectiveness in order to mitigate greenhouse gas emissions, for example. These steps include setting up the Competence Centre for Sustainable and Innovative Public Procurement (KEINO), developing the voluntary Green Deal model for setting targets as well as preparing a performance-based environmental fund.

The Competence Centre for Sustainable and Innovative Public Procurement (KEINO) started operations on 1 March 2018. KEINO is a network-like consortium, and the parties in charge of implementing and jointly developing its various areas include Motiva Ltd, the Association of Finnish Local and Regional Authorities, VTT Technical Research Centre of Finland Ltd, Business Finland, the Finnish Environment Institute (SYKE), Hansel Ltd, KL-Kuntahankinnat Oy and the Finnish Innovation Fund Sitra.

KEINO seeks to develop and pilot new operating models for procurements together with procurement units. The development groups for low-emission transport, low-emission maintenance contract procurement, development of the responsibility of hospital districts in procurement activities and low-carbon construction aim to meet the climate targets in particular.

The Accelerator project, coordinated by SYKE, counsels municipalities in procurements that include low-carbon and circular economy potential.

Additionally, Motiva Ltd and the ministries are preparing to pilot the Green Deal model between the ministries and interested areas, with the aim of promoting the goals of sustainable development

7 The need for new measures and flexibilities must be evaluated regularly

According to current estimates, existing measures will be sufficient to fulfil the emission reduction obligation set for 2013–2020. In contrast, it appears that Finland's emissions will exceed the annual emission allocation set for 2020. 2020 is already so close that there is not enough time to adopt new, efficient emission reduction measures. However, there are uncertainties involved in the matter because the annual fluctuation in emissions can be considerable. We cannot be certain about the situation in 2020 until 2022, when the final emissions data for 2020 is published. If emissions exceed the emission allocation in a single year, Finland will primarily utilise the inter-annual flexibilities included in the Effort Sharing Decision to meet its obligation. For example, when the emission allocation for 2016 was exceeded, it was compensated with the surplus emission units gained from previous years, when emissions fell below the emissions allocations.

If the surpluses accumulated in previous years are not sufficient to fulfil the obligation, other flexibilities can be utilised. These include emission reduction units obtained with the project-based mechanisms included in the Kyoto Protocol, for example. Finland is preparing to utilise flexibilities, within the imposed restrictions, to meet its target for 2020 if total emissions for 2013–2020 exceed the emission allocation set for Finland. At present, the account of the state of Finland holds approximately 8.5 Mt in Certified Emission Reductions (CERs[3]) and approximately 2.9 Mt in Emission Reduction Units (ERUs[4]). These can be utilised to fulfil the emission reduction obligation. Additionally, the Effort Sharing Decision includes the capability to purchase emission units from other countries in order to fulfil one's own obligation.

The measures included in the Medium-term Climate Change Policy Plan are primarily sufficient to meet the emissions reduction target for 2030. Some of these measures

3 CERs are produced by Clean Development Mechanism (CDM) projects carried out in developing countries.

4 ERUs are produced by Joint Implementation (JI) projects carried out in industrial countries.

were already adopted in 2018, and they will continue to yield emission reductions in 2021–2030. Based on continuous monitoring of the plan's implementation, it is possible to adopt new measures or enhance the effectiveness of existing measures as necessary. Future Annual Climate Reports will comment on the sufficiency of the measures in more detail, particularly from the perspective of the 2030 target. However, it already seems that new measures will be needed in the transport sector, for example.

Finland should also prepare to use flexibilities in 2021–2030. Use of the inter-annual flexibilities will remain necessary due to the fact that annual fluctuations will probably continue after 2020. Furthermore, the obligation will become significantly stricter compared to the level in the previous period, which is why new policy measures will be adopted. Their effectiveness usually involves uncertainty, which increases the uncertainty about meeting the targets for the whole effort sharing sector. Because of this, emission units purchased from other Member States may also be required for fulfilling the obligation in the future. In any case, preparedness to purchase these units should be developed in the next few years.

In Finland, the decision to utilise the one-off flexibility granted by the Effort Sharing Regulation is made by the Finnish Government. According to the Effort Sharing Regulation, the European Commission must be notified of the use of the flexibility by the end of 2019. In 2021–2030, the planned utilisation of the flexibility may be adjusted downwards twice (in 2024 and 2027). Both the 2016 National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan work with the assumption that the one-off flexibility will be utilised in full.

8 Urgency of adaptation measures highlighted

In 2005, Finland was the first EU country to prepare a National Climate Change Adaptation Plan. Adaptation refers to a society's ability to adapt to a changing climate by being prepared for risks related to the weather and climate and developing solutions required for this. Based on evaluations carried out in 2009 and 2013, the preparedness of different sectors for the consequences of climate change varied to a great extent. The use and management of water resources received a particularly good evaluation. The necessity of cooperation between different sectors was highlighted.

The National Climate Change Adaptation Plan 2022 was approved as a Government resolution in 2014. The plan also implements the EU's adaptation strategy at the national level. The objective of the adaptation plan is for Finnish society to have the capacity to manage the risks related to climate change and to adapt to any changes in the climate. The aim is for adaptation to be incorporated as part of the planning and operations of sectors and operators and for operators to have the necessary methods for evaluating and managing climate risks at their disposal. Research and development, as well as communications and education, are used to increase society's ability to adapt and develop innovative solutions.

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, at a general level, society's important operations.

An interim evaluation of the adaptation plan was published in spring 2019. Based on the interim evaluation, awareness of the importance of adaptation measures has increased, particularly in the administration and production of information, but climate risks and the need to adapt to them are not yet acknowledged adequately. As a result, the management of climate risks is partly inadequate, and the planning and implementation of adaptation measures is not thorough enough for us to be able to prevent the harmful future impacts

of climate change cost-effectively. For example, we are probably not yet able to identify all significant financial risks. It is necessary to tailor tools more closely to the needs of operators.

The urgency of adaptation measures is highlighted because the financial losses arising from global warming and extreme weather and water-related events are on the rise. For example, the cost of flood damage within the EU is estimated to increase tenfold over the course of the current century from the current annual damage costs of approximately EUR 10 billion. In Finland, the increase of flood risk is mitigated by decreased spring flooding, but the flood risk in Finland is estimated to increase two- or three-fold from the present risk due to increased stormwater floods, among other things. The highest losses will be incurred by the industrial, transport and energy sectors, but the costs of inaction may increase very sharply. The risks posed by diseases, pests and the spread of invasive species are a threat to the health of humans, animals and plants, the natural environment, agriculture, forestry, game husbandry and fishery. Their impacts are also indirectly transmitted to Finland through global flows of goods, energy, money and people. As the risks are considerable, we must strengthen our coherent climate change policy in order for climate change to be mitigated, i.e. emissions to be cut, while we strengthen the climate sustainability of society.

Adaptation to climate change should be strengthened, particularly to improve risk management. In 2018, adaptation to climate change was integrated into the national risk assessment and its regional risk assessments. Better climate sustainability tools than are currently available are required for monitoring climate sustainability at national, regional and local levels in order for decision-making to be based on sufficient data. Strengthened cooperation, partnerships and sustainable solutions may, for their part, promote the export of Finnish expertise and the solving of challenges related to global food security, sufficiency of clean water and the sustainability of the use of natural resources.

Annex 1. Policy measures according to the Medium-term Climate Change Policy Plan

	Policy measure	Progress of implementation	More information
Transport	Subsidies for the construction of distribution infrastructure for electricity and biogas used in transport	EUR 3 million/year was reserved in the budget of the Ministry of Employment and the Economy (TEM)/Energy Authority for 2018–2021 for supporting the construction of infrastructure for electric transport and the use of biogas in transport. The Finnish Government issued a decree on the subject on 27 June 2018. The first tender process for the subsidy was held in autumn 2018. EUR 1.5 million/year was reserved in the budget of the Ministry of the Environment (YM)/Housing Finance and Development Centre of Finland (ARA) for 2018–2021 for organisations that own residential buildings to make changes required by electric car charging stations to properties' electrical systems. The subsidy became available for application to housing companies in late summer 2018.	The subsidy for distribution infrastructure is used to promote investments in the public charging and refuelling infrastructure that uses alternative power sources: natural gas refuelling stations, electric bus charging systems and high-powered and basic charging systems for vehicles. ARA's subsidy is used to promote the spread of capabilities to charge electric cars at home and thereby increase the electric car fleet.
	Nordic cooperation	Finland/the Ministry of Transport and Communications (LVM) held a meeting in Sköldvik, Porvoo, that was attended by ministers for climate and energy affairs from other Nordic countries.	The meetings included discussions on ways to reduce emissions from transport and possible cooperation areas in the transport sector.
	Supporting the procurement and conversion of all-electric cars, and scrapping premiums	EUR 6 million/year was reserved in LVM's budget for 2018–2021 for the promotion of the purchasing of all-electric cars and the conversion of old cars to run on ethanol or natural gas. Another EUR 8 million was reserved in LVM's budget for 2018 for scrapping premiums for old cars. A Government proposal concerning subsidies and premiums was submitted on 26 October 2017. The act came into effect on 1 January 2018.	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 state. 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. Scrapping premiums were granted to buyers of new cars who scrapped their old car. Depending on the power source used, the premium was either EUR 2,000 or EUR 1,000.
	Green Deal for the automotive sector	The climate agreement (Green Deal) between the state and the automotive sector was signed on 22 November 2018.	The shared goals of the automotive industry and the state support the reduction of carbon dioxide emissions from transport, improvement of vehicles' energy efficiency and the spread of biofuels and other alternative power sources. The agreement was signed by the Ministry of Transport and Communications and the Ministry of the Environment on behalf of the state, and it will be in force until 2025.

	Policy measure	Progress of implementation	More information
	Public procurement	On 11 February 2019, the EU concluded negotiations on the Clean Vehicle Directive (CVD). The Directive will most likely receive final approval from Parliament in the near future. The preparation of a national legislation will start after this. The plan is to also strengthen the guidance services for public procurement units in order to meet the Directive's goals in Finland.	The Directive defines a clean vehicle and sets the minimum percentages of these vehicles in the public procurements of each EU Member State. The Directive covers the procurement of both cars and passenger and freight transport services.
	MAL agreements and the development of public transport	The implementation of MAL agreements for 2016–2019 is underway in the Helsinki, Tampere, Turku and Oulu regions. The agreements coordinate the planning of land use, housing and traffic, with zoning and housing production being concentrated in areas that are easily accessible by public transport in the urban structure, for example. MAL funds have been allocated to projects that support sustainable modes of transport in these regions. The state has supported the implementation of the tramway in Tampere and the Jokeri Light Rail line in the Helsinki region.	In autumn 2018, negotiations were initiated in the Helsinki, Tampere, Turku and Oulu regions for the 2020–2023 agreement period. The aim is to bring the agreements into effect immediately at the beginning of 2020.
	Rail-related purchases	EUR 2 million/year was reserved in LVM's budget for 2018–2021 for increasing purchases related to rail transport.	The additional appropriation will be allocated to the following projects in 2018–2019: extending the Helsinki–Kokkola connection to Ylivieska, extending the Helsinki–Kuopio connection to Kajaani, Kotka–Kouvola, Joensuu–Nurmes, Pori–Tampere, Helsinki–Kolari and Seinäjoki–Vilppula. Use of the additional appropriation in 2020–2021 will be agreed upon separately at a later time.
	Controlling the locations of jobs and services	These policies are implemented through MAL collaboration between the state and the four largest urban regions.	
	Complementary construction and construction of new buildings	These policies are implemented through MAL collaboration between the state and the four largest urban regions.	
	Programme for the promotion of walking and cycling	The preparation of the promotion programme was completed in March 2018. The Finnish Government confirmed the resolution supporting the promotion programme on 22 March 2018. EUR 3.5 million/year was reserved in LVM's budget for implementing the programme in 2018 and 2019.	The resolution and promotion programme include ten sets of measures for increasing walking and cycling by 2030. One completely new measure was introduced: a new joint investment programme between the state and municipalities for improving the conditions for walking and cycling along city street networks. A total of EUR 7 million in funding was allocated for launching the programme in 2018–2019.
	Bicycle park-and-rides at traffic nodes	The Finnish Transport Infrastructure Agency has granted funding for bicycle park-and-rides. Subsidies have also been granted to municipalities for developing the pedestrian and cycling infrastructure.	

	Policy measure	Progress of implementation	More information
	Development of transit station areas	Led by the Ministry of the Environment, a service pilot called Fiksu Assa was launched in spring 2018. It brought climate-smart services and products that make everyday life easier to seven transit stations in six cities for four days.	Through the pilot, ERDF funding was granted to Helsinki Region Environmental Services (HSY), Helsinki, Espoo, Vantaa, Riihimäki and Hämeenlinna, which will continue piloting the Fiksu Assa concept in 2019–2020.
	Looking into congestion charges	Congestion charges were looked into in conjunction with the planning of MAL 2019 in the Helsinki region, among other contexts. Progress in the matter requires legislative changes as well as active measures by the state and urban regions.	
Agri-culture	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 €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.
	Afforesting organic soil and wetlands	Being looked into	Potential of land use measures in climate change mitigation (MISA)
	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 in 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. 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.
	Promoting biogas production	Rural Development Programme for Mainland Finland 2014-2020	Investment support in the amount of 40% of the eligible total costs can be granted for investments in renewable energy on farms. The energy generated by the supported facility must be used on the farm. 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. The rates and amounts granted in business subsidies by the Rural Development Programme are affected by the enterprise's size, location and the business activity that is supported, among other things. 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.
	Promoting the increasing and preserving of soil carbon stocks and implementation of the 4 per 1,000 initiative through research projects and pilots	Rural Development Programme for Mainland Finland 2014–2020	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). 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.Several related research and development projects are underway.

Building-specific heating	Obligation to distribute biofuel oil	The Act on the Promotion of the Use of Biofuel Oil was approved by Parliament on 6 February 2019.	Starting from 2021, some of the light fuel oil intended for heating, machinery and fixedly installed 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, at least 10% in 2028.
	Taxation of heating fuels	The tax was raised as of 1 January 2019.	The tax on light fuel oil was raised by approximately 2%.
	Discontinuation of 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.	A key measure has been switching to the use renewable energy sources in conjunction with the tender process for district heating plants.
Waste management	Looking into transferring emissions from waste incineration from the effort sharing sector to the emissions trading sector	The transfer of emissions from waste incineration has been abandoned, at least for the time being.	Other methods are being looked into for reducing emissions from waste incineration, such as the possibility of a Green Deal agreement.
F-gases	Avoiding equip-ment containing F-gases in public procurements	The criteria have been prepared for green public procurement. Publication and implementation are planned for 2019.	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.
	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.	
	Looking into and demonstrating alternative technologies suited for local conditions	Project planning has been initiated.	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.
Machi-nery	Obligation to distribute biofuel oil	The Act on the Promotion of the Use of Biofuel Oil was approved by Parliament on 6 February 2019.	Starting from 2021, some of the light fuel oil intended for heating, machinery and fixedly installed 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, at least 10% in 2028.
	Taxation of heating fuels	The tax was raised as of 1 January 2019.	The tax on light fuel oil was raised by approximately 2%.
	Improving the quality of data on emissions from machinery	A project funded by YM for the development of the TYKO model was completed on 15 May 2019.	The aim of the project was to improve the quality of the baseline data in the TYKO model.
	Increasing the percentage of energy-efficient and low-emission machinery through public procurement	A survey has been carried out for a Green Deal agreement concerning the public procurement of machinery and machine contracting.	Setting up a development group focusing on maintenance contracts.

	Policy measure	Progress of implementation	More information
	Promoting energy-efficient use of machinery with information guidance.	Needs relating to instruction in the use of machinery have been identified.	YM has made a funding reservation (€50,000) for a project related to user training in 2019.
Consumption	Encouraging citizens to reduce their carbon footprint by half	The Carbon Diet calculator has been updated to a new version that provides users with tips for reducing their own carbon footprints. Small-scale carbon footprint pilots implemented on the Place to Experiment platform in 2019 to look for new solutions to the themes of everyday mobility, energy efficiency solutions at home and sustainable local consumption. Investigation has been carried out on greenhouse gas emissions related to public procurement and the consumption lifecycle of households as well as on the use of raw materials. The analysis also takes the impacts of import and export into account.	A total of 15 small-scale pilots received a grant in the amount of €5,000 for implementing their proposal. In autumn 2019, a decision will be made on further funding (€25,000 in total) for up to three of the best scalable pilots.
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.	€1 million/year has been reserved for speeding up the climate work of municipalities and regions in 2018–2020.
	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.	
	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.
	Encouraging all public sector operators to discontinue the use of oil for heating properties by 2025	This measure has not been started.	
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 for promoting low-emission construction sites and sustainable water management solutions, among other things.
Monitoring	Developing assessments of the effectiveness of climate and energy policy	A VN TEAS project called 'assessment of the cost effectiveness of emission reduction measures' has been launched and will be implemented in 2019.	The aim of the project is to improve the knowledge base of cost effectiveness assessments. Among other things, the project includes a review of other countries' practices, assessing the cost effectiveness of the chosen actions and providing recommendations to improve cost effectiveness assessments.

Annex 2. Sector-specific indicators

1. Transport

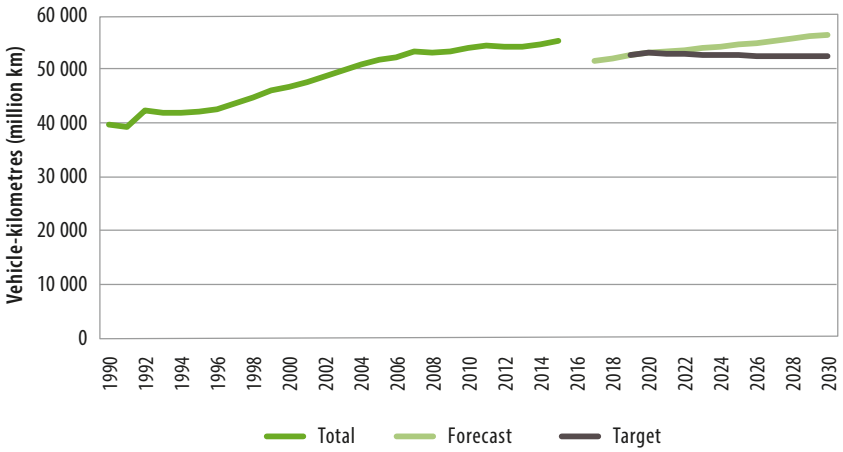

Figure 12. **Vehicle-kilometres (million km) travelled in 1990–2017, a forecast for 2018–2030 and the target for 2020–2030. There was a change in the statistical method in 2016, which may, for its part, explain the dip in 2016–2017. The next few years will most likely tell us whether the increase in the vehicle-kilometres travelled by passenger cars is truly coming to a halt or whether this recent trend is simply a dip related to the statistical method.**

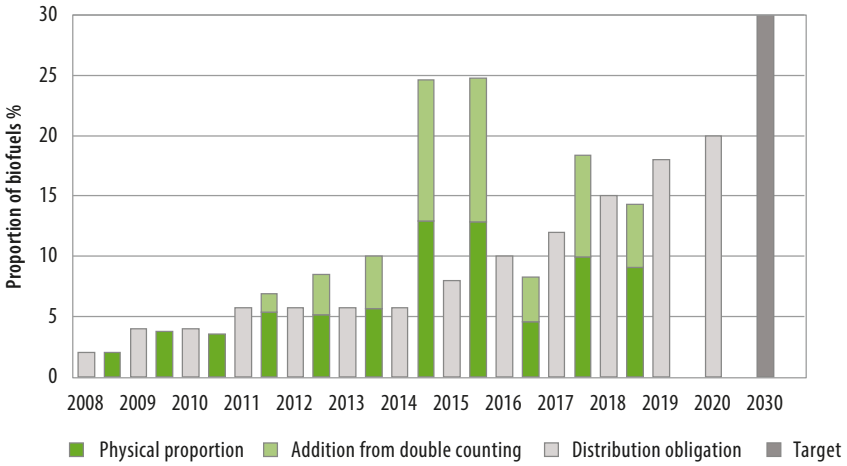

Figure 13. **Proportion of biofuels in transport fuels (%). Double counting is taken into account in the targets for 2008–2020. In contrast, the 2030 target does not include double counting. The 2018 data is a proxy estimate. Statistics of Eurostat and Statistics Finland were used as sources.**

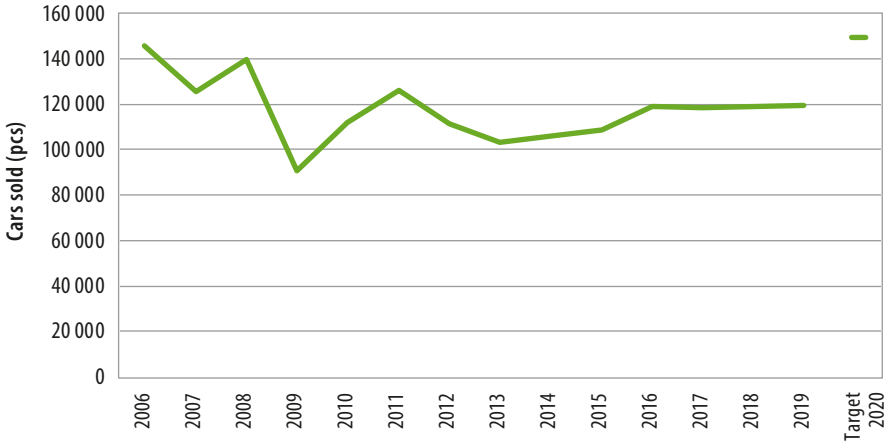

Figure 14. **Number of new cars sold in Finland. The average age of passenger cars on the road has continued to increase in recent years. At the beginning of 2018, it was 11.7 years, not including museum cars. Approximately 150,000 new passenger cars would have to be sold annually in order for the average age of the car fleet to be lowered. A total of approximately 120,000 new passenger cars were sold in 2018, and the number was even lower in the previous years.**

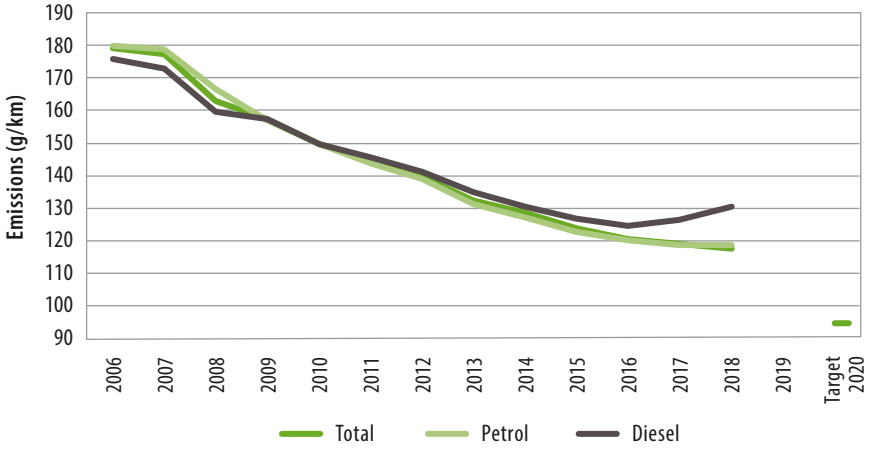

Figure 15. **CO_2 emissions (g/km) from passenger cars registered for the first time. By the end of 2018, emissions had decreased by 28% from 2008. The CO2 emissions from passenger cars registered for the first time in 2018 were 117.4 g/km on average. In order to reach the 2020 target, emissions would have to decrease by 5.5 g per year on average. In 2010–2018, emissions have declined at an annual rate of 4.0 g. Emissions from diesel-powered cars even increased in 2017 and 2018.**

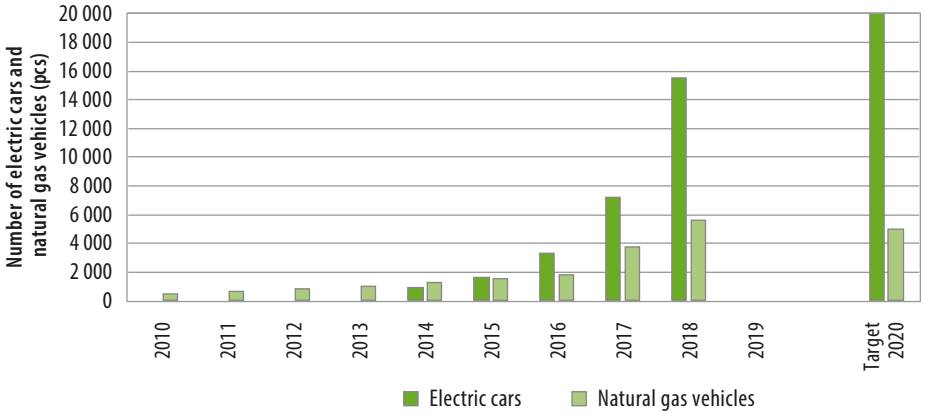

Figure 16. **Number of electric cars and natural gas vehicles in Finland in 2010–2018. According to the national distribution infrastructure plan, there should be no fewer than 20,000 electric cars and 5,000 natural gas vehicles in Finland in 2020. In 2018, there was a total of approximately 15,500 electric cars and approximately 5,600 natural gas vehicles in Finland. The 2020 target for natural gas vehicles has therefore already been reached, and the target for electric cars will most likely also be met. All-electric vehicles account for a smaller percentage of all new electric cars every year. In 2018, the percentage of all-electric vehicles was approximately 16%.**

2. Agriculture

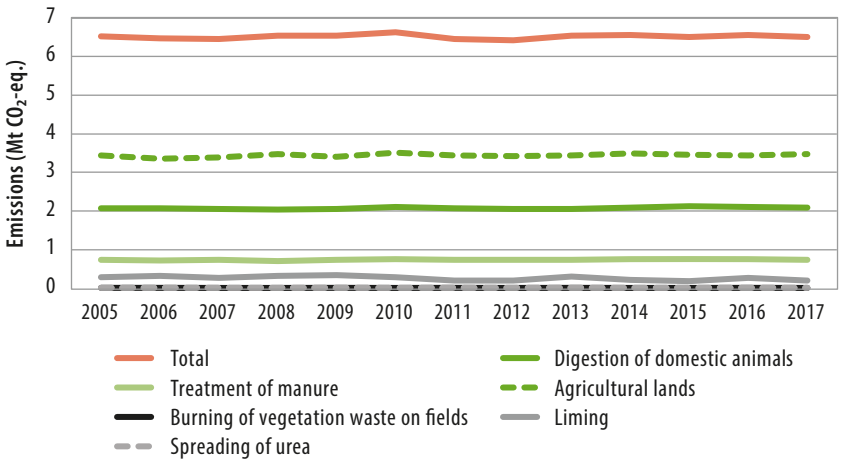

Figure 17. **Greenhouse gas emissions from the agricultural sector allocated to the effort sharing sector in 2005–2017, broken down by source of emissions.**

3. Building-specific heating

Figure 18. **Consumption of light fuel oil in the effort sharing sector, broken down into machinery, heating of buildings and other use. 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.**

4. Machinery

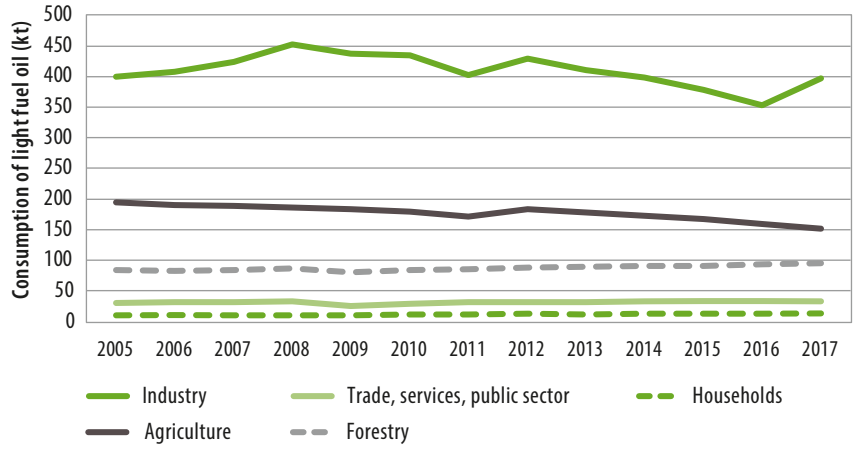

Figure 19. **Use of light fuel oil in machinery, broken down by sector. Consumption is highest in industry. The second highest consumption levels are found in agricultural machinery, but the quantities used are less than half of the quantities used in industry. Households account for a relatively small proportion.**

5. Waste management

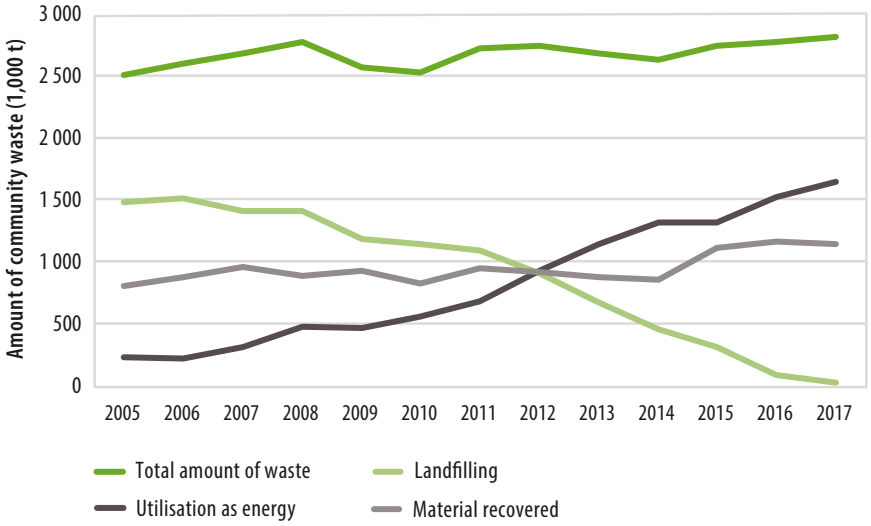

Figure 20. **Amount of municipal waste in Finland by treatment method. The total amount of waste in 2017 was approximately 2,812,000 tonnes, of which approx. 1% was placed in landfills, while approx. 41% was utilised as material and approx. 59% as energy.**

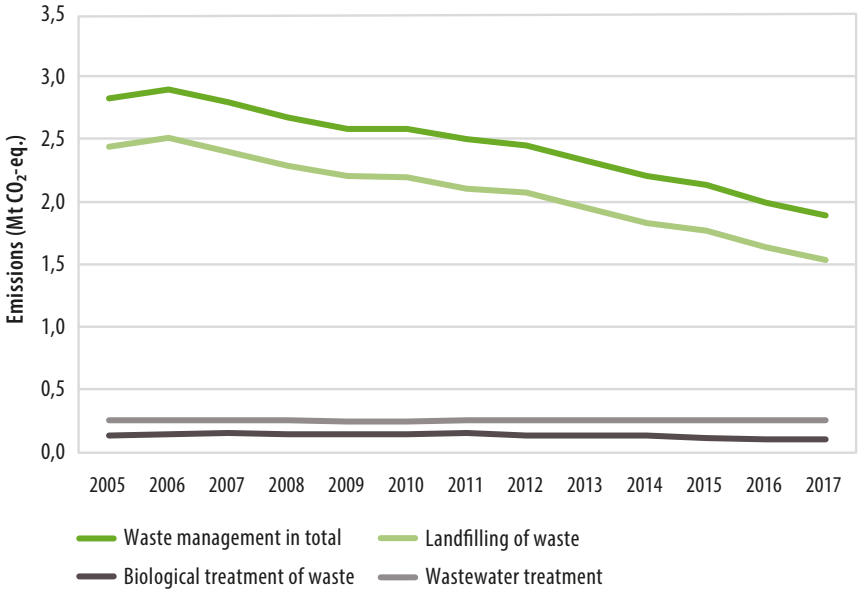

Figure 21. **Emissions from waste management, broken down by source. The greatest source of emissions is landfills, though their emissions have decreased strongly as a result of decreased landfilling.**

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