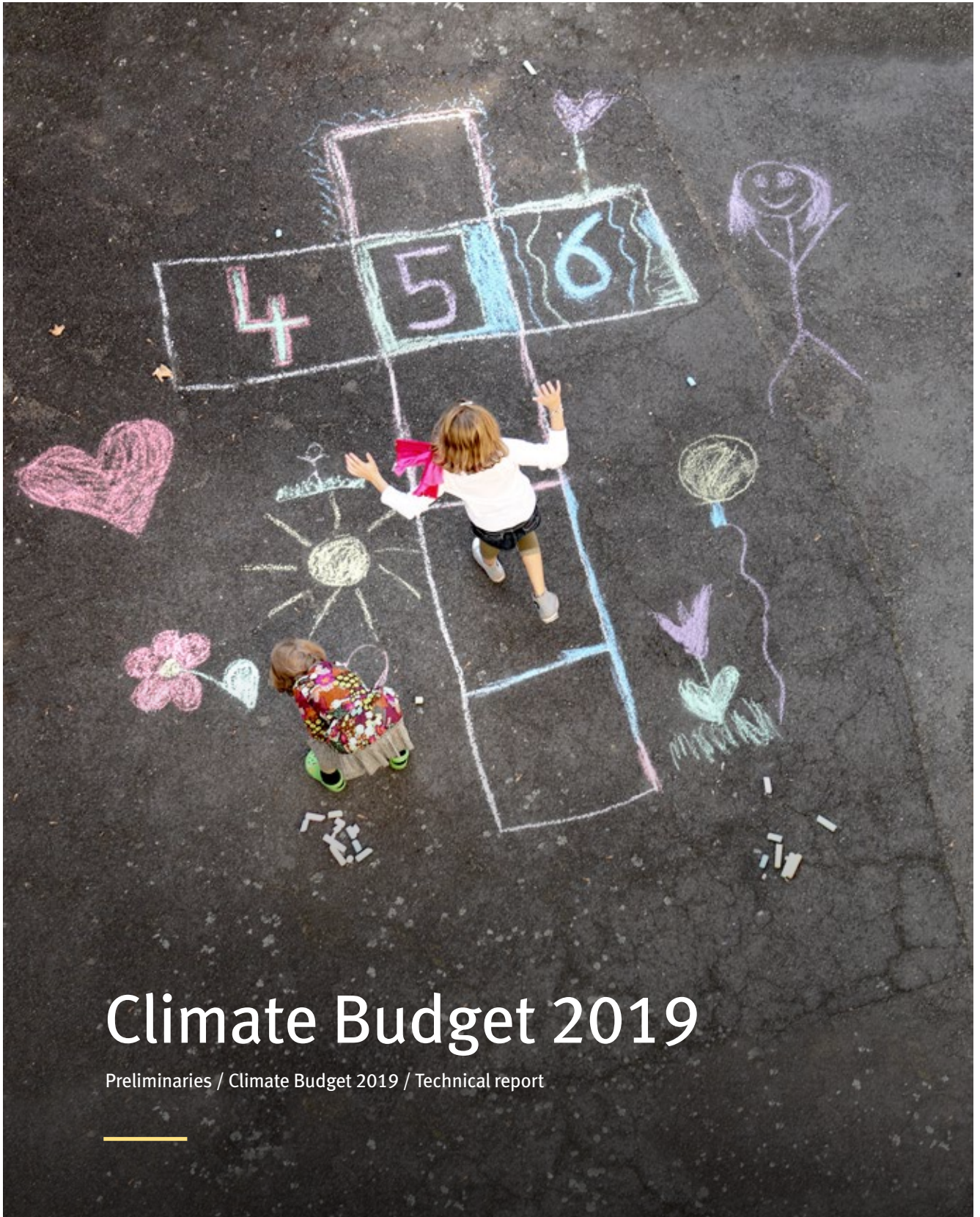




City of Oslo
Municipality of Oslo



Climate Budget 2019

Preliminaries / Climate Budget 2019 / Technical report

The Climate Budget for 2019 is the third such document and is the City of Oslo's most important management tool for achieving the ambitious goal of a virtually zero-emission city by 2030. The document consists of three parts: a short introduction containing a description of the City Government's most important goals linked to "A greener city"; the City Government's proposed Climate Budget, including measures, climate effects, and allocations of responsibility; and, finally, the Climate Agency's Technical Report for the Climate Budget, which describes the contents and methodology of the Climate Budget in detail. ❖❖❖

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A greener city

The City Government wants to create a livelier urban society, with more green spaces, better air quality, and easier access to nature and opportunities for outdoor recreation. Accordingly, we are continuing to prioritize climate measures that will help to achieve these goals. We will make climate-friendly travel easier through continual upgrades to public transport and by building more kilometres of cycle paths. ❖



CLIMATE-FRIENDLY TRAVEL WILL BE EASIER

Car traffic in Oslo is declining. Our strong commitment to public transport will make climate-friendly travel even easier. In 2019, the City Government will boost its funding for the procurement of transport services from Ruter by NOK 115 million. [client should check] On public transport, the age limit for free child travel will be raised from four to six, and the age limit for child fares will be raised from 16 to 18. In 2019, we will construct 26 kilometres of new cycle infrastructure and introduce new grants to encourage climate friendly travel to and from work. The City Government will also boost its efforts to maintain pavements, footpaths and cycle routes during the winter months.

CAR-FREE CITY LIFE

The City Government will prioritize people and activities by making the city centre a more pleasant place to spend time, with an emphasize on shopping, outdoor cafés, art and culture, more benches, opportunities for play and other activities, and more planting. We will improve lighting in prioritized streets and urban spaces and take better care of street surfaces. Our work on the Car-Free City Life project will continue at full steam. We will establish more fully pedestrianized streets and more streets where pedestrians have priority.

A CLEANER CITY

Oslo is at the forefront of the battle against plastic pollution and the City Government will phase-out the use of unnecessary single-use plastic in the municipality. NOK 40 million will be allocated in this Economic Plan period to fund more frequent cleaning and rubbish clearing in the city's parks and streets and along hiking trails. We will continue our efforts to prevent littering in parks and recreational areas at weekends and on hot summer days in the most affected districts.

A BROAD COMMITMENT TO CLIMATE MEASURES

The main source of greenhouse gas emissions in Oslo is transport. Accordingly, the rapid phasing out of fossil-fuelled vehicles is essential for the achievement of Oslo's climate goals. Consequently, the City Government is proposing a number of measures to encourage the transition to zero-emission vehicles. We will allocate funding to hasten the installation of battery-charging infrastructure for private cars, vans and taxis. We will also allocate funding to encourage more climate-friendly travel to and from work. We will step up our efforts to make building and construction activities in Oslo fossil-free and the City Government proposes to allocate NOK 84.3 million to improve the energy efficiency of municipal buildings. In order to promote early transitions to climate-friendly solutions amongst the city's residents and businesses, we will also inject NOK 134 million into the Climate and Energy Fund during the current Economic Plan period.

CLIMATE KNOWLEDGE

In autumn 2019, the Climate House will open at the Natural History Museum in the Botanical Gardens at Tøyen. We have allocated NOK 24.5 million during the current Economic Plan period to fund collaborative efforts to disseminate information about climate change among children and teenagers. Our goal is to explain what factors affect the climate and what we can do to reduce emissions. The funding will support an educational initiative at schools in Oslo, among other things.

FARMING IN THE CITY

The City Government wants Oslo to become a greener city, where urban spaces are used actively and function as social meeting places for the city's residents. Accordingly, the City Government is focusing on urban farming by preserving school gardens and establishing new areas of allotments. We have allocated NOK 12 million in 2019 and 2020 to urban farming. In 2019, Sørli Educational Farm will open at Østmarka and the City Government is also allocating funding for arable farming at Losæter.

Climate budget

The City Government and the City Council have set ambitious climate targets for Oslo. This Climate Budget has been developed as a governance tool for efforts to achieve these targets. ❖



2.1 INTRODUCTION

The City Government and the City Council have set ambitious climate targets for Oslo. This Climate Budget has been developed as a governance tool for efforts to achieve these targets. Oslo's Climate Budget 2017 was the first document of its kind in the world and Oslo has experienced national and international interest in this new governance tool. In 2018, the Climate Budget was, among other places, presented at the IPCC's first Cities & Climate Change Science Conference.

The Climate Budget has two main functions. Firstly, it shows whether the existing measures to reach climate targets are sufficient. Secondly, the Climate Budget imposes an obligation on all municipal bodies to submit regular status reports on the climate measures for which they are responsible. Both these functions give new and improved potential for the governance of climate policy and climate efforts in Oslo.

The Climate Budget also serves important pedagogical purposes. It shows that no single measure or single actor can achieve all the emission reductions required. Oslo's climate targets can only be achieved through the implementation of a broad spectrum of measures with the efforts from the city's inhabitants and businesses. In addition, it requires a programme of active and successful collaborations with regional and state authorities as well as across the city's own agencies.

Since Oslo's greenhouse gas emissions plateaued in 2013, we have witnessed a fall in the city's emissions. The Norwegian Environment Agency's most recent statistics for emissions by municipality show that Oslo's emissions in 2016 were 8 percent lower than in 2015. By comparison, emissions fell nationally by only 1.1 percent in the same period.

Emissions from the sources included in Oslo's climate targets totalled 1,085,000 tonnes CO₂-equivalents (CO₂e) in 2016, the lowest level recorded in the emissions statistics. This means that in 2016 we had already achieved an emissions level that was lower than the target for 2017, which the Climate Budget for that year set at 1,195,000 tonnes CO₂e.

The latest figures from Statistics Norway show that emissions on a national level fell by 1.7 percent from 2016 to 2017. This may indicate that Oslo's emissions will also fall in 2017. However, this cannot be confirmed until publication of the 2017 emission statistics for municipalities, expected in spring 2019.

Although the Climate Budget 2019 is Oslo's third climate budget, it remains a pioneering project. The City Government's ambition is to gradually improve the Climate Budget as we gain experience and competence. The Climate Agency has been established as a strong new specialist entity within the City of Oslo. It plays a central role by supplying the analytical basis for the preparation of the city's Climate Budgets and by advising on, and actively encouraging, the implementation of climate measures.

In its consideration of the Climate and Energy Strategy (City Council Proposition 195/16), the City Council adopted the targets of reducing emissions by 50 percent by 2020 and 95 percent by 2030, compared to 1990-levels. Achievement of these targets presupposed cooperation with the national government on the construction of a carbon capture and storage (CCS) facility at the Klemetsrud waste incineration plant, which is Oslo's largest point source of greenhouse gas (GHG) emissions.

Due to delays in the national government's decision-making process regarding the funding of a full-scale CCS project, Oslo's climate target for 2020 was downgraded by 166,000 tonnes CO₂e when the adopting the Climate Budget for 2018. Accordingly, the amended climate target for 2020 is to cap emissions at 766,000 tonnes CO₂e.

To more frequently assess how GHG emissions in Oslo are changing and do so with data that is closer to real time than is currently possible using climate statistics from national sources, we have developed a set of indicators collectively known as the Oslo Climate Barometer. The Climate Barometer is publicly accessible at www.klimaoslo.no (in Norwegian). The barometer gives us early notice of positive and negative trends, and indicates the extent to which measures and instruments are achieving their intended effects. The Climate Barometer also forms the basis of the City Government's ordinary reporting to the City Council.

During the preparation of the Climate Budget 2018, it became clear that the assessments of the effects of implemented and planned measures did not provide adequate reassurance that attainment of the 2020 target was within reach. In particular, the aggregate reductions expected to be achieved by climate measures with currently quantifiable effects fell about 100,000 tonnes CO₂e short of the reductions necessary to achieve the 2020 target. This prompted a decision to commission studies of four packages of measures with an aim to assess potential for achieving larger emissions cuts.

The studies identified measures that could potentially cut emissions by a maximum of just under 100,000 tonnes CO₂e by the end of 2020. Measures that could give significant emissions cuts by the end of 2020 were identified in two sectors in particular: the construction sector and the transport of goods and services. Several of these measures are included in the budget proposal for 2019. Other measures will be evaluated more closely before decisions are made regarding implementation. The studies of the packages of measures also provided useful input for our work on a new Climate Strategy for 2020-2030.

In order to achieve the 2020 climate target, emissions must be reduced between the start of 2017 and the end of 2020 by 319,000 tonnes CO₂e, compared with the most recent data for emissions in 2016. Where it is possible to quantify the effects of measures, we estimate that emission reductions totalling 223,000 tonnes CO₂e will be achieved through current or planned measures. Other measures that have been implemented, but whose effects cannot yet be quantified are expected to result in further reductions. In order to increase the probability of achieving the 2020 target, we will also consider options for boosting the effectiveness of existing measures and instruments.

In our work to update and improve the Technical Report that forms the basis for the Climate Budget 2019, the effects of all measures in the budget have been reassessed. The level of subject matter expertise now present within the Climate Agency has improved the municipality's ability to assess and quality control the individual measures in the Climate Budget. While conducting this work, the Climate Agency has uncovered some weaknesses and errors in earlier assessments and studies. The most significant error was committed by the consultancy firm COWI in its projection of the emissions-reducing effect of the new Oslo Package 3 road-user payment system. The Oslo Package 3 Secretariat commissioned the study. Because of this error, the emission reductions were over-estimated by nearly 30,000 tonnes. The error was discovered at a late stage in our work on this Climate Budget.

One challenge when preparing the Climate Budget, and for effective emissions management, is the fact that publication of the national climate statistics by municipality is delayed by over a year. When preparing the Climate Budget 2019, for example, the most recent statistics available to us were those for 2016. Another challenge is the fact that the statistics for some types of emissions include a high degree of uncertainty. Oslo, together with other municipalities, has pointed to these issues in dialogue with the national authorities. Currently the system for national statistics is undergoing improvements and we trust that this work will result in better and more frequently updated statistics.

Important climate initiatives in the Climate Budget 2019

On 1 March 2019, the second stage of the Oslo Package 3 agreement between Oslo, Akershus County and the national government will come into effect. This stage involves changes to toll-ring charges and new toll system boundaries in Oslo. The Climate Budget 2019 also contains a series of measures that will facilitate climate-friendly journeys around Oslo. Public transport fares will increase only to the extent necessary to reflect the consumer price index. The public transport company Ruter is preparing extensive upgrades to its services, with a particular emphasis on routes that cross the new toll system boundaries. In addition, Ruter will continue to introduce fossil-free and zero-emission technology in the public transport sector, including 70 electric buses that will enter into service in Oslo during 2019.

Cycling in Oslo will be even better in 2019, with the construction of 26 km of new cycling lanes and upgrades to 6 km of existing lanes. The aggregate length of cycle routes that are maintained year-round to the highest operational standard will be increased by 50 percent to 120 km. Work to install new and upgraded cycle parking facilities in Oslo will continue during 2019.

In 2019, Oslo will enter a new phase in its work to electrify transport. The proportion of electric passenger cars is growing, and all forecasts suggest continued rapid growth in electric car ownership. We are continuing installation of charging points on publicly owned land, with a target of installing 600 new points during 2019. The subsidy schemes for installing charging infrastructure in housing cooperatives and similar residential buildings are continuing, with a target of enabling 15,000 new charging points during 2019.

A number of new, electric light commercial and utility vehicles have entered the market during 2018, and more are expected in the coming years. In order to facilitate the rapid introduction of electric vehicles in these segments as well as in the taxi fleet, the City Government is proposing to increase investments in charging infrastructure by NOK 13 million in 2019 and NOK 7 million in 2020. In addition, businesses and sole proprietors will be eligible to apply to the Climate and Energy Fund for funding to install charging infrastructure for their vehicles, with a target of installing 1,500 new charging points during 2019.

The use of public procurement as an instrument to achieve climate targets will be further enhanced during 2019. A new position will be created within the Agency for Improvement and Development to coordinate efforts to impose standardized requirements for municipal procurement in the construction sector.

In order to reduce emissions associated with non-municipal construction activities, the City of Oslo will increase its efforts to provide guidance to developers. There are also plans for new subsidy schemes from the Climate and Energy Fund to encourage fossil-free, zero-emission construction activities. Norway's first zero-emission construction site will be piloted in Olav Vs Gate in Oslo.

We propose to inject NOK 133 million into the Climate and Energy Fund in the current economic plan period. The subsidy schemes operated by the fund will facilitate the implementation of measures by private individuals and businesses in Oslo to help reduce GHG emissions and use energy more efficiently.

2.2 OSLO'S CLIMATE TARGETS

When ratifying the Climate and Energy Strategy for Oslo (City Council Proposition 195/16), the City Council adopted the targets of reducing GHG emissions by 50 percent by 2020 and by 95 percent by 2030, compared with 1990 emission levels.

The national government subsequently delayed its decision about funding full-scale CCS projects. As a result, during its consideration of the Climate Budget 2018, the City Council increased its cap on 2020 emissions by 166,000 tonnes CO₂e to 766,000 tonnes CO₂e. This revised target corresponds to a 50 percent reduction in emissions compared to 1990, i.e. a reduction of 1.2 million tonnes CO₂e, as estimated in the resolution adopting the Climate and Energy Strategy for Oslo in 2015, plus estimated 2020 emissions of 166,000 tonnes CO₂e attributable to waste incineration at the Klemetsrud plant.

The climate target for 2020 is based on emission sources included in the municipal emission statistics at the time when the City Council adopted its Climate and Energy Strategy for Oslo. Accordingly, emissions from maritime traffic, aviation and agriculture are not included in the climate target for 2020. In Oslo, there are only marginal emissions from aviation and agriculture (in the most recent climate statistics, for 2016, emissions from aviation and agriculture were 1 and 1,326 tonnes CO₂e respectively). The Climate Agency has furthermore obtained confirmation that the agricultural emissions were mistakenly allocated to Oslo. Emissions from maritime traffic in Oslo are covered by a separate climate target, which is discussed in more detail below.

Emissions from maritime traffic

The Norwegian Environment Agency estimates that 2016 emissions from maritime traffic in Oslo totalled 38,807 tonnes CO₂e. The City Government recently published its *Action plan to make the Port of Oslo a zero-emission port*, which is currently awaiting consideration by the City Council. The action plan proposes a target of reducing emissions from maritime traffic in Oslo (defined as the area within the five islands known as Steilene) by 85 percent by 2030. This is much more ambitious than the previous target of a 50 percent reduction by 2030, which was adopted as part of the Climate and Energy Strategy for Oslo in 2015.

2.3 UNCERTAINTY REGARDING EMISSIONS STATISTICS AND ASSESSMENTS OF EFFECTS

Oslo's climate budget is pioneering work. One of the challenges we have to manage as part of this work is the significant level of uncertainty about national emissions statistics for Norwegian municipalities and about the assessment of the climate effects of planned and implemented measures.

The national emission statistics for Norwegian municipalities, which are fundamental to Oslo's Climate Budget, are under continuous development. This work on improving the statistics is a result, among other things, of demands made by Oslo and other municipalities for more accurate and frequent municipal emissions statistics. The statistics are available at <http://www.miljostatus.no/klimagassutslipp-kommuner> (in Norwegian).

Another consequence of this continuous development is that changes will also be made to estimates for Oslo's emissions in previous years. Currently, emission statistics by municipality are available from 2009 to 2016 with comparable figures, but pre-2009 statistics are not comparable and will not be further updated.

The Norwegian Environment Agency is making efforts to improve the statistics. Publication of a new version is expected in late 2018 or early 2019. We anticipate that this version will provide new estimates for emissions from road traffic and from diesel used on construction sites, among other things. Both of these constitute significant sources of emissions in Oslo, so the amended statistics may have considerable impact for attainment of our targets.

The assessment and calculation of the climate effects of various measures is a complex exercise. In order to estimate expected reductions in emissions, we must make a number of assumptions. The Climate Agency has led the efforts to assess the effects of the measures in the Climate Budget; assessments of several measures have been conducted with input from external analyses and in collaboration with segment experts. A description of the assessments that have been completed for the individual measures in the Climate Budget can be found in the *Technical Report for Oslo's Climate Budget 2019*. Although the assessments that are presented in the Climate Budget are based on the best available information and methodology, it is essential to point out that uncertainty remains regarding both the magnitude of the emissions reductions and the time at which they will be realized.

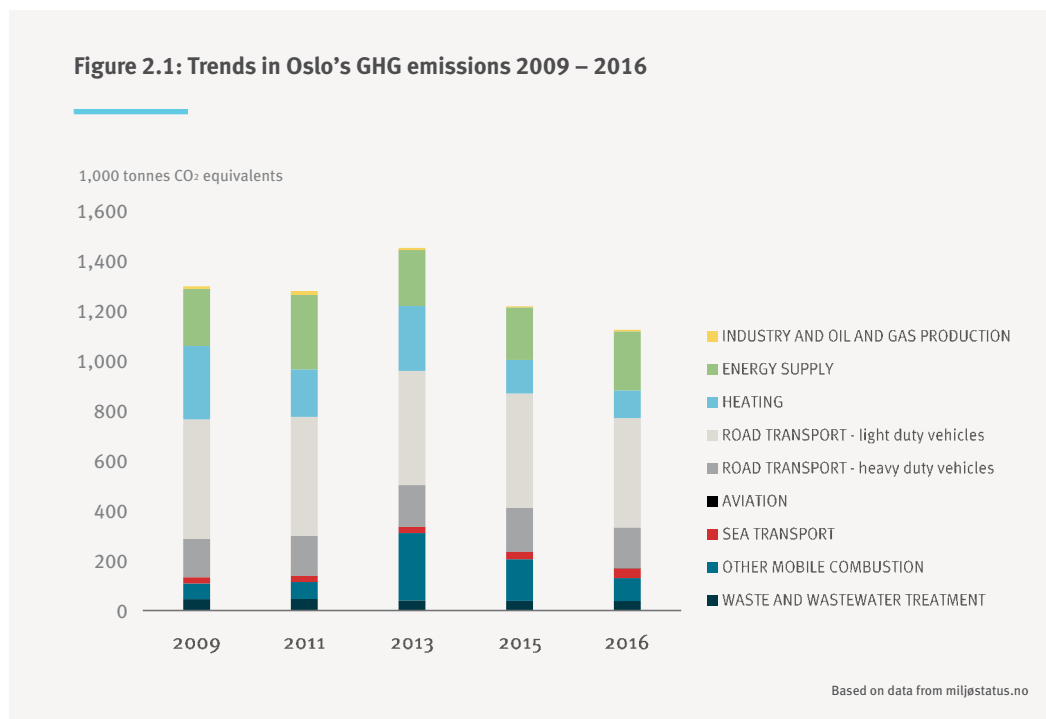
The City Government's approach to these challenges is based on the use of the best available knowledge, transparency regarding the data and methods used, transparency regarding elements of uncertainty, and a gradual improvement of the Climate Budget that reflects improved knowledge and increased capacity. The Climate Agency was established to form a new centre of expertise within the City of Oslo.

2.4 STATUS OF GHG EMISSIONS IN OSLO

In April 2018, the Norwegian Environment Agency published new and improved statistics for GHG emissions in Norwegian municipalities over the period 2009 to 2016. These new statistics were developed by the Norwegian Environment Agency in collaboration with the Norwegian Association of Local and Regional Authorities (KS) and Statistics Norway (SSB). These new statistics provide us with figures that can be compared from 2009 onwards.

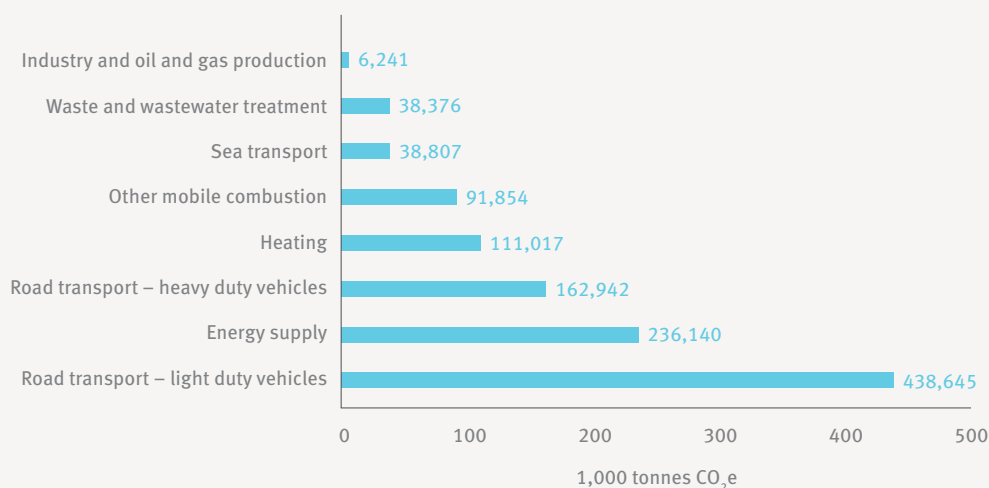
The statistics show that Oslo's total GHG emissions fell by nearly 14 percent between 2009 and 2016. From 2015 to 2016, Oslo's emissions fell by 8 percent, which was equivalent to a reduction in absolute figures of approximately 94,000 tonnes CO₂e. As far as the emissions sources included in Oslo's climate targets for 2020 were concerned, the reduction in this year was approximately 104,000 tonnes CO₂e, or almost 9 percent.

Greenhouse gas emissions in 2016 were reduced to just over 1.1 million tonnes CO₂e (including aviation and maritime traffic). This is the lowest level of annual emissions recorded in the statistics time series. Figure 2.1 shows trends in Oslo's GHG emissions between 2009 and 2016. Figure 2.2 shows the distribution of emissions per emissions sector in 2016.



The reduction in emissions from 2015 to 2016 is attributable to emission reductions of approximately 32,500 tonnes CO₂e from road traffic and 23,500 tonnes CO₂e from heating, among other things. The reasons for this change include measures and instruments that are encouraging a move towards fossil-free transport, together with the impending ban on fossil oil-based heating. The statistics also show a significant decline in emissions from Non-road mobile machinery (which in the case of Oslo relates mainly to the volume of sales of diesel fuel for construction machinery).

Figure 2.2: Distribution of CO₂ emissions in Oslo in 2016 by sector



Based on data from miljøstatus.no

Emissions from agriculture are omitted from figure 2, since the Norwegian Environment Agency has confirmed that a small quantity of emissions was erroneously attributed to Oslo.

The Oslo Climate Barometer was developed in order to track key emissions parameters more frequently than national climate statistics permit. The Climate Barometer does not provide increased accuracy about actual emissions trends. However, it is a useful tool for tracking activity trends. These trends in turn closely relate to Oslo’s most significant emissions sources. Updated figures from the Climate Barometer are available at www.klimaoslo.no (in Norwegian).

2.5 THE CURRENT SITUATION

Below we present selected trends about various climate efforts in Oslo. This is not intended to be a comprehensive description. For further information, please see the reports submitted by the City Government to the City Council.

Continued growth in public transport

In 2017, the public transport company Ruter recorded its largest annual increase in passenger numbers, ever. Passenger journeys increased by 5.9 percent in the total area served by Ruter and by 6.1 percent in Oslo. There was 371 million passenger journeys in Oslo and Akershus County. Figures from July show that passenger journeys so far in 2018 increased by 5.1 percent (over the same period in 2017) and that public transport’s market share of motorized journeys in Oslo stands at 52 percent (as a rolling 12-month average). There is a high level of satisfaction with public transport services among Oslo’s population. In a marketing survey conducted for Ruter, 82 percent of respondents in Oslo said they were satisfied with the services provided. In a climate survey, 86 percent of respondents

said that there should be greater commitment to public transport in Oslo, in order to reduce demand for private cars. 73 percent of respondents were fairly or strongly in agreement, that public transport services met their everyday needs.

Rapid change in Oslo's vehicle fleet

Oslo is experiencing a rapid transition to low- and zero-emission vehicles. At the start of 2018, 17.5 percent of privately owned cars in Oslo were chargeable vehicles, i.e. full battery-electric vehicles or plug-in hybrids. At the start of 2017, it was 10.6 %. The number of new electric vehicles in Oslo increased by 48 percent, while sales of diesel vehicles fell by 9 percent. Of all new cars sold in Oslo from January to September 2018, 38 percent were electric. Provisional figures from Fjellinjen show that 17.4 percent of vehicles passing through the toll ring in August 2018 were fully electric. The figure for September 2017 was 13 percent.

The proportion of new electric light commercial vehicles (LCVs) in Oslo has increased since last year. So far, in 2018, over 10 percent of new LCVs sold in Oslo have been electric. Accordingly, sales of electric LCVs are significantly higher in Oslo than elsewhere in Norway, where only 3.5 percent of new LCVs sold so far this year have been electric.

Reduced traffic from new toll charges favouring zero- and low-emission vehicles and congestion charge during rush hours

A new system of toll-ring charges was introduced on 1 October 2017. These favour zero- and low-emission vehicles and impose a congestion charge during rush hours. New figures from Fjellinjen show that 381,000 fewer vehicles passed through the toll stations in August 2018 than in August 2017. The underlying statistics show that 873,000 fewer fossil-fuelled vehicles passed through the toll stations, while the number of electric vehicles increased by 492 000. So far in 2018 (i.e., as of August), the number of vehicles passing through the toll stations has fallen by 4.7 percent over the same period in 2017.

More fossil-free construction projects

Oslo's municipal undertakings for buildings have taken the lead on fossil-free construction activities. In this segment, fossil-free construction is on its way to becoming the norm. As of the first quarter of 2018, all construction sites run by the Municipal Undertaking for Cultural and Sports Facilities were fossil free. Eighty percent of sites run by the Municipal Undertaking for Social Housing and thirty percent of sites run by the Municipal Undertaking for Educational Buildings and Property were fossil free. Forecasts from the Agency for Urban Development suggest that nearly 90 percent of the agency's construction sites will be fossil free in 2018. We see that other developers are following the city's example and that suppliers are adapting rapidly to new environmental requirements. Even so, the Climate Barometer shows a significant increase in sales of fossil diesel fuel for construction machinery in Oslo in 2017 and 2018. Accordingly, we recommend reinforcing efforts to promote fossil-free construction practices through the measures in this budget.

Progress towards implementing carbon capture and storage at the Klemetsrud facility

On 10 August 2018, the Ministry of Petroleum and Energy announced that Fortum Oslo Varme would be offered grants for FEED studies of carbon capture and storage (CCS) at its Klemetsrud waste-to-energy facility. Once the FEED studies are completed, the government will make a new assessment and,

if relevant, invite the Parliament (Storting) to vote on investment in the establishment of a full-scale CCS project. The government has indicated that such a vote would probably take place in 2020/2021.

Upcoming ban on fossil oil-based heating

On 1 January 2020, a national ban on fossil oil-based heating systems in buildings will come into force. Until 1 December 2018, the City of Oslo is providing grants to housing cooperatives and similar groups who want to replace fossil oil-based heating systems. In autumn 2018, the Climate Agency will run an information campaign about the impending ban and opportunities to obtain grants from Oslo's Climate and Energy Fund and Enova. Enova will continue to provide grants for replacing oil-fired heating systems with systems using renewable energy until the end of 2019. So far, 1,744 housing cooperatives and similar groups have obtained grants from the City of Oslo for the replacement of oil-fired boilers. Sales of fossil heating oil have declined markedly in Oslo.

Good results from setting climate requirements in procurement

In 2017, the City Council adopted a new municipal procurement strategy. This strategy imposes stringent environmental and climate requirements on procurements. Implementation of the strategy is in progress. Several new transport contracts have been signed, which will be serviced largely by biogas-fuelled or zero-emission vehicles. The public transport company Ruter now requires that all new contracts with biodiesel shall satisfy sustainability and palm oil free criteria. A growing proportion of municipal construction activities are fossil free.

Tabling of an action plan for a zero-emission port

In June 2018, the City Government tabled its *Action plan to make the Port of Oslo a zero-emission port* (City Council Proposition 168/18). The plan includes 17 measures to reduce emissions from maritime traffic and port activities. The target is to cut emissions from the port by 85 percent by 2030. The plan shows that passenger ferries and local ferries account for 50 percent of the port's CO₂ emissions. Accordingly, emissions from the port can be halved by replacing or converting only these 16 vessels.

2.6 SUMMARY OF WORK ON PACKAGES OF CLIMATE MEASURES

In its Climate Budget 2018, the City Government announced studies of "packages of measures" designed to increase the likelihood of attaining the 2020 climate target. The Climate Agency led the work on these packages, with contributions from other relevant municipal entities. Businesses, academics and NGOs have also been consulted as part of this work. So far, three reports are completed. The final report, on *Measures for a fossil-free city centre from 2024* will be completed during the autumn of 2018. These reports also comprise an important technical basis for work on the new Climate Strategy 2030, as notified in City Council Proposition 1 2018.

The completed studies cover *Climate-friendly travel to and from work*, *Climate-friendly transport of goods and services*, and *Fossil-free and zero-emission construction practices*. A brief summary of the studies' findings, along with their results, can be found in the *Technical Report for the Climate Budget 2019*. The studies are also available in their entirety at klimaoslo.no (in Norwegian).

The studies identified measures with an aggregate maximum potential for reducing emissions in 2020 by approximately 94,000 tonnes CO₂e. The actual climate effects of the proposed measures will depend on the orientation of both measures and instruments.

The studies have been a central element in the preparation of the Climate Budget 2019. In this Climate Budget, measures that have emerged from the studies constitute approximately 43,500 tonnes CO₂e of the estimated emissions reductions shown in Table 2.2.a. Some of the proposed measures, particularly measures for climate-friendly travel to and from work and climate-friendly goods transport, are included among the measures that should contribute to attaining the 2020 target (Table 2.2.B), even though so far, no final estimated climate effect has been determined for these measures, because the final design of these measures is still under consideration. The packages of measures also provide useful input for our work on a new Climate Strategy for 2020-2030.

2.7 CAP ON EMISSIONS IN THE CLIMATE BUDGET 2019

The main principle underlying the preparation of this Climate Budget is an assessment of the most recent known emissions levels and expected trends in light of the implementation of existing and planned measures. Calculations of the cap on emissions and the effects of measures are based on emissions levels in 2016, which are the most recent known levels. Accordingly, the calculations do not take account of possible changes in emissions levels taking place after 2016.

Based on the Norwegian Environment Agency’s emissions statistics for 2016, expert assessments of the expected effects of climate measures in 2017 and 2018, and the unaltered climate target for 2020, we propose the following caps on emissions in the Climate Budget 2019:

Table 2.1: Cap on annual CO₂e emissions in the City of Oslo in 2019 and 2020, measured in tonnes CO₂e.

Sector	1990	2016	2019	2020
Stationary		392,000	320,500	318,000
Mobile		693,000	612,000	544,000
Required additional emissions reductions				-96,000
TOTAL	1,200,000	1,085,000	932,500	766,000
Anticipated cuts in CO ₂ e emissions compared to 2016 levels			152,500	319,000

The cap apply to emissions sources included in Oslo’s climate targets. Emissions from maritime traffic, agriculture and aviation are not included.

The City Government acknowledges that achieving the targets set for 2020 will be a demanding task. As shown in Table 2.2A, those climate measures whose effects we have been able to quantify amount to a total reduction of 223,000 tonnes CO₂e in 2020. Achievement of the targets for 2020 requires emission cuts of 319,000 tonnes CO₂e compared to the level of emissions in 2016. The City Government will implement several measures in an endeavour to achieve the necessary remaining reductions, which total 96,000 tonnes CO₂e, see Section 2.8.

As notified in City Council Proposition 1/2018, the City Government has commenced work on a new Climate Strategy for Oslo for 2020-2030, with the intention of presenting the strategy to the City

Council in spring 2019. We do not consider it appropriate to propose annual emissions caps after 2020 until such a proposal can be based on the new strategy.

The City Government wishes to emphasize that there is uncertainty regarding both the calculations of measures' emission-reducing effects and the anticipated timing of when the effects will occur. For a more detailed discussion of this uncertainty, see Section 2.3 above and the *Technical Report for Oslo's Climate Budget 2019*.

2.8 MEASURES IN THE CLIMATE BUDGET 2019 - 2020

When preparing this budget, the Climate Agency assessed the expected emissions-reducing effect of each measure. As discussed in Section 2.3, these assessments are uncertain. The technical evaluations that form the basis of the assessments of effects are contained in the *Technical Report relating to Oslo's Climate Budget 2019*, available at www.klimaoslo.no/klimabudsjettet-2019 (only available in Norwegian at the time of publishing, may be translated at a later date).

Table 2.2A: Measures with assessed emissions-reducing effects. More information about the individual measures is contained in Table 2.6 and in the sector-specific discussions.

Emissions sector	Emissions source	No.	Measures and instruments	Responsibility for implementation (reporting responsibility for joint measures in parentheses)	Effect* 2016-2020 (tonnes CO ₂ e)
Heating	Municipal buildings	1	Phase-out of oil-fired heating - <i>National ban from 1 Jan. 2020</i>	All (KLI)	500
	Residences and business premises	2	Phase-out of oil-fired heating - <i>National ban from 1 Jan. 2020</i> - <i>Information about state subsidies schemes (ENOVA)</i>	MOS National govt. KLI	69,000
Energy supply	District heating, excluding waste incineration	3	Phase-out of the use of fossil oil and gas for district heating during peak-load periods - <i>Target set by Fortum Oslo Varme AS</i>	NOE	4,000
Road traffic	Light and heavy duty vehicles	4	Road-user payment system at the toll ring, assuming the implementation of prior measures: - <i>Installation of adequate charging infrastructure for passenger cars</i> - <i>Continued implementation of local and regional instruments to promote the use of zero-emission cars.</i> - <i>Continued implementation of national instruments to promote the use of zero-emission cars.</i> - <i>Increase in public transport capacity to cope with population growth and reduced use of private cars.</i> - <i>Package of 100 initiatives to reduce delays on public transport.</i>	MOS BYM/KLI MOS National govt. Ruter BYM	36,000

Emissions sector	Emissions source	No.	Measures and instruments	Responsibility for implementation (reporting responsibility for joint measures in parentheses)	Effect* 2016-2020 (tonnes CO ₂ e)
		5	Implementation of national 20 percent biofuel blending requirement in 2020	National govt.	30,500
	Light vehicles	6	Better provision for cyclists - <i>The Cycling Project</i> - <i>Subsidy schemes</i>	MOS BYM KLI	1,500
		7	New permit regulations for taxis. Zero-emission by 2022 - <i>Charging infrastructure</i> - <i>Subsidy schemes</i>	MOS BYM KLI	7,000
		8	Use of zero-emission vehicles/sustainable biofuels in the municipal light-vehicle fleet	All (UKE)	1,000
		9	Package of measures to encourage climate-friendly transport of goods <i>Utility transport</i> - <i>Dedicated parking spaces for zero-emission goods/utility vehicles</i> - <i>Charging infrastructure</i> - <i>Setting requirements within the municipality</i> - <i>Subsidy schemes</i> <i>National subsidy scheme: exchange of fossil-fuelled goods vehicles for electric goods vehicles</i>	MOS FIN BYM BYM UKE KLI National govt.	17,500
	Heavy duty vehicles	10	Fossil-free public transport by 2020	MOS Ruter	27,500
		11	Use of zero-emission vehicles/sustainable biofuels in the municipal fleet of heavy duty vehicles	All (UKE)	1,000
Other mobile combustion	Diesel-powered motorized equipment	12	Package of measures to encourage the use of zero-emission construction machinery <i>Machinery fleet</i> - <i>Standardized municipal procurement requirements</i> - <i>Subsidy schemes</i> - <i>Voluntary agreements with businesses in the sector</i>	FIN NOE UKE KLI KLI	26,000
		13	Municipal construction machinery to be zero-emission or use sustainable biofuels	All (UKE)	1,500
TOTAL estimated emissions reductions within sectors included in Oslo's climate goals for 2020					223,000
Maritime sector	Maritime traffic	14	Shore power facilities - <i>Shore power for international ferries</i> - <i>Shore power at Sydhavna</i>	NOE HAV HAV	2,300
		15	Zero-emission public transport - <i>Nesodden ferries</i>	MOS Ruter	4,200
TOTAL maritime					6,500

* Here, the assessments of effects are rounded to the nearest 500 tonnes CO₂e. Accordingly, in some cases there are discrepancies with the more precise assessments of effects shown in the Climate Agency's Technical Report for Oslo's Climate Budget 2019.

As shown in Table 2.2.A, the aggregate expected emission reductions in 2020 from measures within the sectors included in Oslo's climate target is 223,000 tonnes CO₂e. Accordingly, there is a discrepancy of approximately 96,000 tonnes CO₂e between the effects of the measures in the table and the reduction of 319,000 CO₂e tonnes that is necessary to achieve the 2020 climate target.

During the preparation of the Climate Budget 2019, all measures included in the Climate Budget 2018 were updated and their effects reassessed. This update involved the deduction of emissions reductions achieved in 2015-2016, i.e. 94,000 tonnes CO₂e, from the assessment of effects, so that these now reflect reductions that must be achieved in 2016-2020.

These new assessments of effects form part of our efforts to improve the technical quality and accuracy of the Climate Budget. One outcome of this quality upgrade is that expected emissions reductions from several measures in the Climate Budget have been downgraded.

The most important changes are as follows:

- **Payment system for road users at the toll ring:** The anticipated effect of this measure has been downgraded by nearly 60,000 tonnes CO₂e. Approximately half of this adjustment was necessary because the Climate Agency identified a calculation error in an earlier analysis of the expected climate effects of new toll rates and new toll stations (the revised Oslo Package 3), which was prepared by consulting company COWI for the Oslo Package 3 Secretariat. The new estimates are also based on new knowledge about emissions factors relating to heavy and light duty vehicles, as well as changes in the passenger car fleet between 2014 and 2016,
- **Nitrous oxide in wastewater:** As explained in previous Climate Budgets, the objective of this measure is to correct a suspected over-estimation of nitrous oxide emissions in the national emissions statistics. In previous Climate Budgets, this measure was assessed as having an effect of 20,500 tonnes CO₂e. The study is underway, but currently the extent of any downwards adjustment of the emissions statistics cannot be predicted with sufficient certainty to recommend the inclusion of this effect in this Climate Budget.
- **Landfill gas:** In previous Climate Budgets, measures to increase the exploitation of landfill gas were assessed as reducing emissions by 6,500 tonnes CO₂e. We have discovered that the source data underlying this estimate is incomplete. Accordingly, the effect of this measure is not included in the Climate Budget 2019.
- **Material recycling of plastics and food waste:** New estimates suggest that the amount of plastic going to incineration is likely to increase between 2016 and 2020, even though the amount of plastic waste sorted into separate waste streams is increasing. Accordingly, it is uncertain whether the measure will generate a net reduction in emissions.
- **Low-emission zone:** Currently we are updating our calculations of the effects of this measure on atmospheric emissions. Until these results are available, the timing for the implementation of this measure will remain uncertain.

Measures to increase the likelihood of target attainment in 2020

The measures included in table 2.2A will not reduce emissions sufficiently to result in a maximum level of emissions at the end of 2020 of 766,000 tonnes CO₂e.

The City Government notes that several measures have been, or are planned to be, implemented, but it is not yet possible to quantify their emissions reducing effects. This applies to measures nos. 16 – 21 in Table 2.2.B below.

The City Government will evaluate possible ways of boosting existing instruments to achieve further cuts in emissions (see measure no. 22 in table 2.2B).



Table 2.2.B: Measures to increase the likelihood of target attainment in 2020

Emissions sector	Emissions source	No.	Measures and instruments	Responsibility for implementation
Waste and waste-water	Landfill gas	16	Landfill gas extraction - Grønmo - Rommen - Stubberud (study)	MOS REN EGE EBY
Energy supply	Waste incineration	17	Increased extraction of plastic from household waste - Waste Strategy	MOS REN EGE
Road traffic	Light vehicles	18	Package of measures to encourage climate-friendly travel to and from work - Grants for measures at municipal workplaces - Engage in dialogue with union representatives - Subsidy scheme for measures in private-sector businesses - Climate-friendly business initiative	MOS, FIN KLI FIN KLI KLI
Road traffic	Light duty vehicles	19	Package of measures to encourage climate-friendly transport of goods Commercial transport - Loading bays - Freight consolidation centres - Charging infrastructure - Climate requirements within the municipality - Subsidy scheme	MOS, FIN BYM BYM BYM UKE KLI
Road traffic	Light vehicles	20	Street parking measures (including resident-only parking) - Resident-only parking zones will be implemented before 2019. - In 2019, just under 200 street parking spaces within Ring 3 will need to be removed in connection with cycling measures, initiatives to reduce delays on public transport, other public transport projects and the Car-Free City Life programme.	MOS BYM BYM
Road traffic	Heavy duty vehicles	21	Package of measures to encourage climate-friendly heavy freight transport - Pilot project for bulk freight transport - Standardized municipal procurement requirements - Pilot for a zero-emission transport route	MOS, FIN KLI UKE KLI
		22	Assess, and potentially implement, enhancements to existing measures in order to increase their climate effects, including: - Possibilities for reducing toll-ring charges for zero-emission or low-emission commercial/utility vehicles. - Possibilities for further roll-out of resident-only parking in city districts. - Possibilities for achieving larger emissions cuts in waste management. - Possibilities for further escalation of efforts to use purchasing power to set climate requirements, inspired by the initiative to promote responsible and productive employment.	MOS

In addition, amendments to the national climate statistics may have a major impact on what emissions cuts are necessary to achieve the City of Oslo's climate targets. As discussed in Section 2.3 above, we anticipate amendments to these statistics in areas that are highly significant for Oslo, such as road traffic and emissions from construction activities.

On top of those measures that can cut emissions further by the end of 2020, the City Government will increase its efforts to enhance the municipal regulatory toolbox to cut emissions. In certain key areas, national regulations constrain opportunities for Oslo, and other municipalities, to operate effective climate governance.

For example, as a municipality, Oslo has few regulatory instruments at its disposal that would allow it to insist on fossil-free or zero-emission construction activities in municipal zoning plans. Oslo has already brought this problem to the attention of the Ministry of Local Government and Modernisation and will take further steps to pursue the matter.

Similarly, existing regulations on low-emission zones can only be imposed on local air quality grounds, not on climate change grounds. The City Government will work to have the regulations amended so that low- and zero-emission zones can be implemented as climate measures, in accordance with the original intention of this initiative.

Experience suggests that putting such new regulations in place, and then applying them in practice, is a very slow process. We consider it unlikely that this work will contribute to attainment of the 2020 target, but it may be very important in achieving a virtually zero-emission city by 2030.

Supporting activities

In addition to the measures listed in Tables 2.2 A and B, the City of Oslo's climate work encompasses a number of activities that support the work to reduce emissions, but which in themselves are not expected to have quantifiable emissions-reducing effects. Furthermore, many activities are intended to prepare the ground for further emissions cuts after 2020.

These activities are included in the Climate Budget in order to demonstrate the wide range of instruments that are being implemented to promote emissions reductions in Oslo, and which agencies are responsible for these various activities, see table 2.3.

Table 2.3: Activities in support of efforts to reduce emissions by 2020, or that lay the groundwork for future emissions reductions.

Category	No.	Activity	Responsibility
Communication/ Mobilization	A	Marketing of Enova's subsidy schemes in Oslo - Contribute to increasing awareness of subsidy schemes - Disseminate information about the ban on using fossil fuel to heat buildings from 2020 - Contribute to hastening the implementation of climate measures	KLI
Communication/ Mobilization	B	Disseminate information about climate solutions to encourage behavioural change - Disseminate information about practical climate measures/ solutions - Disseminate information about municipal climate efforts - Further develop the KlimaOslo.no communications platform	KLI
Communication/ Mobilization	C	Businesses for the Climate - Continue cooperation on climate measures between businesses and the city authorities in the City of Oslo. Increase the number of participants. - In 2019, the role of businesses will be key to Oslo's status as European Green Capital.	KLI
Communication/ Mobilization	D	Climate communications targeted at children and teenagers - Climate portal for pupils at Oslo schools - Climate pilots in Oslo schools The Climate House - Technical input to/collaboration with the Climate House - Teaching and actively disseminating information to primary and lower secondary schools - Exhibitions and dissemination of information to the city's population	KLI UDE
Communication/ Mobilization	E	Bykuben – Oslo Centre for Urban Ecology - Continue to develop what the centre offers to everyone who wants to learn about, and participate in, ecological work in the urban environment. - Help the city's residents to feel a sense of ownership over, and see the potential in, the shift towards becoming a zero-emissions society. - Provide guidance to the city's districts in the development and promotion of local environmental and climate measures.	BYU
Facilitating measures	F	Car-Free City Life Programme - Measures to create a better and livelier urban environment within Ring 1 during the current City Council term.	PBE, BYM
Facilitating measures	G	Better provision for pedestrians	BYM
Facilitating measures	H	Climate-friendly urban development including densification around transport hubs	EBY, PBE, BYM
Facilitating measures	I	Increased material recycling of commercial waste - In 2019 and 2020, the Agency for Waste Management will work to achieve a target of 36 percent material recycling for commercial waste. - Improve facilitation to allow increased reception and post-sorting of commercial waste.	REN

Category	No.	Activity	Responsibility
Facilitating measures	J	Reduced usage of single-use plastics in municipal activities - Map the municipality's use of plastics. - Prepare guidance for organizing plastic-free, eco-friendly events - Collaborate with key actors in this field in Oslo	BYM
Facilitating measures	K	Acquire sites for municipal climate measures (incl. energy stations) - As needed, contribute to identifying suitable areas for the implementation of climate measures. - This measure is particularly directed towards sites for energy stations and associated infrastructure, but can also be applied in other contexts.	EBY
Facilitating measures	L	Production of biogas for fuel - Production of biogas from food waste at Romerike Biogas Plant - Production of biogas from sewage sludge at Bekkelaget Wastewater Treatment Plant - VEAS is considering investing in equipment to upgrade the biogas to fuel quality.	EGE VAV VEAS
Facilitating measures	M	Establish energy stations supplying at least one renewable fuel (not including battery-charging facilities and biodiesel) for passenger cars and light duty and heavy duty commercial vehicles. - Plan and contribute to the establishment of energy stations at Alnabru, Ryen and Klemetsrud. - In 2019, a scheme will be implemented to provide grants from the Climate and Energy Fund for the establishment of energy stations.	KLI
Study/planning/pilot	N	Facilitation of smarter and more climate-friendly journeys - Pilot project: Mobility-as-a-service ("MaaS") project designed to simplify everyday travel logistics (several actors). - Pilot project: Smarter transport in the Oslo region (safer, more efficient, and more eco-friendly road transport). - Continue the development of Intelligent Transport Systems (ITS) and sensor technology to improve parking and traffic management - Optimal management of signalling equipment for pedestrians, cyclists, and public transport - Establish a new system to prioritize public transport	BYM/Ruter BYM/Ruter BYM
Study/planning/pilot	O	Facilitating more efficient and climate-friendly commercial and utility transport - Use Intelligent Transport Systems (ITS) for commercial traffic - Zero-emission final mile city distribution	BYM
Study/planning/pilot	P	Pilot project for electrification of an entire housing cooperative (EU – Green Charge)	BYM
Measures in the period to 2030	Q	Carbon capture at the Klemetsrud facility (Fortum Varme AS)	NOE
Measures in the period to 2030	R	New Fornebu Light Railway	MOS
Measures in the period to 2030	S	New central metro tunnel	MOS
Measures in the period to 2030	T	Tram programme	MOS
Measures in the period to 2030	U	New signalling and interlocking plant for the metro	MOS

Measures to promote the use of biogas and hydrogen vehicles

In Oslo, we are now seeing a rapid transition from passenger vehicles powered by fossil fuels to electric passenger cars, because of national, regional and municipal measures. Achieving a transition to zero-emission technology (hydrogen, electricity and biogas) in the case of heavier vehicles and construction machinery is more difficult. The reasons are partly price-related, due to immature markets, and technological.

According to the Climate and Energy Strategy for Oslo, *“The City of Oslo shall facilitate a city logistics system where traffic demand is reduced, and where all new cars and light freight vehicles in Oslo shall use renewable fuels or be plug-in hybrids from 2020”* (Initiative 5). In addition, *“The City of Oslo shall facilitate required changes so that at least 20 % of heavy duty vehicles in Oslo shall use renewable fuels by 2020. Furthermore, all heavy-duty vehicles and construction machinery shall be able to use renewable fuels by 2030”* (Initiative 6).

According to the Hydrogen Strategy (Proposal 1057/14), Oslo and Akershus shall be one of the world’s leading regions for the testing and early adoption of hydrogen as a transport fuel, based on fossil-free fuel production. By 2025, the region of Oslo and Akershus shall have a sufficiently developed network of hydrogen refuelling stations to allow it to serve as the model for a national and Nordic infrastructure for hydrogen vehicles. The distribution of such stations and the application of measures should then allow the number of hydrogen vehicles to increase beyond 10,000.

A number of the measures in the Climate Budget should contribute to increasing consumption of hydrogen and biogas:

Work on establishing energy stations should continue, including the establishment of a subsidy scheme for upgrading petrol stations to energy stations providing hydrogen and biogas.

Through our procurement strategy for transport and construction machinery, we will make systematic efforts to demand zero-emission fuel sources, including electricity, hydrogen and biogas. During 2019, Oslo’s food waste, among other things, will be transported using biogas-fuelled vehicles to the biogas facility at Nes.

Hydrogen vehicles will continue to pass free of charge through the toll ring. The City Government will also work to reduce toll-ring charges for biogas vehicles.

2.9 NEW FUNDING FOR CLIMATE MEASURES IN 2019-22

The tables below present a general overview of additional funding for climate measures in 2019–2020 in addition to the funding currently included in the city’s approved budget or economic plan.

Table 2.4: Climate measures in the operating budget

ACTIVITIES FUNDED BY THE CITY TREASURY			<i>Figures in NOK 1,000</i>			
Category, cf. Tables 2.2A, 2.2B, 2.3	Name of measure	Responsibility	2019	2020	2021	2022
4.b	Subsidies for Ruter – fares package for children and teenagers	Ch. 711 Procurement of transport services		13,000	13,000	13,000
16.a	Stubberud - study to identify required measures	Ch. 400 Agency for Planning and Building Services	2,000			
18.b	Grants for municipal workplaces - follow-up of climate-friendly travel to and from work	Ch. 771 Climate Agency	25,000	25,000		
12.b, 21.a	Standardized requirements for building and construction sites	Ch. 125 Agency for Improvement and Development	1,000	1,000	1,000	1,000
21.b	Survey and pilot project for handling of bulk freight	Ch. 771 Climate Agency	1,000	1,000		
D1)	Communications about climate for children and teenagers – the Climate House and school climate ambassadors.	Ch. 771 Climate Agency	500	2,000	2,000	2,000
D1)	The Climate House – educational initiatives for kindergartens, schools and the general population in Oslo	Ch. 200 Education Agency	1,500	4,500	6,000	6,000
N1)	“Smarter transport in the Oslo Region” (collaborative project)	Ch. 542 Agency for Urban Development (BYM)	5,000	5,000		
N1)	Optimal management of signalling equipment for pedestrians, cyclists, and public transport	Ch. 542 Agency for Urban Development (BYM)	1,250			
O1)	More efficient and climate-friendly commercial transport	Ch. 542 Agency for Urban Development (BYM)	3,500			
P1)	Pilot project – Electrification of an entire housing cooperative (in compliance with EU – Green Charge)	Ch. 542 Agency for Urban Development (BYM)	2,000	2,000		
TOTAL measures			43,250	53,500	22,000	22,000
SELF-FUNDING AGENCIES						
4.a, 6.a, 7.a, 9.a, 12.a, 18.a, 19a	Increased funding commitment limit Subsidies for Climate and Energy Measures ²⁾	Ch. 770 Subsidies for Climate and Energy Measures	40,000	40,000	40,000	40,000
TOTAL self-financing			40,000	40,000	40,000	40,000

¹⁾ Table 2.3 Activities in support of efforts to reduce emissions by 2020, or that lay the groundwork for future emissions reductions.

²⁾ In 2018, the funding commitment limit is NOK 80 million.

Table 2.5: Climate measures in the investment budget

ACTIVITIES FUNDED BY THE CITY TREASURY			<i>Figures in NOK 1,000</i>			
Category, cf. Tables 2.2A, 2.2B, 2.3	Name of measure	Responsibility	2019	2020	2021	2022
1.a	Replacement of remaining oil-fired boilers in cultural buildings	Ch. 501 Agency for Cultural Affairs	4,000			
6.b	Increased planning and investment activity for cycle routes	Ch. 761 Cycling project (Agency for Urban Development)	19,000			
7.b	Pilot of electric taxis in Olav Vs Gate	Ch. 542 Agency for Urban Development (BYM)	2,600			
8.a	Replace fossil-fuelled vehicles with zero-emission vehicles by 2020 -	Ch. 360 Agency for Child and Family Welfare Services	3,000	3,000		
7.c, 9.b	Pilot project to install rapid battery chargers - electric taxis and commercial vehicles	Ch. 542 Agency for Urban Development	3,400			
9.c	Charging stations for electric LCVs	Ch. 542 Agency for Urban Development	7,000	7,000		
12.c	Zero-emission construction practices – risk fund and pilot project in Olav Vs Gate	Ch. 542 Agency for Urban Development (BYM)	10,000			
13.a	Tank facility for renewable diesel/biodiesel	Ch. 542 Agency for Urban Development (BYM)	600			
13.b	Replacement of fossil-fuelled machinery and equipment with zero-emission equivalents.	Ch. 542 Agency for Urban Development (BYM)	2,750	5,750		
N 1)	Establish a new system to prioritize public transport	Ch. 542 Agency for Urban Development (BYM)	8,000	7,000		
TOTAL measures City Treasury			60,350	22,750	0	0
14.a	Shore power at Sydhavna (incl. Norcem)	Ch. 060 Oslo Havn KF	9,000	5,000	5,000	5,000
SELF-FUNDING AGENCIES						
8.b	Miscellaneous collection	Ch. 640 Agency for Waste Management	28,000			
13.c	Miscellaneous projects	Ch. 640 Agency for Waste Management	5,000			
8.c	Procurement of electric street sweeper vehicles	Ch. 650 Agency for Fire and Rescue Services	400	800		
TOTAL self-financing			33,400	800	0	0

¹⁾ Table 2.3 Activities in support of efforts to reduce emissions by 2020, or that lay the groundwork for future emissions reductions.

Total grants to climate measures

As indicated in the table above, the City Government proposes to allocate NOK 141 million of its operating budget to climate measures within the period of its current economic plan. In addition, funds have been reallocated in order to set aside NOK 6 million for an information campaign on climate-friendly travel, and NOK 17 million for a pilot mobility-as-a-service (“MaaS”) project. At the same time, the City Government proposes to allocate a total of NOK 83 million to invest in climate measures in 2019 and 2020. In addition, funding has been set aside for investment in shore power at Sydhavna, which is being funded from the Oslo Port Authority budget. The existing economic plan sets aside NOK 20 million in 2019 and NOK 20 million in 2020 for climate measures in municipal buildings. This funding will be allocated based on applications from municipal entities.

Climate and Energy Fund

We propose to increase the Climate and Energy Fund by NOK 133 million in during the current Economic Plan period. Since 2017, the City Government has injected capital funding of NOK 213 million. We propose to increase the funding commitment limit to NOK 120 million for 2019. For comparison, the annual funding commitment limit for 2015 was NOK 45 million. The annual funding commitment limit has been raised as the result of the establishment of new subsidy schemes and subsidy payments have increased in proportion with the increase in the funding commitment limit.

Charging infrastructure

The current economic plan allocates a total of NOK 60 million to investments in charging infrastructure in 2019 and 2020. In addition, the City Government proposes to increase investment in charging infrastructure by NOK 13 million in 2019 and NOK 7 million in 2020. This increase in funding is linked primarily to the increased focus on charging infrastructure for commercial and utility vehicles, including taxis. In addition, the Climate and Energy Fund operates several schemes to subsidize the installation of charging infrastructure for passenger cars, LCVs and taxis, as well as to install charging infrastructure at workplaces.

Table 2.6: Description of measures in tables 2.2A and 2.2B

Measure no.	Description of measure:
Measures in table 2.2.A	
1	Phase out the use of oil-fired heating in municipal buildings and operations. For several years, the City of Oslo has been phasing out the use of oil-fired heating in municipal buildings and operations. In the first quarter of 2018, there were still eight oil-fired boilers in municipal buildings. These will be removed by 2020.
2	Phase out the use of fossil fuel in privately-owned buildings. The national ban on the use of fossil fuel oil and paraffin for heating will come into force on 1 January 2020. For several years, the City of Oslo has subsidized the removal of oil-fired boilers in privately owned buildings and housing cooperatives in order to hasten the phasing out of fossil-fuelled heating systems in Oslo. This subsidy scheme will be abolished as from 1 December 2018. In 2019, work will be focused on ensuring the rapid realization of projects that have already been approved for subsidies. In addition, the City of Oslo will take active steps to inform homeowners about the impending ban and about the possibility of applying to the national government’s Enova fund for grants to subsidize the phasing out of oil-fired boilers.

Measure no.	Description of measure:
Measures in table 2.2.A	
3	Phase out the use of fossil oil and gas for district heating (peak load). In order to achieve its target of fossil-free district heating in an average year, during recent years Fortum Oslo Varme has converted its remaining oil-fired boilers to enable the use of bio-oil. The last remaining oil-fired boiler (at Ullevål) was converted into a bio-boiler in 2018. Currently, approximately 1 percent of the energy in the district-heating system derives from fossil gas. In 2019, work will start on replacing this fossil gas with biogas.
4	New payment system for road users at the toll ring, with essential related measures. From March 2019, stage 2 of Oslo Package 3 will be implemented. This involves two-way toll collection in Oslo (half the original toll rate being collected each way); a new inner toll ring in Oslo; and toll stations at the city limits for traffic coming from Follo and Romerike. Low toll rates will be introduced for electric vehicles. Hydrogen vehicles will be exempt. The assessment of the effect of this measure is based on the following assumptions: <ul style="list-style-type: none"> - Ensure adequate battery-charging infrastructure for passenger cars. We must ensure that the continued rapid phasing-in of electric cars is not held back by a lack of charging points. Work to install public charging points is continuing, as is the subsidy scheme for installing charging infrastructure in housing cooperatives and similar residential buildings. The City Government is preparing to introduce a payment system at all municipal charging stations during 2019. The reasons for doing so include promoting the more efficient use of charging points, and funding a faster expansion of the network to reflect market trends. - Continuation of municipal and regional instruments to promote the use of zero-emission vehicles. - Continuation of national instruments to promote the use of zero-emission vehicles. - Increase public transport capacity to meet increased demand. Ruter is working continually to expand its services to ensure a continued high rate of growth in passenger numbers to boost the competitiveness of public transport against private cars. We expect a significant growth in the number of passenger journeys on Oslo's public transport network in 2019, due to the introduction of Stage 2 of the new road-user payment system. - Package of 100 initiatives to reduce delays on public transport. A series of measures will be introduced to improve the punctuality and attractiveness of public transport
5	National biofuel blending requirements. The Norwegian parliament (Storting) has enacted national requirements concerning the blending of specific proportions of biofuel into petrol and diesel used for road transport. The blending requirements were fixed at 5.5 percent in 2015, 8 percent in 2017, 10 percent in 2018, 12 percent in 2019 and 20 percent in 2020. The biofuel used must satisfy EU sustainability criteria. Since biofuels are considered climate neutral, fuel blending has a significant emissions reducing effect. In 2019, there is an additional requirement that 5 percent of the biofuel used must be "advanced biofuels". Such biofuels have greater climate benefits.
6	Better provision for cyclists. Facilitating year-round cycling is important for achieving the target that 25 percent of journeys should be made by cycle by 2025. The first winter during which the city's cycle paths were maintained saw a 38-percent increase in the number of winter cycle journeys. The City Government proposes a significant increase in the budget for the maintenance of cycle routes in the economic plan, so that new infrastructure can also be maintained to a high standard. In addition, funding has been set aside in 2019 for the continuation of a pilot project for climate-friendly winter maintenance of cycle routes. In addition, there is a continued commitment to expanding the cycle route network, cycle parking provisions and other minor cycling-related measures. The target for 2019 is to build 26 km of new cycle routes and upgrade 6 km. Another priority in 2019 will be to improve cycle parking. Among other initiatives, a new subsidy scheme is being developed to support the provision of cycle parking at housing cooperatives and similar residential buildings.
7	Introduce taxi licensing regulations that require the use of zero-emission vehicles by 2022. The City Government will table a proposal to the City Council during the winter of 2018/2019 regarding the amendment of taxi licensing regulations. As required by the Commercial Transport Act, licence-holders will have four years to satisfy the new requirements. Oslo has almost 2000 taxis. By the end of 2022, zero-emission vehicles will replace all of them. We are considering whether one-third of the emissions reduction can be achieved by the end of 2020. The replacement of fossil-fuel taxis is dependent on there being adequate access to charging infrastructure for electric taxis. Accordingly, the following measures will be implemented: <ul style="list-style-type: none"> - Preparations for the installation of battery-charging infrastructure for taxis on municipal land, with two new rapid charging stations and 100 new fast charging points. - Pilot project for the rapid charging of taxis - Establishment of a subsidy scheme so that taxi owners can apply for funding to install battery-charging infrastructure at home.

Measure no.	Description of measure:
Measures in table 2.2.A	
8	Switch to zero-emission vehicles in the City of Oslo's own light duty vehicle fleet, possibly using biofuels. Ensure that all the approximately 1200 vehicles in the municipal fleet are zero-emission vehicles before 2020. As of the first quarter of 2018, 55 percent of the vehicles in the municipal light duty fleet were zero-emission.
9	Package of measures to promote climate-friendly commercial and utility transport. Commercial/utility transport makes up a large proportion of traffic in Oslo. The proportion of zero-emission vehicles in this segment is currently very small (1.5 percent in the first quarter of 2018), although the choice of zero-emission vehicles is increasing rapidly. A series of measures will be implemented to encourage a rapid transition to zero-emission vehicles. There is a partial overlap between the measures targeted at the commercial and utility segments in this vehicle fleet. <ul style="list-style-type: none"> - More dedicated parking spaces for zero-emission commercial/utility vehicles. - 100 new charging stations for commercial/utility vehicles - Use of municipal procurement as an instrument. We will apply minimum requirements, and possibly customized award criteria that reward climate-friendly solutions, in order to encourage carriers to make changes to their vehicle fleets. We will consider imposing logistical requirements regarding route optimization and consolidated freight transport. We will also consider the possible HSE implications of such requirements. - New subsidy schemes to assist businesses in the transition to zero-emission commercial/utility vehicles. - The establishment of consolidated freight centres to enable zero-emission final mile city distribution will cut emissions, reduce traffic, and improve air quality. The City of Oslo should facilitate the establishment of at least two privately run consolidated freight centres during 2019.
10	Fossil-free public transport by 2020. All public transport operated by Ruter must be fossil free by the end of 2020. The largest change will occur in 2019 and 2020 with the roll-out of tenders. In addition, Ruter is aiming for all public transport to be zero-emission by 2028.
11	Municipal heavy duty vehicles to run on zero-emission/sustainable biofuels. The City of Oslo's goal is to ensure that all municipal vehicles and motorized machinery are zero emission, and if possible powered with sustainable biofuels, during 2020. <p>The City of Oslo's procurement strategy specifies, "In general, vehicles and construction machinery used to perform work for the City of Oslo should have zero-emissions technology. Where a procurement process allows for the use of different technology, this should be justified specifically in the contract strategy. For vehicles and machinery where zero-emission technology is not available, biofuels (preferably biogas) should be used.</p>

Measure no.	Description of measure:
Measures in table 2.2.A	
12	<p>Package of measures to promote zero-emission construction sites. The combustion of fossil diesel on construction sites is a large, and probably growing, source of GHG emissions in Oslo. The City of Oslo has been proactive in demonstrating that fossil-free construction is a practical option. In addition to continuing to boost efforts to make the city's own construction activities ever more climate-friendly, we will intensify our efforts to promote fossil-free and zero-emission construction practices among developers in the public and private sectors. As the City of Oslo has few regulatory instruments at its disposal to impose requirements on developers, we will concentrate on the following measures:</p> <ul style="list-style-type: none"> - Increased use of our consultancy role in the processing of development proposals. We will create user-friendly websites to provide high quality and straightforward information about how to reduce GHG emissions and other pollution during a construction process. We will establish procedures so that this topic is addressed at kick-off meetings for urban zoning development projects and for preliminary meetings for construction permit applications. The topic will also be addressed in existing fora for dialogue with developers. We will also hold seminars and take other measures to disseminate information. - Use of municipal procurement as an instrument. Minimum requirements, and perhaps customized award criteria that reward the best solutions from a climate perspective, will be applied in procurement processes for municipal construction projects. To optimize the effective use of procurement as an instrument for reducing emissions, we will establish standardized climate and environmental requirements. We will also improve and standardize our guidance on climate-friendly procurement. - Conduct a coordinated dialogue with the market. Engaging in dialogue with the market is an important tool for establishing appropriate and effective requirements, in consultation with suppliers. This is also an arena for creating accurate expectations in the market regarding the types of requirements the City of Oslo will impose in the future. The imposition of different requirements by different municipal entities creates an unfortunate situation and sends a confusing message to the market. Accordingly, we will consider conducting a coordinated dialogue with the market, to ensure that the City of Oslo conveys a consistent message to suppliers about the nature of municipal requirements in the future. - New subsidy schemes will be established to encourage the testing and use of zero-emission technologies and climate-friendly solutions in the construction sector. - Voluntary agreements with businesses in the sector. Many major real estate companies are signing up to requirements for zero-emission building sites, and we will investigate whether there is a basis for negotiating a voluntary agreement about emissions reductions in the construction sector.
13	<p>Municipal construction machinery to be zero-emission or use sustainable biofuels. During 2020, the City of Oslo's goal is to ensure that all municipal vehicles and motorized machinery are zero emission, and if that is not possible, powered by sustainable biofuels. The City of Oslo's procurement strategy specifies, "In general, vehicles and construction machinery used in connection with the performance of work for the City of Oslo should have zero-emissions technology. Where a procurement process allows for the use of different technology, this should be justified specifically in the contract strategy. For vehicles and machinery where zero-emission technology is not available, biofuels (preferably biogas) should be used."</p>
Measures in the maritime sector:	
14	<p>Shore power facilities</p> <ul style="list-style-type: none"> - Continuing work on shore power facilities for international ferries at Vippetangen and Hjortnes. In 2011, a shore power facility was installed for Color Line ferries at Filipstad. In 2018, Oslo Port Authority installed a shore power facility at Vippetangen, and Stena Line will start using the facility in 2018. Following completion of a conversion programme during 2019 and 2020, DFDS ferries will start using the facility. - New shore power facility at Sydhavna cargo port. Work will continue during the entire period of Oslo's current Economic Plan on installing a shore power facility at Sydhavna cargo port
15	<p>Zero-emission public transport on the Oslo Fjord</p> <ul style="list-style-type: none"> - Currently, the plan is to convert the Nesodden ferries to all-electric operations during 2019 (currently the Nesodden ferries run on fossil fuel). - The current plan is also to convert the island ferries, which currently run on biodiesel, to all-electric operations during 2021. This measure will not reduce emissions in relation to Oslo's Climate Budget, but over time the phasing out of biodiesel will give a higher overall climate benefit, improve local air quality, and reduce operating costs.

Measure no.	Description of measure:
Measures in table 2.2.B	
16	Reduced emissions of landfill gas from Grønmo, and a study of possible measures at Stubberud. In 2018, a new solution was installed to recover energy from landfill gas due to a high risk of flaring. 2019 will be the first operational year when this measure has an effect. In addition, other measures at the site will ensure reduced emissions of landfill gas. In 2019, work will start on a study to assess possible measures to reduce emissions of landfill gas at the Stubberud landfill site.
17	Increased extraction of plastic from household waste. A new waste strategy is currently under consideration. A priority is to implement measures to increase the sorting of waste and re-use among the city's population, including increasing the amount of plastic that is extracted from household waste for recycling.
18	Increasing climate-friendly travel to and from work in both the public and private sectors. As discussed under Measure 7, journeys to and from work account for a significant proportion of traffic, and accordingly GHG emissions, in Oslo. In addition to climate-related effects, measures to reduce the use of cars for these kinds of regular journeys will help improve air quality and reduce congestion. While municipal employees perform approximately 10 percent of these journeys, employees of other public- and private-sector workplaces account for the rest. As well as promoting more climate-friendly journeys to and from work among its own employees, the City of Oslo will also work to achieve similar changes in the rest of the workforce. Measures to be implemented include: <ul style="list-style-type: none"> - Allocating of funds to improve facilitation of climate-friendly travel to and from work (e.g. secure cycle parking, lockers, etc.) at municipal workplaces. Funding will be allocated based on applications from individual workplaces. Award of funding will require measures to reduce car use. - Engaging in dialogue with union representatives to identify and discuss other measures that could encourage more climate-friendly travel to and from work. - Engaging in dialogue with businesses in Oslo regarding measures that could reduce the number of people driving to work at private-sector workplaces. We will use the collaborative forum "Businesses for the Climate" among others to encourage and challenge businesses and to exchange experiences of relevant measures. - Establishing a subsidy scheme so that businesses can apply for grants for measures that promote climate-friendly travel to and from work. Award of funding will require measures to reduce car use.
19	Package of measures to promote climate-friendly commercial and utility transport, specific measures for the commercial segment (see also Measure 9). Apart from the measures described under Measure 9, the following measures will be implemented to promote climate-friendly commercial transport: <ul style="list-style-type: none"> - Gradually impose restrictions on access to loading bays to zero-emission vehicles. In 2019, we will pilot zero-emission commercial deliveries in two to three areas/streets. Starting from 2019, further areas within the Car-Free City Life zone will be reserved for deliveries by zero-emission vehicles. We will conduct a survey of suitable areas for a zero-emission delivery initiative inside Ring 3, with a view to implementation in 2019 or 2020. - The establishment of consolidated freight centres and zero-emission final mile city distribution will reduce emissions, reduce traffic, and improve air quality. The City of Oslo should facilitate the establishment of at least two private-sector consolidated freight centres during 2019.
20	Street parking measures (including resident-only parking). During 2018, resident-only parking will be implemented in all or parts of nine of Oslo's 15 districts. The resident-only parking zones will contribute, among other things, to reducing parking by non-residents, and accordingly will have a deterrent effect on traffic. Similarly, the resident-only parking zones will help reduce pressure on street parking and probably reduce the number of people driving around looking for a vacant space. In 2019, just under 200 street parking spaces within Ring 3 will need to be removed in connection with cycling measures, initiatives to reduce delays on public transport, other public transport projects and the Car-Free City Life programme.

Measure no.	Description of measure:
Measures in table 2.2.B	
21	<p>Measures to reduce emissions from heavy vehicles. Currently, no zero-emission heavy goods vehicles are available on the market. Transitioning to biogas-fuelled vehicles may be a satisfactory alternative, and will be promoted through other measures in the Climate Budget. Attempts will be made to implement measures to promote efficiency in, and/or reduce demand for, the use of heavy goods vehicles. A significant proportion of heavy goods transport in Oslo involves the haulage of bulk cargoes to and from construction sites. We will commence a project to assess and pilot measures to reduce the haulage of bulk cargoes. We will also prepare regulations concerning the management of bulk cargoes in municipal procurements of construction projects. The City of Oslo will work to ensure the early phasing in of zero-emission vehicles on regular transport routes in Oslo, for example between Alnabru Terminal or the Klemetsrud facility and Oslo Port Authority (“zero-emission routes”).</p>
22	<p>Assess, and potentially implement, enhancements to existing measures in order to increase their climate effects. We consider that measures that so far have not been identified or adopted for implementation are unlikely to result in significant emissions reductions by the end of 2020. Accordingly, we consider that the greatest potential for achieving further reductions lies in strengthening existing measures and instruments.</p>



Technical report

Methodological improvements have been implemented since the preparation of the Technical Report for the Climate Budget 2018. Along with new and improved statistics for GHG emissions at a municipal level, these improvements have given us a better foundation of knowledge for assessing GHG emissions and climate measures in Oslo. ❖



1. Introduction

The City of Oslo has set ambitious goals to reduce emissions of greenhouse gases (“GHG emissions”). The Climate Budget is the City of Oslo’s most important tool for reducing GHG emissions, and forms an integral part of the city’s ordinary budget, the City Council Proposition 1/2019. The Climate Budget provides an overview of measures that the City Government is planning to implement in order to achieve Oslo’s climate goals, including calculations of the anticipated emissions reductions for each measure. The responsibility for implementation of each measure is assigned to the relevant municipal body. The Climate Budget also includes measures implemented or funded by the national government that have a direct impact on emissions reductions in Oslo.

This is the third time that the City of Oslo has published a separate Climate Budget. Preparation of the Technical Report for the Climate Budget is the responsibility of the City of Oslo’s Climate Agency. This report summarizes the methods and sources that form the basis for the assessments of effects.

Since the preparation of the Technical Report for the Climate Budget 2018, there have been an ongoing methodological improvement. At the same time, new and improved statistics for GHG emissions at a municipal level have been published. These improvements have given us a better foundation of knowledge for assessing GHG emissions and climate measures in Oslo.

1.1. OSLO’S CLIMATE GOALS FOR 2020

The Norwegian Environment Agency, in partnership with the Norwegian Environment Agency (KS) and Statistics Norway (SSB), has published new, improved statistics for GHG emissions by municipality for the years 2009 to 2016 (Norwegian Environment Agency, 2018). The new statistics include several additional emissions sectors. Emissions are attributed to each municipality on the basis of data about local activities. These new, improved emissions statistics form the basis of the assessments in this Technical Report.

When ratifying the Climate and Energy Strategy for Oslo (City Council Proposition 195/16), the City Council adopted the goals of reducing GHG emissions by 50 percent by 2020 and by 95 percent by 2030, compared with 1990 emission levels.

As a result of delays in the national government’s decision-making about funding full-chain CCS projects, during its consideration of the Climate Budget 2018, the City Council set a goal for 2020 of capping emissions at 766,000 tonnes of CO₂ equivalents (CO₂e). This corresponds to a 50 percent reduction in emissions compared to 1990, i.e. a reduction of 1.2 million tonnes CO₂e, as estimated in the 2015 resolution adopting the Climate and Energy Strategy for Oslo, plus 166,000 tonnes CO₂e, representing estimated emissions in 2020 caused by waste incineration at the Klemetsrud plant. The climate goal for 2020 includes those emissions sources included in the national climate statistics

by municipality when the City Council adopted its Climate and Energy Strategy for Oslo. Accordingly, emissions from maritime traffic, aviation and agriculture are not included in the climate goal for 2020. Oslo has only marginal emissions from aviation¹. Emissions from maritime traffic are covered by a separate climate goal, which is discussed below.

On 10 August 2018, the Ministry of Petroleum and Energy announced that it would offer grants to Fortum Oslo Varme for FEED studies of carbon capture and storage (CCS) at its Klemetsrud waste-to-energy facility. The aim of the FEED studies is to further improve the demonstration project. Once the FEED studies are completed, the government will reassess the project and, if relevant, invite the Storting to vote on investment in CCS at Klemetsrud. According to the government's timetable, this vote could take place in 2020/2021. Since the CCS plant would not be operational until three years from the start of construction, the earliest date for the start of CCS at Klemetsrud would be in 2023.

Under the proposed Action Plan for Oslo Port (City of Oslo, 2018), maritime traffic is covered by a separate climate goal, which is to reduce emissions in the area within the five islands known as Steilene by 85 percent by 2030. Although emissions from maritime traffic are not included in Oslo's 2020 climate goal, the Climate Budget 2019 contains separate calculations for the effects of measures targeted at these emissions. The calculations take 2016 as the baseline for a specific climate goal for maritime traffic and define the goal as an 85 percent reduction in emissions within the borders of the City of Oslo by 2030.

1.2. OVERALL FRAMEWORK FOR THE CLIMATE BUDGET

In order to assess what emissions reductions are required in order to achieve the 2020 climate goal, it has been necessary to calculate a "framework" for the Climate Budget. We have done this by calculating the difference between total emissions in the last year for which figures are available and the goal for 2020. The result indicates what emissions reductions are needed.

In 2016, emissions from sectors included in the formulation of the climate goal totalled 1,085,215 tonnes CO₂e. If emissions are to be capped at 766,000 tonnes CO₂e in 2020, emissions must be reduced by 319,215 tonnes in the period 2016-2020. The goal for emissions from maritime traffic is subject to a separate framework for the period to 2030. In this report, we assess measures targeted at maritime traffic for the period 2016-2020.

1.3. SCOPE OF THE CLIMATE BUDGET

We have based the assessments in this Technical Report on, and have attempted to limit them to, direct GHG emissions from Oslo as a geographical unit, defined as "Scope 1". In other words, the emissions accounting and Climate Budget only include emissions from manufacturing and other activities within Oslo's city limits. Emissions from the use of electricity, defined as "Scope 2"), and other emissions released indirectly by Oslo (defined as "Scope 3") are excluded from the emissions accounting and the Climate Budget. The definitions for Scopes 1-3 are contained in the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC Protocol"), which is a protocol for the accounting of GHG emissions by cities and municipalities (WRI, 2014).

¹ The most recent climate statistics put emissions from aviation and agriculture in 2016 at, respectively, 1 and 1 326 tonnes. The Climate Agency has obtained confirmation that the agricultural emissions allocated to Oslo were a mistake.

The goals in the Climate Budget are formulated to include the same emissions sectors that were included in the emissions statistics at the start of the current City Council term. The sectors are as follows:

- Industry, oil and gas
- Energy supply
- Heating
- Road traffic
- Other mobile combustion
- Waste and wastewater

The new version of the national emissions statistics also includes emissions from maritime traffic and aviation, but since these sectors have been added since the start of the current City Council term, they are not included in the formulation of the climate goals. The Climate Budget includes a separate goal for maritime traffic.

The Climate Budget covers the following greenhouse gases: carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). These gases are included in the GHG emissions statistics published by the Norwegian Environment Agency (Norwegian Environment Agency, 2018). Nationally, chlorofluorocarbons (HFCs, PFCs and SF) account for 3 percent of total emissions. Emissions of these gases are not allocated geographically in the statistics. As a result, emissions of HFCs in Oslo, primarily from air-conditioning and other cooling equipment, are not included in the statistics.

The Climate Budgets for 2017 and 2018 included some measures to promote energy efficiency, but since the scope of budget is now limited to direct GHG emissions, such measures are no longer included.

1.4. UNCERTAINTY

Assessing and calculating the climate effects of the various measures is a complex exercise. A number of assumptions and suppositions have to be made when estimating anticipated cuts in emissions. The Climate Agency has headed efforts to assess the effects of the measures set forth in the Climate Budget; assessments of several measures have been conducted against the background of external analyses and in consultation with out-of-house professionals. Although the assessments that are presented in the Climate Budget are based on the best available information and methodology, it is essential to point out that uncertainty remains regarding both the magnitude of the emissions reductions and the time at which they will be realized.

The Norwegian Environment Agency is making continual efforts to improve its municipal emissions statistics. During 2019, it will publish new figures for road traffic emissions. These are being calculated using a new model that is intended to take better account of local conditions. This will significantly reduce the uncertainty that currently taints statistics by municipality for emissions from road traffic.

The new model being used to calculate the new statistics will result in adjustments to previously published emissions figures. The recalculation will affect emissions figures for the whole period, meaning that there will be changes to the figure for 2016 and, consequently, the emissions cuts required to achieve Oslo's climate goals. If the new figures show that emissions were higher than

previously thought in 2016, then more stringent measures will be needed to achieve the climate goals. The reverse will be true if the new statistics show a lower level of emissions.

The Climate Agency commissioned the Centre for International Climate and Environmental Research – Oslo (CICERO) and the Institute for Transport Economics (TØI) to calculate a new baseline scenario for Oslo's GHG emissions in the period to 2030 assuming that no municipal measures are implemented. This work was completed in September 2018. The baseline scenario indicates hypothetical emissions trends in the periods to 2020 and 2030. The changes that emerge in the baseline scenario may mean that changes will have to be made with regard to the measures needed to achieve the 2020 goal of capping emissions at 766,000 tonnes CO₂e. This Technical Report does not include an assessment of how this baseline scenario affects the measures needed in the period 2016-2020 to achieve the 2020 goal.

1.5. GUIDANCE FOR READERS

Chapter 2 examines the status of Oslo's annual greenhouse gas (GHG) emissions in light of the most recent available data. Chapter 3 describes the overall framework for the Climate Budget, in light of the formulation of the 2020 goal and the formulation of a separate goal for maritime traffic. Chapter 4 describes the assessment of the emissions-reducing effects of the measures contained in the Climate Budget. Chapter 5 summarizes annual trends in the effects of climate measures, and assesses the probability of goal attainment and emissions levels in the period to 2020.

Attachment 1 provides detailed descriptions of measures with quantified emissions-reducing effects, while Attachment 2 describes measures without quantified emissions-reducing effects. Attachment 3 provides an overview of new grants for climate measures in the budget period 2019-2022. Attachment 4 provides an overview of changes in the statistical basis for, and assessments of the measures in, the Climate Budget 2019, compared to the Climate Budgets 2017 and 2018.

2. Greenhouse gas emissions in Oslo

In 2018, Norwegian municipalities gained access to new and improved emissions statistics. These were the result of a collaborative project by the Norwegian Environment Agency, Statistics Norway (SSB) and the Norwegian Association of Local and Regional Authorities (KS) to expand and upgrade the existing emissions statistics. The new statistics cover more emissions sectors, such as aviation and maritime traffic, and give figures for emissions of the gases carbon dioxide, methane and nitrous oxide for the years 2009-2016. The new statistics are not comparable with earlier statistics, and accordingly cannot be used in combination with statistics for the years from 1990 to 2009, which were calculated using old methods, to assess the effects of climate measures.

This chapter provides background information about the new statistics, an overview of implemented and planned statistical changes, and a summary of the status of, and trends affecting, emissions in Oslo.

2.1. BACKGROUND STATISTICAL INFORMATION

Statistics for GHG emissions from each Norwegian municipality are calculated each year by the Norwegian Environment Agency in collaboration with Statistics Norway (SSB). These statistics are available at Miljostatus.no (Norwegian Environment Agency, 2018) and form the starting point for the City of Oslo's Climate Budget. Emissions statistics for the years 2009 to 2016 were published in April 2018, and figures for 2017 are expected in early 2019. The statistics have been upgraded by the Norwegian Environment Agency in collaboration with the Norwegian Association of Local and Regional Authorities (KS) and Statistics Norway (SSB). This work was commissioned by the Ministry of Climate and Environment, for the purpose of improving emissions statistics at municipal level.

The new statistics are based on calculations by Statistics Norway and reporting to the Norwegian Environment Agency, among other things. The statistics have been prepared by the Norwegian Environment Agency. The statistics include:

- Emissions figures for the years 2009, 2011, 2013, 2015 and 2016.
- Emissions figures for each of the following greenhouse gases: carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O).
- Emissions figures for nine emissions sectors and 37 emissions sources.

A key principle underlying the emissions statistics is that they should reflect the levels of emissions that occurred within the borders of each municipality. However, the available source data does not always reveal where usage actually took place. The statistics include only direct emissions within the

borders of each municipality. The statistics do not include emissions caused by indirect usage by the municipality or its residents. For example, emissions from wastewater treatment will be attributed to the municipality where the wastewater treatment plant is located, even though some of the wastewater may come from neighbouring municipalities.

The emissions figures have been developed in order to optimize comparability over time. Accordingly, the same methods and source data have been used for the whole time series, as far as possible. The statistics are based on source data that show trends at a local level, as far as possible. Accordingly, these data sources are not always the same as those used for national emissions accounting. Consequently, there is sometimes a discrepancy between the aggregate emissions for all municipalities and the national total. In general, however, the same emissions-accounting principles and methods are applied both for municipalities and for Norway as a whole.²

2.1.1. IMPROVEMENTS TO THE STATISTICAL BASIS

Significant changes since the last published statistics

Until 2012, Statistics Norway published statistics for GHG emissions by municipality. These statistics were discontinued, however, because the quality was not fit for purpose. The new statistics from the Norwegian Environment Agency retain many of the key features of the earlier statistics (Statistics Norway's Municipal Analysis). However, they also cover more emissions sources, include more detailed information, and have been calculated using new methods. Aviation and maritime traffic are included as new emissions sectors, and calculations for several emissions sources are based on reporting to the Norwegian Environment Agency or the KOSTRA system of municipal reporting to the national government. The methods and data sources are described in a memorandum (Norwegian Environment Agency, 2018).

Emissions figures in previous publications, including emissions statistics for years prior to 2009, were calculated using different methods, and are not directly comparable with the new figures.

The Climate Budget 2018 was based on the earlier version of the statistics, and the improvements made to the underlying statistics could potentially cause major changes that will affect both emissions levels and trends.

However, the improvements implemented so far have not had a major impact on emissions trends since 2009, compared with previous statistics – and the newly published statistics do not affect the assessments made in the previous Climate Budgets. Attachment 4 contains a detailed description of changes made to this Climate Budget as a result of the statistical improvements.

Future improvements

The Norwegian Environment Agency is working continually to improve its emissions statistics and we expect a new version to be published in early 2019. In order to ensure that the figures are comparable over time, as far as possible, the improvements and the inclusion of new data will result in adjustments both to the figures for the most recent year and for all years back to 2009.

Planned improvements to the statistics include, among other things, the use of a new model for calculating emissions from road traffic, which will make more allowances for local circumstances.

² In the case of maritime traffic and aviation, there are some differences in emissions-accounting methodology between the national and municipal statistics, but these have little effect on the figures for Oslo.

This will reduce the substantial uncertainty that currently taints the statistics for road-traffic emissions by municipality, but the change may have an impact on emissions trends for road traffic in Oslo.

Another planned improvement to the statistics is to include carbon emissions and sequestration relating to forests, land use and changes in land use. We do not yet know the magnitude of such emissions and sequestration in Oslo.

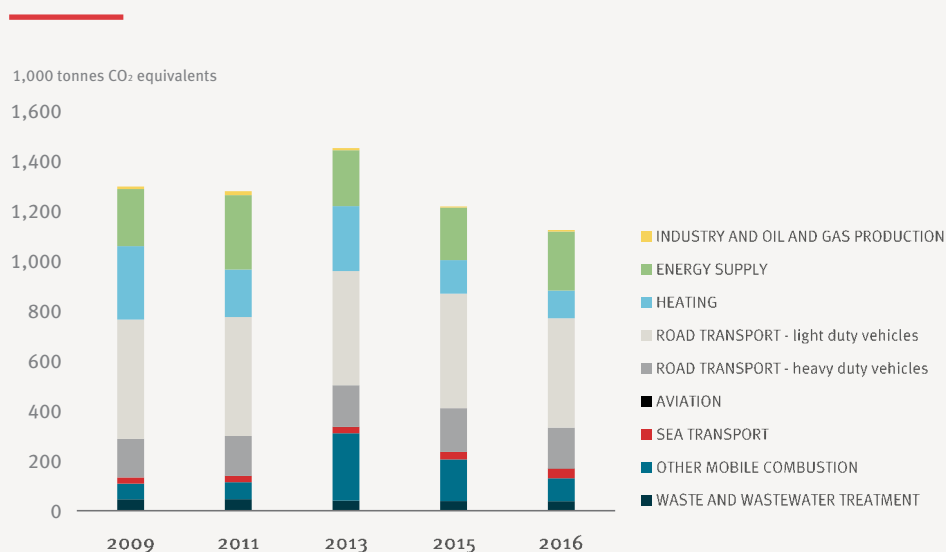
2.2. TRENDS IN OSLO'S GREENHOUSE GAS EMISSIONS

In 2016, GHG emissions in Oslo totalled over 1.12 tonnes CO₂e. From 2015 to 2016, emissions were cut by nearly 8 percent. Oslo's emissions have varied in the period 2009-2016. In 2009, emissions in Oslo totalled approximately 1.28 tonnes CO₂e. After a slight fall in 2011, Oslo's emissions peaked in 2013 at 1.45 million tonnes CO₂e. Emissions were cut significantly between 2013 and 2015, falling to under 1.22 million tonnes CO₂e (fig. 2.1, Table 21). The high levels of emissions in 2013 were due to high demand for red diesel (gas oil), with emissions being calculated on the basis of sales statistics and recorded under the sector "Other mobile combustion", with the emissions source given as "Diesel-powered motorized equipment".

In 2016, emissions fell to just over 1.12 tonnes CO₂e, which is the lowest annual figure in the time series (Table 2-1). The reduction in emissions was attributable to reduced emissions equivalent to approximately 32,400 tonnes CO₂e from road traffic and approximately 23,300 tonnes CO₂e from heating, among other things. The reduction may have been caused by the implementation of measures and instruments to encourage fossil-free transport, and the announcement of an impending ban on the use of oil-fired heating systems in buildings.



Figure 2-1: GHG emissions in Oslo for the period 2009 to 2016. Emissions are stated as 1,000 tonnes CO₂e and show the proportions of greenhouse gas emissions from the different sectors.



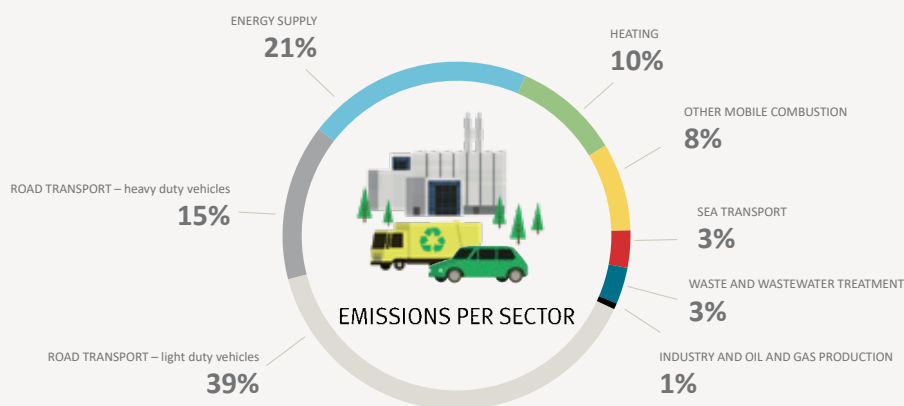
Source: Norwegian Environment Agency (2018)

Table 2-1: GHG emissions by emissions sector in Oslo for the period 2009-2016. Emissions are stated as tonnes of CO₂ equivalents.

EMISSIONS SECTOR	2009	2011	2013	2015	2016
INDUSTRY, OIL AND GAS	9,979	16,049	8,458	4,155	6,241
ENERGY SUPPLY	228,615	297,945	224,098	210,698	236,140
HEATING	294,333	190,634	260,219	134,327	111,017
ROAD TRAFFIC - light vehicles	478,329	476,798	458,071	459,175	438,645
ROAD TRAFFIC - heavy duty vehicles	154,652	159,038	166,272	174,800	162,942
AVIATION	0	1	1	1	1
MARITIME TRAFFIC	24,876	24,876	24,876	29,486	38,807
OTHER MOBILE COMBUSTION	62,531	68,071	270,152	167,227	91,854
WASTE AND WASTEWATER	56,971	46,387	40,417	38,626	38,376
TOTAL	1,299,285	1,279,798	1,452,565	1,218,494	1,124,023

Source: Norwegian Environment Agency (2018)

Figure 2-2: GHG gases in Oslo per sector in 2016. Emissions are shown as percentages of total emissions.



Source: Norwegian Environment Agency (2018)

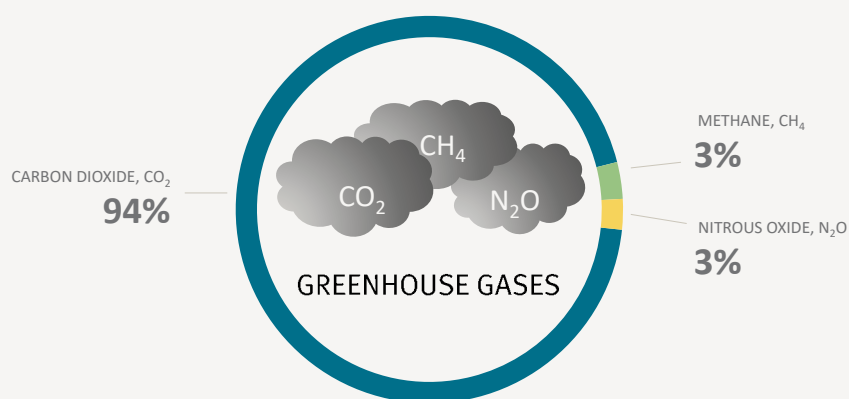
Greenhouse gas emissions from “Other mobile combustion” fell by 75,400 tonnes CO₂e, or 45 percent, from 2015 to 2016. We attribute this mainly to a reduction in the use of diesel-powered motorized equipment, which mainly comprises machinery used in the construction industry. There continues to be considerable uncertainty about these figures. Elements of uncertainty include what proportion of the emissions actually occur in Oslo, and what proportion of the emissions reduction is attributable to an actual decline in activity or to a transition to fossil-free alternatives.

Road traffic is the largest emissions source in Oslo, and accounted for 54 percent of all emissions in 2016. Energy supply accounts for 21 percent of Oslo’s emissions (fig. 2-2). These emissions originate mainly from waste incineration at the Klemetsrud and Haraldrud facilities. Emissions from this sector have increased by 12 percent between 2015 and 2016. Emissions from heating account for approximately 10 percent of Oslo’s emissions, while emissions from “Other mobile combustion”, including construction machinery, account for 8 percent of the total. The emissions sectors “Waste and wastewater” and “Industry, oil and gas” account for 3 percent and 0.6 percent respectively of the total.

Emissions from maritime traffic and aviation have been allocated to specific municipalities for the first time. Maritime traffic accounted for emissions of nearly 40,000 tonnes CO₂e, or just over 3 percent of total emissions. Aviation accounted for only marginal emissions in 2016, or 0.5 tonnes CO₂e, attributable mainly to helicopters taking off and landing in Oslo.

For 2016, Statistics Norway erroneously allocated a small quantity of agricultural emissions to Oslo, equivalent to 1,326 tonnes CO₂e. We anticipate that this error will be corrected in the next published statistics, and accordingly have omitted the figure from our analysis.

Figure 2-3: GHG gases in Oslo per gas in 2016. Emissions are shown as percentages of total emissions.



Source: Norwegian Environment Agency (2018)

CO₂ is the primary greenhouse gas

Greenhouse gas emissions in Oslo consist mainly of CO₂, which is generated by, among other things, the combustion of fossil energy sources. In 2016, Oslo's emissions of CO₂ totalled just over 1 million tonnes. Only a very small proportion of Oslo's GHG emissions in 2016 was attributable to emissions of methane (CH₄) and nitrous oxide (N₂O) (figure 23, table 22).

Emissions of methane in Oslo are attributable mainly to historical activities at landfill sites, waste incineration, and biological waste treatment (emissions from home composting, centralized composting facilities, and biogas plants). In addition, there are some methane emissions from sources including industry, oil and gas, road traffic, fossil-fuel-fired heating systems, and wood burning). Methane emissions comprised 3.1 percent of total emissions in 2016.

Table 2-2: Annual emissions of each greenhouse gas: carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Quantities of gas are stated as tonnes of CO₂ equivalent (CO₂e).

GREENHOUSE GASES	2009	2011	2013	2015	2016
Carbon dioxide, CO ₂	1,233,122	1,210,120	1,384,031	1,157,172	1,060,900
Methane, CH ₄	42,463	44,285	36,553	32,298	34,501
Nitrous oxide, N ₂ O	23,700	25,393	31,981	29,025	28,621
TOTAL	1,299,285	1,279,798	1,452,565	1,218,494	1,124,023

Emissions of nitrous oxide in Oslo are mainly attributable to wastewater, waste incineration, and biological waste treatment. In addition, there were some emissions of nitrous oxide from road traffic, diesel-powered motorized equipment, and industry, oil and gas. Nitrous oxide emissions comprised 2.5 percent of total emissions in 2016.

2.3. GHG EMISSIONS PER SECTOR/SOURCE

2.3.1. ROAD TRAFFIC

Road traffic, which includes light and heavy duty vehicles, is the largest source of emissions in Oslo. Emissions from road traffic in 2016 totalled approximately 602,000 tonnes CO₂e. Emissions fell by 32,000 tonnes CO₂e from 2015 to 2016. This corresponds to a reduction of over 5 percent. The proportion of biofuels in overall fuel consumption increased significantly from 2015 to 2016, and this was an important contributory factor to the reduction in emissions.

In the period 2009 to 2016, emissions from light vehicles fell gradually by approximately 8 percent, from approximately 478,000 tonnes CO₂e in 2009 to approximately 439,000 tonnes CO₂e in 2016. In the same period, emissions from heavy duty vehicles have varied between a low of approximately 155,000 tonnes CO₂e in 2009 to a peak of approximately 175,000 tonnes CO₂e in 2015. In 2016, emissions from heavy duty vehicles totalled approximately 163,000 tonnes CO₂e, an increase of 5 percent over 2009.

Road traffic emissions are calculated by dividing national emissions between municipalities. The national emissions are based on data from automatic traffic counting equipment operated by the Norwegian Public Roads Administration (NPRA), the road traffic index, and Statistics Norway's model for municipal roads. The statistics are uncertain at municipal level. In addition, the growing proportion of electric passenger cars in Oslo's vehicle fleet represents a further source of uncertainty, since variations in electric car ownership between municipalities are not reflected in the emissions statistics. In 2016, 5.8 percent of cars registered in Oslo were electric, against 3.7 percent nationally.

A new model for calculating emissions from road traffic is currently under development, in order to facilitate the capturing of the effects of measures and instruments, and to reduce the level of uncertainty. According to current plans, the new results will be published in late 2018/early 2019, and will include adjusted statistics for the whole time series 2009-2016.

2.3.2. ENERGY SUPPLY

Energy supply includes emissions from waste incineration; district heating (not including waste incineration); power generation; and other energy-supplying activities.

Emissions from the source "Waste incineration" are calculated from reports submitted to the Norwegian Environment Agency by the waste incineration facilities at Klemetsrud and Haraldrud, among other things. In 2016, emissions totalled approximately 231,600 tonnes CO₂e. Accordingly, the facilities are the largest single emissions sources in Oslo, accounting for 21 percent of all emissions in 2016. Emissions from waste incineration have fluctuated over the time series, but increased by over 13 percent from 2015 to 2016. This is equivalent to an increase of 25,900 tonnes CO₂e.

Fortum Oslo Varme AS has informed us that 2015 was an exceptional year at the Klemetsrud facility,

as the moving grates were taken out of service for upgrading. Consequently, waste was incinerated at lower temperatures, resulting in more emissions, that year.

Emissions from district heating (excluding waste incineration) fell sharply between 2015 and 2016. The emissions, which totalled less than 4,600 tonnes CO₂e, were attributable to the use during peak-load periods of heating oil, paraffin, natural gas and refinery gas. The emissions fell because Fortum Oslo Varme AS cut its consumption of heating oil between 2015 and 2016. At the same time, the use of natural gas during peak-load periods has increased. But since the burning of gas produces a fewer emissions per kWh, total emissions from district heating (excluding waste incineration) have fallen in this period.

2.3.3. HEATING

Heating covers emissions from the use of fossil fuels to heat commercial and residential properties. It also covers emissions from burning wood. Emissions are attributable mainly to the combustion of various petroleum products, such as heating oil, paraffin and LPG (Liquid Petroleum Gas).

The calculations of emissions from heating (excluding the burning of wood) are based on sales statistics for petroleum products, and in 2016, emissions in Oslo totalled approximately 107,000 tonnes CO₂e. This was a reduction of more than 22,000 tonnes CO₂e (17 %) over 2015. The reduction may have resulted from the announcement of a ban on the use of fossil heating oil in buildings from 2020. For several years, the City of Oslo has been providing grants through its Climate and Energy Fund to subsidize the phase-out of oil-fired heating in private households. Other factors that influence the use of fossil fuels for heating are electricity prices and variations in winter temperatures. Some of the reduction between 2015 and 2016 may be explained by a reduction in the need for heating, since daily temperature records show that winter 2016 was milder than winter 2015,

We have divided emissions between different types of buildings by using data reported through the KOSTRA system for energy consumption in municipal buildings. In 2016, emissions from municipal buildings totalled just over 74 tonnes CO₂e. Most of these emissions were attributable to sports buildings.

In 2016, emissions from wood-burning totalled 3,553 tonnes CO₂e. This figure represents emissions of nitrous oxide and methane. No CO₂ emissions were recorded, as wood-burning is considered to have a net zero carbon footprint.

2.3.4. OTHER MOBILE COMBUSTION

Other mobile combustion covers emissions from the use of red diesel (gas oil) to power motorized tools in the building and construction sector, among other things. Construction machinery is considered to be the largest source of such emissions. In addition, we have allocated a small quantity of emissions, 503 tonnes CO₂e, in 2016 to the use of snowmobiles. Snowmobiles are used for several purposes in Oslo, including the preparation of cross-country ski trails.

Diesel-powered motorized equipment has been a major source of emissions in Oslo in recent years. Emissions have fluctuated from approximately 62,000 tonnes CO₂e in 2009, to 270,000 tonnes CO₂e in 2013, 167,000 tonnes CO₂e in 2015 and finally 91,350 tonnes CO₂e in 2016. There was a 45

percent reduction in emissions from 2015 to 2016. The emissions calculations are based on sales figures for petroleum products and are particularly uncertain for this emissions source (see Chapter 2.4).

There is uncertainty associated with emissions from the sector “Other mobile combustion”, and the City of Oslo is in dialogue with Statistic Norway regarding the need to upgrade these emissions figures.

2.3.5. WASTE AND WASTEWATER

Methane emissions from landfill sites were between 25,000 and 26,000 tonnes CO₂e in 2009 and 2011, and were 16,000 tonnes CO₂e in both 2013 and 2015. In 2016, emissions totalled approximately 17,500 tonnes CO₂e. The Agency for Waste Management anticipates a 7 percent annual reduction in GHG emissions from landfill sites, since the sites are no longer in use (Agency for Waste Management, 2017). The sites also have systems for harvesting landfill gas generated by decomposing waste. These systems should further reduce emissions. According to reporting to the Norwegian Environment Agency, gas extraction at the Grønmo and Rommen sites was reduced by 15 percent from 2015 to 2016. This reduction in gas extraction has caused an increase in GHG emissions, because more methane is being emitted into the atmosphere, instead of being burnt.

Emissions from biological waste treatment are divided into three categories: biogas production, municipal composting facilities and home composting. Emissions in Oslo are only from biogas production and municipal composting facilities, with fluctuating levels of emissions of methane and nitrous oxide between 2009 and 2016. In 2016, emissions from biological waste treatment totalled 10,000 tonnes CO₂e. These included 2,167 tonnes CO₂e from biogas facilities and 7,916 tonnes CO₂e from municipal composting facilities. Since 2015, these emissions have been reduced by 1,539 tonnes CO₂e.

The calculation of emissions from municipal composting facilities is based on the total quantity of organic waste composted in Norway, which is allocated amongst municipalities with municipal composting facilities on the basis of local data. Emissions from biogas facilities are calculated according to the quantity of biogas produced. According to international guidelines (UN Intergovernmental Panel on Climate Change – IPCC 2006), methane emissions are equivalent to 5 percent of the quantity of biogas produced. In reality, methane emissions from biogas facilities may be lower, and the Climate Agency will investigate to what extent the standard factor applied by the IPCC is applicable to facilities in Oslo.

Emissions from wastewater totalled approximately 10,800 tonnes CO₂e in 2016. The figure was calculated on the basis of figures reported by treatment facilities to the Norwegian Environment Agency and data from the statistics bank maintained by Statistics Norway for water and wastewater.

The Agency for Water and Wastewater Services has commenced a study designed to improve the technical basis for the calculation of GHG emissions from water and wastewater in Oslo. The results of this study are expected in December and may provide a better basis for assessing this source of emissions.

2.3.6. MARITIME TRAFFIC

Greenhouse gas emissions from maritime traffic increased by approximately 14,000 tonnes CO₂e in the period 2009-2016. The figures for maritime traffic are based on an assumption by the Norwegian Environment Agency that the figures for 2009 and 2011 were equal to the emissions figure for 2013, since 2013 was the first year in which emissions were recorded through the use of activity data from individual vessels. Starting from 2013, emissions calculations have been based on information about the movements of individual vessels. This information is obtained from automatic identification system (AIS) transponders installed on every ship operating within the city limits.

In 2016, emissions from maritime traffic totalled 38,800 tonnes CO₂e. Emissions from maritime traffic increased by approximately 9,300 tonnes CO₂e, or 32 percent, from 2015 to 2016. This increase can be attributed to two main factors:

- 1) increased activity in all shipping segments (with the exception of bulk shipping, where emissions have declined, and RoRo ferries, where emissions levels have been constant).
- 2) with effect from 1 January 2016, we started to calculate emissions for steam boilers on board, based on fuel consumption. Previously, steam-generating boilers were not included in the emissions calculations made using AIS data. The inclusion of this new source can explain the increase in emissions of approximately 9,300 tonnes CO₂e from 2015 to 2016. We calculate that emissions from steam-generating boilers exceeded 9,300 tonnes CO₂e in 2016. This may mean emissions from main and auxiliary engines have fallen in the period 2015 to 2016.

2.3.7. INDUSTRY, OIL AND GAS

This sector covers emissions from oil and gas extraction, industry and mining, and includes many activities covered by the EU emissions trading system (EU ETS). Emissions from onshore facilities associated with oil and gas extraction are allocated to the municipality where the plant/facility is located. The calculated emissions are based on EU ETS reporting and reports submitted to the Norwegian Environment Agency by the relevant facilities.

This sector includes emissions from industrial processing and combustion. In the case of Oslo, the only emissions of this type are from combustion in facilities not covered by the EU ETS. There are no facilities in Oslo that produce oil or gas, there are no facilities covered by the EU ETS, and there are no emissions from industrial processing. In 2016, emissions in Oslo from combustion in industry totalled just over 6,200 tonnes CO₂e. The level of such emissions fluctuates significantly from year to year.

2.3.8. AGRICULTURE

In 2016, a small quantity of agricultural emissions was allocated to Oslo, equivalent to 1,326 tonnes CO₂e. The Climate Agency has learnt that these emissions were included in the statistics by mistake, and accordingly we anticipate that this figure will be corrected and will appear as zero in the next round of statistics. No agricultural emissions are attributed to Oslo in statistics published for the years 2009, 2011, 2013 and 2015. The emissions for 2016 are omitted from the analysis.

Although the statistics for Oslo should not contain emissions figures for agriculture due to confidentiality, the emissions in 2016 derive from actual agricultural activity in the municipality. Methane emissions are caused by the digestive processes of farm animals and nitrous oxide is emitted from farmland. The emissions are allocated to municipalities using a distribution formula that takes into

consideration, among other things, the number of farm animals, the area of cultivated land, the proportion of organically farmed land, and so on. Carbon dioxide emissions from farmland are reported under the sector “Forests, land use, and changes in land use” in the national emissions accounts. Currently these figures are not available by municipality.

2.3.9. AVIATION

This emissions source includes emissions associated with the departure and arrival phases of aeroplanes and helicopters taking off and landing at Norwegian airports in connection with domestic and international flights. In 2016, only 0.5 tonnes CO₂e of emissions in Oslo were attributable to aviation. Most likely, these emissions relate to helicopters and small aircraft taking off and landing in Oslo. It is reasonable to assume that helicopter take-offs and landings in Oslo occur mainly at the official helicopter pads at Rikshospitalet University Hospital and Ullevål University Hospital. Emissions levels vary considerably from year to year, and are calculated on the basis of fuel consumption.

Emissions from this sector are divided geographically, which means that emissions associated with air travel by Oslo’s inhabitants and businesses are attributed to Ullensaker Municipality, among others, where Oslo Airport is based. In 2016, emissions from aviation in Ullensaker Municipality totalled 251,840 tonnes CO₂e.

2.4. UNCERTAINTY

2.4.1. OSLO AS BOTH COUNTY AND MUNICIPALITY

The emissions statistics by municipality are published by the Norwegian Environment Agency, with Statistics Norway as the major supplier of data. In addition, Statistics Norway publishes emissions statistics by county (Statistics Norway, *Utslipp av klimagasser*, 2018). Oslo’s status as both municipality and county is unique, and means that both the statistics published by Statistics Norway and the statistics published by the Norwegian Environment Agency are relevant bases for our climate work. The emissions figures published by Statistics Norway and the Norwegian Environment Agency differ because:

- The Norwegian Environment Agency’s statistics include more emissions sources and provide more detailed information than Statistics Norway’s county statistics.
- The Norwegian Environment Agency statistics by municipality include maritime traffic, aviation and snowmobiles as emissions sources. These are not included in the county statistics from Statistics Norway.
- The county statistics from Statistics Norway provide more detail about emissions from industry and oil and gas extraction, while the Norwegian Environment Agency’s statistics by municipality contain more detailed statistics for energy supply, heating, agriculture, and waste and wastewater.
- The use of different source data and different calculation methods gives different results.

In the figures from Statistics Norway, the aggregate of emissions from the various counties has to equal the national total, while the statistics from the Norwegian Environment Agency are based to a greater extent on known local activities, in order to provide the most certain possible estimate of emissions from individual municipalities.

In general, the county figures from Statistics Norway are arrived at by dividing national emissions

between counties through the use of distribution formulae. The distribution formulae are information/statistics that should be the measure of an activity, for example population figures or the area of farmland (Aasestad, Høie, Sandmo, & Thovsen, 2016).

When developing the emissions figures by municipality, a general principle has been to use data sources that to the greatest extent possible describe local trends. If data sources of adequate quality exist at municipal level, these are used as the starting points in the statistics by municipality, rather than the national total. This means that aggregate emissions for all municipalities do not necessarily correspond to the national total.

Major differences in estimated emissions for heating and diesel-powered motorized equipment³

For some of the emissions sources, Statistics Norway produces the emissions figures in the statistics by municipality. In these cases, the emissions in both the municipal and county statistics will in general be identical at county level. This is true for road traffic and landfill gas. For other emissions sources, in particular heating and diesel-powered motorized equipment, there is a significant discrepancy between the figures. This is because different methods are used to allocate the emissions.

In the statistics by municipality, each municipality is allocated emissions from diesel-powered motorized equipment on the basis of delivery addresses for consignments of red diesel (gas oil). Emissions resulting from the combustion of red diesel without a delivery address are shown as unallocated, i.e., they are not allocated to municipalities. In Statistics Norway's emissions statistics by county, a distribution formula is used to allocate these residual emissions between the various counties. In the case of Oslo, this means that emissions from motorized equipment in 2016 were 18 percent lower in the statistics by municipality than in the statistics by county. There is a similar difference in the methods used to calculate emissions resulting from heating. For this emissions source, Oslo's emissions were 27 percent lower in 2016 in the statistics by municipality than in the statistics by county.

The City of Oslo uses the Norwegian Environment Agency's statistics as its starting point

Climate efforts in Oslo should be based on up-to-date data for emissions of greenhouse gases. Accordingly, the City of Oslo will base its future annual Climate Budgets on the Norwegian Environment Agency's statistics for greenhouse gas emissions by municipality. The Norwegian Environment Agency's statistics are based on Statistics Norway's emissions calculations, but reduce the level of uncertainty by including more emissions sources and new calculation methods. The Norwegian Environment Agency's emissions statistics will also be used by other Norwegian municipalities.

2.4.2. UNCERTAINTY AND ANTICIPATED FUTURE STATISTICAL IMPROVEMENTS

The statistics that form the basis for the Climate Budget are undergoing continual improvement, but there is still a high level of uncertainty about Oslo's emissions from certain emissions sources.

As mentioned above, there is an ongoing project to improve the calculation of emissions from road traffic. This project will result in adjustments to the emissions calculated to result from road traffic in Oslo for all years in the time series 2009-2016. It is possible that emissions trends and levels in Oslo will be affected by other changes made to calculation methods in the future. Such changes may affect the amount of emissions reductions needed to achieve the 2020 goal of capping Oslo's emissions at 766,000 tonnes CO₂e.

³ Information taken from a memorandum from the Norwegian Environment Agency

For other sources, there are known uncertainties that are more difficult to tackle. One example we have already mentioned is emissions from diesel-powered motorized equipment and heating. For these sources, there is a major difference between the municipal and county statistics. This difference may indicate the uncertainty concerning what proportion of sales of the relevant petroleum products that are actually used for combustion in Oslo. The statistics by municipality and the statistics by county both take as their starting points the final annual sales statistics for petroleum products (Statistics Norway, Sal av petroleumsprodukt. Årleg, endelege tal, 2018). These statistics record a particularly large decline in sales to “wholesale trade in fuel” in the City of Oslo in 2016. We do not know how large a proportion of sales not registered to any municipality in fact had a delivery address in Oslo. If sales of red diesel (gas oil) do not have a delivery address in Oslo, but the diesel is in fact used in the municipality, this method will have caused emissions in 2016 to be underestimated. Accordingly, the actual reduction in emissions between 2015 and 2016 may be less than 45 percent.

In addition to its annual statistics, Statistics Norway publishes monthly figures for sales of petroleum products (SSB, Sal av petroleumsprodukt, månedleg, førebelse tal, 2018). The aggregate of the monthly sales statistics is not the same as the annual statistic for Oslo. Thus it is possible, if we take the Norwegian Environment Agency’s statistics as our starting point, that Oslo’s emissions are somewhat underestimated. On the other hand, the starting point for the geographical allocation of the emissions is the delivery address, and it is likely that some of the red diesel, heating oil and paraffin that is delivered to addresses in Oslo is not actually used in Oslo. All in all, the emissions statistics for diesel-powered motorized equipment and heating are particularly uncertain, and unfortunately, we do not know of any sources of data that could reduce this uncertainty. The Climate Agency has commissioned DNVGL to estimate GHG emissions from building and construction activities in Oslo. Provisional results indicate that a smaller proportion of emissions than previously thought can be attributed directly to building and construction activities in Oslo. The estimates from DNVGL are uncertain, and do not provide a basis to draw conclusions. The Climate Agency will assess the need for a further study of alternative areas of use for red diesel.

The Climate Agency has become aware that a small quantity of emissions linked to the use of natural gas for heating was attributed erroneously to Oslo in 2009. No statistics have been calculated for the use of natural gas for heating in Oslo in other years. The Climate Agency will attempt to assess the extent of the error and will request that the statistics are corrected accordingly.

In respect of emissions caused by the heating of municipal buildings, there is uncertainty due to deficient and defective reporting using the KOSTRA reporting system. The Climate Agency has found significant discrepancies when comparing the Norwegian Environment Agency’s statistics with the figures reported in connection with the Environment and Climate Report 2016. The Norwegian Environment Agency’s statistics for emissions from municipal buildings, which are based on KOSTRA figures, record emissions of 74.2 tonnes CO₂e in 2016. Data reported in connection with the Environment and Climate Report suggests that emissions from municipal buildings in 2016 totalled approximately 439 tonnes CO₂e. Accordingly, we consider that the KOSTRA reporting system is inadequate for Oslo, and that emissions from municipal buildings were in fact six times higher than is recorded in the Norwegian Environment Agency’s statistics. If the statistics for this emissions source were to be adjusted upwards, then emissions from the use of fossil fuels to heat commercial and residential properties would have to be downgraded by a corresponding amount.

The Technical Report for the Climate Budget included a measure to “Conclude documentation of nitrous oxide volumes in wastewater, with the aim of correcting Statistics Norway’s emissions figures”. This project has not yet been concluded, and accordingly it is currently unclear how much, if at all, the statistics for nitrous oxide emissions from wastewater will be downgraded. If the project shows that actual emissions are lower than those recorded in the current statistics, this will reduce the need for emissions-reducing measures. This assumes that Statistics Norway and the Norwegian Environment Agency will update their source data for published statistics in the light of new findings.

Even improved statistics will not reflect the effect of all relevant climate measures. Take emissions from ships, for example. A ship’s fuel consumption and, accordingly, its emissions are calculated on the basis of data about the ship’s movements and changes in position. If the ship performs work that is not reflected in its movements, e.g. hauling, dynamic positioning, loading or trawling, its emissions will be underestimated. The emissions calculations will only reflect changes in fuel consumption if the work performed by the ship affects its speed or the type of fuel/engine technology. However, we consider this effect to be less significant for Oslo, since the largest emissions source do not perform the activities described above.

The calculation of a ship’s fuel consumption in port is based on the installed power of its on-board generators and typical load factors for port operations for each engine. For some types of ship this will result in actual emissions being over-estimated, while the reverse is true for other types. Over all, we believe that fuel consumption from activities in the port are somewhat over-estimated. Measures targeted at reducing in-port fuel consumption are little reflected in the statistics. Examples of such measure include the installation of shore power facilities, the use of district heating, and battery-powered operations. For example, the impact of the shore power facility at Hjortnes, which has been used by Color Line since 2011 and which reduces emissions each year by 3,000 tonnes CO₂e, will not be reflected in the statistics.

3. Framework for the Climate Budget

In order to assess what emissions reductions are required in order to achieve the 2020 climate goal, it has been necessary to calculate a “framework” for the Climate Budget. We have calculated this framework by assessing the difference between the level of emissions in the last year for which figures are available and the goal for 2020. The result tells us by how much Oslo’s emissions need to be reduced. We have calculated a general framework based on the sectors covered in the formulation of the 2020 goal, i.e. industry, oil and gas; energy supply; heating; road traffic; other mobile combustion; and waste and wastewater. We have calculated a separate framework for the 2030 emissions goal for maritime traffic. Emissions from aviation are not included in the formulation of the goal. Historically, such emissions have been negligible in Oslo.

3.1. CALCULATION OF THE GENERAL FRAMEWORK

The framework for the Climate Budget 2019 is determined by Oslo’s 2020 climate goal of capping emissions at 766,000 tonnes CO₂e. The framework includes all the emissions sectors in the Norwegian Environment Agency’s emissions statistics (Norwegian Environment Agency, 2018), with the exception of maritime traffic and aviation. When calculating the framework, we have assumed that emissions from agriculture are basically zero (this is discussed in Chapter 2.3.8). The calculation of the framework for the Climate Budget is based on emissions levels in 2016, not on a baseline scenario.

By virtue of the draft Action Plan for Oslo Port (City of Oslo, 2018), maritime traffic is covered by a separate climate goal to reduce emissions in the area within the five islands known as Steilene by 85 percent by 2030. In the Climate Budget 2019, we assess maritime traffic against the goal of reducing emissions from this sector by 85 percent by 2030 within Oslo’s city limits, with 2016 as the reference year. See Chapter 3.3 below for a discussion of the goals set for maritime traffic.

Based on the 2020 goal of capping Oslo’s GHG emissions at 766,000 tonnes CO₂e, we must reduce emissions by at least 319,215 tonnes CO₂e in the period 2016-2020.

Table 3-1: Framework for measures in the Climate Budget 2019.
Quantities of gas are stated as tonnes of CO₂ equivalents.

CLIMATE BUDGET 2019	1990	2016	2020
GHG emissions (exclusive of maritime traffic and aviation)*	1,200,000	1,085,215	-
Goal in tonnes		-	766,000
Need for measures		-	319,215
EMISSIONS IN 2020 (exclusive of maritime traffic and aviation)*			766,000

* emissions from agriculture are set equal to 0

Important remarks

The framework for the Climate Budget 2019 has not been calculated in conformity with a baseline scenario. The calculated requirement for measures applies only if emissions levels are assumed to remain constant from year to year in the absence of any measures being implemented. Accordingly, it is not possible to set a framework for emissions with complete certainty. If emissions go down or up as a result of reduced or increased activity, or a change in technology that was not triggered by a climate measure, then the aggregate framework amounts may decrease or increase. It is possible that emissions from some sources have increased in 2017, or will increase in the period to 2020, e.g. emissions from other mobile combustion (use of red diesel), landfill gas, and waste incineration.

In connection with the preparation of a new Climate Strategy for Oslo, the Climate Agency commissioned CICERO, with the Institute for Transport Economics (TØI) as subcontractor, to calculate a new baseline scenario for Oslo's GHG emissions in the period 2017-2030. The baseline scenario estimates how emissions trends would develop given the continuance of existing policies and no new measures. The CICERO report, which describes the baseline scenario for Oslo's GHG emissions in the period to 2030, was completed in September 2018. This was after we had completed the assessments of measures for the Climate Budget 2019 and after the City Government had drafted the Climate Budget. Accordingly, we should be cautious when considering the baseline scenario and the effects of the measures described in the Climate Budget 2019 in relation to each other. Such caution is additionally important because some measures are included in both the baseline scenario and the Climate Budget, because they are adopted policy. For example, this applies to the effects of the revised Oslo Package 3, the biofuel blending requirement, and the ban on oil-fired heating from 2020. The Climate Agency will use the new baseline scenario in developing the knowledge basis for the City of Oslo's Climate Budget 2020. This will include assessments of the future effects of climate measures in the context of projected emissions trends in the absence of these measures (the baseline scenario).

Improvements to the emissions statistics by municipality, and possible adjustments to existing emissions figures, makes the task of assessing both the framework and the potential for achieving the climate goals in the Climate Budget very challenging. In particular, new methods of calculating emissions from road traffic may increase emissions figures in the time series 2009-2016. According, the required reduction in emissions may exceed 319,215 tonnes CO₂e in the period 2016-2020. "Goal

in tonnes” does not indicate maximum total emissions in 2020, since this goal does not include emissions from maritime traffic and aviation. Emissions from agriculture are expected to be basically zero. The calculation assumes that emissions will be held at a constant 2016 level.

3.2. THE FRAMEWORK FOR MARITIME TRAFFIC

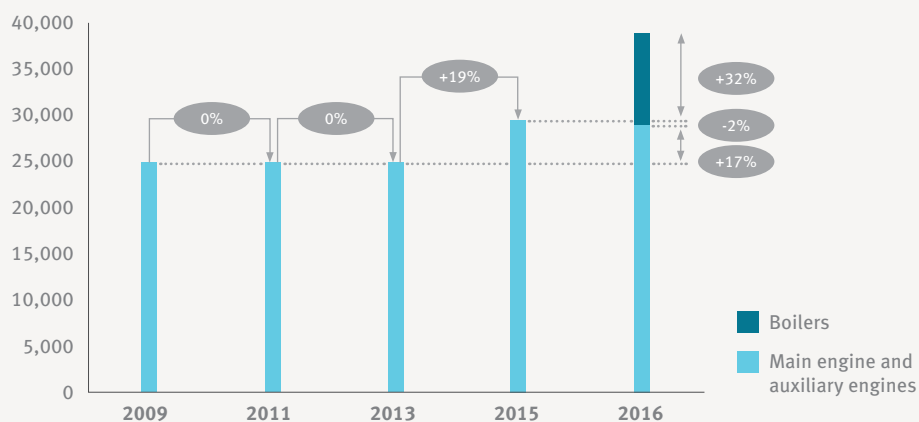
By virtue of the draft Action Plan for Oslo Port (City of Oslo, 2018), maritime traffic is covered by a separate climate goal to reduce emissions in the area within the five islands known as Steilene by 85 percent by 2030. The Climate Budget 2019 assumes that maritime traffic is covered by a separate framework with the goal of reducing GHG emissions by 85 percent within Oslo’s city limits, taking 2016 as the reference year (Table 3-2).

Table 3-2: Emissions, targets, and requirements for measures in the maritime sector. Quantities of gas are stated as tonnes of CO₂ equivalents.

CLIMATE BUDGET 2019	1990	2016	2020
Emissions from maritime traffic	24,876	38,807	-
Target in tonnes (85 percent reduction)*		-	5,821
Requirements for measures		-	32,987
EMISSIONS FROM MARITIME TRAFFIC 2030			5,821

* taking 2016 as the base year

Figure 3-1: Greenhouse gas emissions from maritime traffic 2009-2016



Source: Norwegian Environment Agency (2018) and the Climate Agency

Measures targeted at maritime traffic will not have any impact on Oslo's overall climate goals, however, since the sector is not included in the formulation of the goals (see Chapter 1). As a result, there is only a 2030 goal for maritime traffic. There is no goal for 2020.

Important remarks

As shown in figure 3-1, emissions from maritime traffic in Oslo have remained relatively stable in the period 2009-2016. The figures for maritime traffic are based on an assumption by the Norwegian Environment Agency that the figures for 2009 and 2011 were equal to the emissions figure for 2013, since 2013 was the first year in which emissions were recorded through the use of activity data from individual vessels. In addition, emissions from boilers (dark-blue emissions) were incorporated into the calculations with effect from 2016. This caused recorded emissions to rise sharply, and it is reasonable to assume that this share of emissions was comparably large in the period 2009-2015. We consider that 2016 is a satisfactory starting point for the goal of reducing emissions by 85 percent by 2030.

3.3. EMISSIONS CEILING IN 2020

Based on the underlying framework for the Climate Budget 2019, the ceiling for total emissions in 2020 will be 766,000 tonnes CO₂e, excluding emissions from aviation and maritime traffic. Oslo Port Authority has ambitious plans to increase activity, which may lead to increased emissions. However, the authority is working simultaneously on measures to reduce existing emissions. It is uncertain what effect measures targeted at the maritime sector will have by 2020, and whether the effect of climate measures targeted at maritime traffic will be captured directly in the emissions statistics by municipality. Take emissions from ships, for example. A ship's fuel consumption and, consequently, its emissions are calculated on the basis of data about the ship's movements and changes in position, combined with technical data about the relevant ship (engine technology etc.). For a measure to be reflected in the statistics, the source data must record a change in the ship's movements and/or in its technical characteristics. On the basis of a simplified forecast, the Climate Agency has assumed that the emissions level can remain constant at 2016 levels in 2020. Total emissions in Oslo, including emissions at a constant 2016 level from aviation and maritime traffic, can then be calculated at 804,808 tonnes CO₂e in 2020.

4. Assessments of effects of measures and instruments

The methods used in preparing this Technical Report for the Climate Budget 2019 are more advanced than the methods used for earlier climate budgets. The evaluations take account of new, improved statistics for emissions at a municipal level. These improvements have helped reduce uncertainty about GHG emissions and the effects of measures in Oslo. There is still some uncertainty about the magnitude of the measures' effects, as well as about when the effects will occur, because effects are dependent on the orientation and implementation of measures and instruments.

In this chapter, we explain the methods used to assess that measures, and provide an overview of the measures and instruments in the Climate Budget. Attachment 1 provides detailed descriptions of the measures in Chapter 4.3. Attachment 2 provides a description of measures in Chapter 4.4. Attachment 3 provides an overview of new grants for climate measures in the budget period 2019-2022. Attachment 4 provides an overview of changes in the statistical basis for, and assessments of the measures in, the Climate Budget 2019, compared to the Climate Budgets 2017 and 2018.

4.1. METHOD

The assessment and calculation of the climate effects of various measures is a complex exercise. In order to estimate the effects of a measure, we must make a number of assumptions and suppositions. Efforts to assess the effects of the measures in the Climate Budget have been headed by the Climate Agency, and in the case of several measures have been conducted against the background of external analyses and in collaboration with out-of-house professionals. Generally, assessments are made by the Climate Agency in consultation with other municipal bodies.

We have attempted to increase the proportion of bottom-up assessments as against top-down assessments. In this context, bottom-up means that the effect of a measure is calculated as a change in activity (activity data) or emissions per unit of activity (emission factor).

Change in emission = \sum change (activity data x emission factor)

Bottom-up calculations require reliable data about what change the measure will bring about in the activity or emissions factor, but can often give more detailed information about both the preconditions for, and the effect of, the measure. On the other hand, top-down calculations tend to be more

general. These take total emissions as their starting point, and then assess how large a proportion of the emissions can be removed with the assistance of the measure.

All the measures have been assessed from a Scope 1 perspective. In other words, they have been assessed for their effect on GHG emissions (CO₂, N₂O og CH₄) within the borders of the City of Oslo, rather than for their effect on consumption. This is in conformity with the scope of the Climate Budget and the emissions statistics by municipality.

In general, the calculation of the effect of the measures takes as its starting point an absolute emissions level in 2016 and is calculated towards 2020. One possible result of using the emissions level in 2016 as our starting point is that there may be an underlying trend that is not captured in the assessments of the effects of measures. Some measures have been adjusted to take account of potential sector-specific emissions trends. These are described in Attachment 1.

The Climate Agency notes that changes may be made to the emissions statistics by municipality published by the Norwegian Environment Agency; that changes may be made to the input data for the assessment of measures; and that the estimates of effects may need to be adjusted to take account of the how instruments are designed and implemented. The assessments in the Technical Report are based on the best available knowledge.

The calculations of the effects of measures have been subjected to in-house and external quality assurance processes in order to reduce uncertainty. This process has been conducted in dialogue with municipal bodies, and in collaboration with, and by awarding commissions to, out-of-house specialist organizations.

Measures and instruments

In its work on the Climate Budget 2019, the Climate Agency has attempted to clarify the distinction between measures and instruments. The technical explanation of the calculations underlying the government's White Paper (Meld. 41 (2016–2017), *Climate Strategy for 2030 – Norwegian transition in collaboration with EU*, defines measures and instruments as follows:

“It is important to be clear about the distinction between measures and instruments. We define a measure as the actual physical change in a society that causes reduced GHG emissions. Instruments are the tools that the government can implement with the intention of triggering measures, such as, for example changes in taxes, regulations, individual decisions, public information campaigns, or various kinds of subsidy schemes.”

The measures in the Climate Budget are calculated and systematized according to the following categories:

- 1) Measures that cause changes in activity (e.g. reduced car traffic)
- 2) Measures that cause changes in technology (e.g. a transition from fossil-fuelled vehicles to electric vehicles)
- 3) Measures that cause a change in the type of fuels used (e.g. a transition from petrol/diesel to biodiesel/biogas)

Categories 1 and 2 are relevant for all emissions sectors and sources, while category 3 is relevant primarily for mobile sources (road traffic, other mobile combustion, maritime traffic and aviation). This Technical Report for the Climate Budget only contains limited analysis of instruments, and accordingly the analysis of measures does not include an evaluation of the instruments effectiveness or cost-efficiency. We have attempted, however, to assess what effect can be achieved by implementing a measure.

The implementation of a measure may be justified on climate grounds, but often other considerations will contribute to the decision on whether to implement it. Light can be shed on these considerations through socio-economic analyses of costs and other benefits, in addition to consequences such as changes in demand for energy, environment- and health-related effects, distributional consequences, and socio-economic costs for individuals, businesses and society. Every measure exists within a complex context, and assessing such contexts would require further data gathering. The long-term goal of the Climate Agency is to improve the methods for making such assessments.

The list of activities in Chapter 4.5 includes measures and additional proposals that are considered to fall outside the scope of the Climate Budget, but which have the potential to reduce indirect emissions; which are essential preconditions for implementation of the measures in the Climate Budget 2019; or which can reduce direct emissions in Oslo in the longer-term.

Uncertainty

The Climate Agency has attempted to isolate the effect of each measure, and has also estimated the measures' aggregate effect, but overlapping effects are a source of uncertainty. This is particularly true of measures targeted at road traffic. The effect of each measure is assessed based on the timing for implementation and the time when the effect is expected to occur. There is uncertainty attached both to when the measure will attain optimum effect, and the actual magnitude of the effect. This will depend on the design of the measure and how it is implemented in practice.

In most cases, the effects of measures are estimated based on absolute emissions levels in 2016, and are not calculated in conformity with a baseline scenario (0-alternative).

4.2. STUDIES OF PACKAGES OF MEASURES FROM THE CLIMATE BUDGET 2018

As a follow-up to the Climate Budget 2018, the Climate Agency has headed the preparation of studies of four packages of measures. The packages are designed to promote climate-friendly travel to and from work; a fossil-free city centre; the climate-friendly transport of goods; and zero-emission construction machinery. The purpose of this work was to identify new measures to cut emissions by 2020.

The studies were prepared by working groups consisting of representatives from the Climate Agency, the Agency for Urban Development, the Agency for Planning and Building Services, the Agency for Real Estate and Urban Renewal, Ruter, the Agency for Improvement and Development, the Municipal Undertaking for Social Service Buildings, the Municipal Undertaking for Educational Buildings and Property, the Municipal Undertaking for Cultural and Sports Facilities, the Municipal Undertaking for Social Housing, the Waste-to-Energy Agency, the Agency for Waste Management, and the Agency for Water and Wastewater Services. The studies were commissioned by the City Government's Department of Environment and Transport. The Climate Agency has been responsible for compiling the reports, and

the final reports were delivered by the Climate Agency. As part of the process, meetings have been arranged to ensure participation and input from external parties, stakeholders and the public.

Multiconsult, DNV GL, the Institute for Transport Economics (TØI) and Asplan Viak have supplied supporting reports with assessments of the emissions basis, evaluations of measures and instruments, and a survey of the travel habits of all municipal employees in the City of Oslo. The assumptions made in these reports are described in more detail under the descriptions of measures in Attachments 1 and 2. Complete versions of the reports are published at www.klimaoslo.no.

The reports from the studies of the packages of measures were delivered to the City Government's Department of Environment and Transport in early May 2018. At the point, the work on the reports on the packages of measures to encourage climate-friendly travel to and from work, climate-friendly goods transport, and zero-emission construction sites was concluded, although work on developing measures and the use of instruments has continued as part of the work on the Climate Budget. The Package of measures for a gradual transition to a "fossil-free city centre within Ring 3 by 2024" is not completed, and work is continuing on potential instruments and how they would be designed.

To a large extent, the emissions figures presented in the packages of measures were calculated by out-of-house contractors. In the packages of measures, total technical emissions-reduction potential by 2020 is calculated as 89,500 tonnes CO₂e. The figures presented are to a large extent theoretical potentials, and the effect in practice will depend on the design and implementation of measures and instruments. No comparisons are made with the emissions levels in the Norwegian Environment Agency's emissions statistics by municipality. Please refer to the reports on the emissions packages for more in-depth information about estimated GHG emissions, projected effects of measures, and uncertainty. When working on these packages of measures, attempts have been made to correct for double-counting where the measures have overlapping effects. Measures from these studies, as far as they are included in the Climate Budget 2019, are discussed in Attachments 1 and 2.

4.3. MEASURES WITH QUANTIFIED EMISSIONS REDUCTIONS

Table 4-1 provides an overview of measures in the Climate Budget with estimated emissions reducing effects, and corresponds to Table 2.2.A in City Council Proposition 1. The "Emissions sector" and "Emissions source" fields in the table refer to the classifications used in the Norwegian Environment Agency's emissions statistics by municipality. Calculated effects of measures are rounded to the nearest 100 tonnes. In City Council Proposition 1, the same effects are rounded to the nearest 500 tonnes. Attachment 1 contains a description of the design of the measures and calculations of their effects.

Table 4-1: Measures with quantified emissions-reducing effect in the Climate Budget 2019.
The effects of measures are stated in tonnes of CO₂ equivalent (CO₂e).

EFFECT OF MEASURES				
Emissions sector	Emissions source	No.	Measures and instruments	Effect 2016-2020 (tonnes CO ₂ e)
Heating	Municipal buildings	1	Phase-out of oil-fired heating - <i>National ban from 1 Jan. 2020</i>	400
	Residences and business premises	2	Phase-out of oil-fired heating - <i>National ban from 1 Jan. 2020</i> - <i>Information about state subsidies schemes (ENOVA)</i>	69,000
Energy supply	District heating, excluding waste incineration	3	Phase-out of the use of fossil oil and gas for district heating during peak-load periods - <i>Goal set by Fortum Oslo Varme AS</i>	4,200
Road traffic	Light and heavy duty vehicles	4	Road user payment system at the toll ring - <i>Install an adequate battery-charging infrastructure for passenger cars</i> - <i>Continue implementation of local and regional instruments to promote zero-emission cars</i> - <i>Continue implementation of national instruments to promote zero-emission cars.</i> - <i>Increase public transport capacity to cope with population growth and reduced use of private cars</i> - <i>Package of 100 initiatives to reduce delays on public transport.</i>	36,100
		5	Implementation of 20 percent national fuel blending requirement in 2020	30,600
	Light vehicles	6	Better provision for cyclists - <i>The Cycling Project</i> - <i>Subsidy schemes</i>	1,600
		7	New licensing rules for taxis: Zero-emission by 2020 - <i>Battery-charging infrastructure</i> - <i>Subsidy schemes</i>	6,900
		8	The municipal light vehicle fleet to run on zero-emission/sustainable biofuels	1,000
	Heavy duty vehicles	9	Package of measures to encourage climate-friendly transport of goods <i>Utility transport</i> - <i>Dedicated parking spaces for zero-emission delivery/utility vehicles</i> - <i>Battery-charging infrastructure</i> - <i>Standardized municipal procurement requirements</i> - <i>Subsidy schemes</i> <i>National subsidy scheme: exchange of fossil LCVs for LCVs</i>	17,600
		10	<i>Fossil-free public transport by 2020</i>	27,700
		11	Use of zero-emission vehicles/sustainable biofuels in the municipal heavy duty fleet	900

Emissions sector	Emissions source	No.	Measures and instruments	Effect 2016-2020 (tonnes CO ₂ e)
Other mobile combustion	Diesel-powered motorized equipment	12	Package of measures to encourage the use of zero-emission construction machinery <i>Machinery assets</i> - <i>Standardized municipal procurement requirements</i> - <i>Subsidy schemes</i> - <i>Voluntary agreement with the industry</i>	26,000
		13	Municipal construction machinery to be zero-emission or use sustainable biofuels	1,400
TOTAL				223,400

Table 4-2: Climate measures for emissions sector “maritime traffic” in the Climate Budget 2019

EFFECT OF MEASURES

Emissions sector	Emissions source	No.	Measures and instruments	Effect 2016-2020 (tonnes CO ₂ e)
Maritime traffic	Maritime traffic	14	Installation of shore power facilities - <i>Shore power for international ferries</i> - <i>Shore power at Sydhavna</i>	2,300
		15	<i>Zero-emission public transport</i> - <i>Nesodden ferries</i>	4,200
TOTAL				6,500

Table 4-3: Effects of measures contained in the Climate Budget, by emissions sector

Emissions sector	Emissions (tonnes CO ₂ e)	Planned reduction 2016-2020 (tonnes CO ₂ e)	By reduction from 2016 emissions
INDUSTRY, OIL AND GAS	6,241	-	-
ENERGY SUPPLY	236,140	4,200	2%
HEATING	111,017	69,400	63%
ROAD TRAFFIC	601,587	122,400	20%
OTHER MOBILE COMBUSTION	91,854	27,400	30%
WASTE AND WASTEWATER	38,376	-	-
TOTAL	1,085,215	223,400	21%

Since maritime traffic is covered by a separate climate goal for the period to 2030, these measures are presented in a separate table (Table 42).

Table 43 shows how the emissions reductions in Table 41 are distributed between the emissions sectors in the emissions statistics. The table also shows how large a part of the emissions total for 2016 can be cut by 2020 through the effects of the measures identified.

4.4. MEASURES WITHOUT QUANTIFIED EMISSIONS REDUCTIONS

Table 4-4 provides an overview of measures in the Climate Budget and is equivalent to Table 2.2.B in City Council Proposition 1. The emissions-reducing effects of the activities in this table are not quantified. The “Emissions sector” and “Emissions source” fields in the table refer to the category in the Norwegian Environment Agency’s emissions statistics by municipality, where it is expected that an effect can be achieved. A description of the measures in Table 4-4 is provided in Attachment 2.

We expect measures 16-21 to have a positive climate effect, but there has not been an adequate technical basis to allow quantification of these effects for the Climate Budget 2019. The continuation or implementation of these measures has been approved in order to improve the likelihood of achieving the 2020 goal. Accordingly, it is not clear to what extent the measures will contribute to achieving the 2020 goal, since there is uncertainty about the potential magnitudes and timings of their effects. Measure 22 refers to further assessment of existing and new measures and instruments, for the purpose of increasing the likelihood of goal attainment.



Table 4-4: Measures to increase the likelihood of goals being achieved in 2020

Emissions sector	Emissions source	No.	Measures and instruments
Waste and waste-water treatment	Landfill gas	16	Landfill gas extraction - Grønmo - Rommen - Stubberud (study)
Energy supply	Waste incineration	17	Increased extraction of plastic from household waste - Waste Strategy
Road traffic	Light vehicles	18	Package of measures to encourage climate-friendly travel to and from work - Grants for measures at municipal workplaces - Engage in dialogue with union representatives - Subsidy scheme for measures in private-sector businesses - Businesses for the Climate
	Light vehicles	19	Package of measures to encourage climate-friendly transport of goods Commercial transport - Loading bays - Freight consolidation centres - Battery-charging infrastructure - Standardized municipal procurement requirements - Subsidy schemes
	Light vehicles	20	Street-parking measures (including resident-only parking) - Resident-only parking zones will be implemented before 2019. - In 2019, just under 200 street parking spaces within Ring 3 will be need to be removed in connection with cycling measures, initiatives to reduce delays on public transport, other public transport projects and the Car-Free City Life programme.
	Heavy duty vehicles	21	Package of measures to encourage climate-friendly heavy freight transport Heavy duty transport - Pilot project for bulk freight transport - Standardized municipal procurement requirements - Pilot for a zero-emission transport route
-	-	22	Assess, and potentially implement, enhancements to existing measures in order to increase their climate effects, including: - Possibilities for reducing toll-ring charges for zero-emission or low-emission commercial/utility vehicles - Possibilities for further roll-out of resident-only parking in city districts - Possibilities for achieving larger emissions cuts in waste management - Possibilities for further escalation of efforts to use

4.5. ACTIVITIES LEADING UP TO 2020 AND 2030

Table 45 provides an overview of climate-related activities to be implemented in the periods to 2020 and 2030, and corresponds to Table 2.3 in City Council Proposition 1. These are activities that support efforts to reduce emissions by 2020, or that lay the groundwork for future emissions reductions. The emissions-reducing effects of the activities in this table are not quantified.

Table 4-5: Activities leading up to 2020 and 2030

Category	No.	Activity
Communication/ mobilization	A	Marketing of Enova's subsidy schemes in Oslo - <i>Contribute to increasing awareness of subsidy schemes</i> - <i>Disseminate information about the ban on using fossil fuel to heat buildings from 2020</i> - <i>Contribute to hastening the implementation of climate measures</i>
Communication/ mobilization	B	Disseminate information about climate solutions to encourage behavioural change - <i>Disseminate information about practical climate measures/solutions</i> - <i>Disseminate information about municipal climate efforts</i> - <i>Further develop the KlimaOslo.no communications platform</i>
Communication/ mobilization	C	Businesses for the Climate - <i>Continue cooperation on climate measures between businesses and the city authorities in the City of Oslo. Increase the number of participants.</i> - <i>In 2019, businesses will play a key role in Oslo's status as European Green Capital.</i>
Communication/ mobilization	D	Climate communications targeted at children and teenagers - <i>Climate portal for pupils at Oslo schools</i> - <i>"Climate pilots" in Oslo schools</i> The Climate House - <i>Technical input to/collaboration with the Climate House</i> - <i>Teaching and actively disseminating information to primary and lower secondary schools</i> - <i>Exhibitions and dissemination of information to the city's population</i>
Communication/ mobilization	E	Bykuben – Oslo Centre for Urban Ecology - <i>Continue to develop what the centre offers to everyone who wants to learn about, and participate in, ecological work in the urban environment.</i> - <i>Help the city's residents to feel a sense of ownership over, and see the potential in, the shift towards becoming a zero-emissions society.</i> - <i>Provide guidance to the city's districts in the development and promotion of local environmental and climate measures.</i>
Facilitating measure	F	Car-Free City Life Programme - <i>Measures to create a better and livelier urban environment within Ring 1 during this City Council term</i>
Facilitating measure	G	Better provision for pedestrians
Facilitating measure	H	Climate-friendly urban development including densification around transport hubs
Facilitating measure	I	Increased material recycling of commercial waste - <i>In 2019 and 2020, the Agency for Waste Management will work to achieve a target of 36 percent material recycling for commercial waste.</i> - <i>Facilities will be improved to allow increased reception and post-sorting of commercial waste.</i>
Facilitating measure	J	Reduced usage of single-use plastics in municipal activities - <i>Survey the municipality's use of plastics.</i> - <i>Prepare guidance for organizing plastic-free, eco-friendly events</i> - <i>Collaborate with key actors in this field in Oslo</i>

Category	No.	Activity
Facilitating measure	K	Acquire sites for municipal climate measures (incl. energy stations) - <i>As needed, contribute to identifying suitable areas for the implementation of climate measures.</i> - <i>This measure is particularly directed towards sites for energy stations and associated infrastructure, but can also be applied in other contexts.</i>
Facilitating measure	L	Production of biogas for fuel - <i>Production of biogas from food waste at Romerike Biogas Plant</i> - <i>Production of biogas from sewage sludge at Bekkelaget Wastewater Treatment Plant</i> - <i>VEAS is considering investing in equipment to upgrade the biogas to fuel quality.</i>
Facilitating measure	M	Establish energy stations supplying at least one renewable fuel (not including battery-charging facilities and biodiesel) for passenger cars and light duty and heavy duty vehicles - <i>Plan and contribute to the establishment of energy stations at Alnabru, Ryen and Klemetsrud.</i> - <i>In 2019, a scheme will be implemented to provide grants from the Climate and Energy Fund for the establishment of energy stations.</i>
Study/planning/pilot	N	Facilitation of smarter and more climate-friendly journeys - <i>Pilot project: Mobility-as-a-service ("MaaS") project designed to simplify everyday travel logistics (several actors).</i> - <i>Pilot project: Smarter transport in the Oslo region (safer, more efficient, and more eco-friendly road transport).</i> - <i>Continue the development of Intelligent Transport Systems (ITS) and sensor technology to improve parking and traffic management</i> - <i>Optimal management of signalling equipment for pedestrians, cyclists, and public transport</i> - <i>Establish a new system to prioritize public transport</i>
Study/planning/pilot	O	Facilitating more efficient and climate-friendly commercial and utility transport - <i>Use Intelligent Transport Systems (ITS) for commercial traffic</i> - <i>Zero-emission final mile city distribution</i>
Study/planning/pilot	P	Pilot project for electrification of an entire housing cooperative (EU – Green Charge)
Measures in the period to 2030	Q	Carbon capture at the Klemetsrud facility (Fortum Varme AS)
Measures in the period to 2030	R	New Fornebu Light Railway
Measures in the period to 2030	S	New central metro tunnel
Measures in the period to 2030	T	Tram programme
Measures in the period to 2030	U	New signalling and interlocking plant for the metro

5. Evaluation of emissions trends in the period to 2020

The revised climate goal for 2020 is to reduce Oslo's GHG emissions from emissions sectors covered in the formulation of the goal to a maximum of 766,000 tonnes CO₂e.

In this chapter, we analyse the probability of goal attainment, annual trends in the effects of measures, emissions trends in the period to 2020, and the need for additional measures to reduce GHG emissions in Oslo.

5.1. ANALYSIS OF THE PROBABILITY OF GOAL ATTAINMENT IN 2020

In light of the revised climate goal for 2020 of reducing Oslo's GHG emissions to a maximum of 766,000 tonnes CO₂e, we must reduce emissions by at least 319,215 tonnes CO₂e in the period 2016-2020. This requirement has been assessed on the basis of absolute emissions levels in 2016.

Currently, we calculate that the quantified emissions-reducing measures will succeed in reducing emissions by 223,400 tonnes CO₂e in the period 2016-2020. This means that there is a gap between the ceiling on limits set by the climate goal for 2020 and the effects of the climate measures of 95,815 tonnes CO₂e.

The Climate Agency's assessment of the probability of goal attainment in 2020 shows a need to boost existing measures and to implement new ones.

In addition to the elements of uncertainty referred to in this Technical Report concerning the effects of the quantified climate measures (in Table 4-1), there are several other factors that must be taken into consideration when considering whether goal attainment in 2020 is possible. One of these factors is that many of the measures that cannot be quantified (in Table 4-4) will contribute to reducing emissions when they are implemented. Parts of this effect, for example reduced emissions from travel to and from work and from commercial transport, may potentially occur in 2020.

In order to increase the likelihood of goal attainment, we could implement new measures and boost existing measures so that they take effect in 2020. In relation to increasing the environmental differentiation of toll-ring fees, reducing emissions from commercial transport and construction machinery, travel to and from work, and in the waste management sector, instruments can be applied more stringently in the period before 2020.

Table 5-1: Projected emissions in 2020 and the gap between projected emissions and the 2020 climate goal

CLIMATE BUDGET 2019	1990	2016	2020
GHG emissions (exclusive of maritime traffic and aviation)*	1,200,000	1,085,215	-
Effect of measures			223,400
EMISSIONS IN 2020 (exclusive of maritime traffic and aviation)*			861,815
2020 goal			766,000
Difference			-95,815

* emissions from agriculture are set basically at 0

The mobile sector is in a period of transition in which it can be difficult to forecast the nature of changes and how rapidly they will occur. One example of the difficulty of calculating effects is that several different measures and instruments may interact to have a greater aggregate effect than would be indicated when assessing each measure or instrument individually.

Improvements in the quality of emissions statistics may also change our assessment of the likelihood of goal attainment, because it may become apparent that emissions levels and trends for significant sources, e.g. road traffic, are different to what was assumed previously.

If new measures are implemented, if existing instruments are applied more stringently, and if measures that are so far unquantified have a significant climate effect, then attainment of the 2020 climate goal may be possible.

Current assessments within the maritime sector show that Oslo is implementing several measures that will take effect by 2020. A reduction in emissions of approximately 85 percent in the period to 2030 is potentially within reach.

Using existing methods, it is uncertain to what extent the impact of some of the measures will be captured in the Norwegian Environment Agency's emissions statistics by municipality. This applies in particular to the use of shore power and quayside energy measures. The Climate Agency will be participating in the reference group on work to improve the emissions statistics, and will highlight this issue with the objective of taking greater account of such measures in future emissions statistics.

5.2. ANNUAL TRENDS IN EFFECTS OF MEASURES

The table below shows emissions in 2016 and estimated reductions in emissions by sector, assuming implementation of the measures described in Chapter 4. The emissions reductions are divided between the years 2017-2020 on the basis of the assumptions described in Attachment 1. The annual effect of the measures is uncertain. The effect of the measures is viewed in relation to emissions levels in 2016. Where we have information about trends in 2017, we have taken account of these trends when allocating the effects of measures to different years. This means that in some cases the emissions effect in 2017 is negative. In such cases, the calculated effect of the years 2018-2020 is increased pro rata. Residual emissions indicate the residual emissions in Oslo for the years 2017-2020 assuming that emissions are not affected by factors other than implementation of the measures. Emissions from aviation and maritime traffic are not included in the climate goal, and accordingly are not shown in the table. The remaining emissions are compared with 2016 emissions for those sectors included in the goal formulation for 2020.

Table 5-2: Greenhouse gas emissions in 2016 and planned emissions reductions by sector

Emissions sector	Emissions 2016	Planned emissions reductions			
		2017	2018	2019	2020
INDUSTRY, OIL AND GAS	6,241	-	-	-	-
ENERGY SUPPLY	236,140	-300	900	1,400	2,200
HEATING	111,017	2,000	22,500	44,900	-
ROAD TRAFFIC	601,587	24,850	24,850	30,700	42,000
OTHER MOBILE COMBUSTION*	91,854	-100	300	400	26,800
WASTE AND WASTEWATER	38,376	-	-	-	-
TOTAL with the framework	1,085,215	26,450	48,550	77,400	71,000
Residual emissions compared with 2016		1,058,765	1,010,215	932,815	861,815

There is uncertainty attached to the calculations of the effects of measures. As already discussed, one of the reasons for this uncertainty is that the magnitude of the activity covered by a measure is not necessarily known. One example is the package of measures to promote zero-emission construction machinery, because there is uncertainty about the actual level of total emissions from construction activities in Oslo. Other sources of uncertainty in the calculations are linked to the choice of emissions factors to use (e.g., if the details of the vehicle fleet composition are unknown), and the time horizon for the implementation of the measure, i.e., whether a measure will achieve full effect within a specific year. In addition, the emissions-reducing potential assumes that all instruments are applied effectively. It will also be challenging to assess goal attainment if the emissions statistics do not capture the effects of measures because they are not included in the source data.

5.3. NEED FOR ADDITIONAL MEASURES IN THE PERIOD TO 2020

The emissions-reducing effect of measures contained in the Climate Budget is approximately 21 percent of emissions in 2016 (restricted to emissions covered in the formulation of the climate goals). This will not allow us to achieve the 2020 goal, and our analysis shows that further measures are needed if we are to achieve this goal. In addition, the Climate Agency commissioned CICERO and the Institute for Transport Economics (TØI) to calculate a new baseline scenario for the years to 2030 (see Chapter 3.1), and this may also affect the need for measures.

It is worth noting some known trends that have occurred since 2016, such as an increase in emissions from the Klemetsrud waste incineration facility in 2017. In addition, the sales figures for petroleum products show a rise in sales of red diesel. There has also been a decline in landfill gas extraction in 2017, and this will probably result in increased emissions from landfill sites. These trends may make it more difficult to achieve the 2020 goal of capping emissions at 766,000 tonnes CO₂e.

If we assume a firm 2020 goal of capping emissions at 766,000 tonnes C₂e, methodological changes and improvements may also make this goal more difficult to achieve.

5.4. MANAGEMENT OF EXISTING INSTRUMENTS AND STUDIES OF NEW MEASURES

As the foregoing discussion shows, we will not be able to reduce emissions sufficiently to achieve the 2020 goal of capping emissions at 766,000 tonnes CO₂e only through measures that already been implemented and the implementation of planned measures whose effects have been quantified. If we are to achieve the 2020 climate goal, we must identify and implement new measures. In addition, the stringency of existing instruments should be increased. City Council Proposition 1, Climate Budget 2019, states: “The City Government will implement additional measures in an endeavour to address the remaining requirement for emissions cuts of 96,000 tonnes CO₂e”. It also states that “The Climate Budget wishes to note the planned implementation of several measures that will result in emissions reductions that so far have not been susceptible to quantification.” This applies to measures 16 – 21 in Table 2.2.B. In addition, the Proposition states that “The City Government will evaluate possible ways of boosting existing instruments to achieve further cuts in emissions (see measure no. 22 Table 2.2B”.

This is incorporated in Table 2.2.B in City Council Proposition 1 as a measure to increase the likelihood of attainment of the 2020 climate goal. This is described in this Technical Report in Chapter 4.4. Measures in this table are expected to contribute to achieving the 2020 climate goal, but we do not have sufficient data to say how much the gap will be closed. Some of the challenges associated with closing the gap are a lack of defined measures or defined areas for which measures and instruments can be developed, as well as timing considerations relating to the implementation and execution of possible measures and instruments. In reality, this work must be executed during 2019, with only one year left until 2020, which poses challenges for the realistic scope for reducing emissions.

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Attachment 1

1. Phasing-out of oil-fired heating in municipal buildings

Effect of measure 2016-2020	400 tonnes CO ₂ e
Effect of measure 2020-	0 tonnes CO ₂ e
	Operations with oil-fired heating (KLI)

1.1. DESCRIPTION OF MEASURE

The government has decided to ban the use of heating oil and paraffin to heat buildings from 2020, cf. Regulations concerning a ban on the use of mineral oil to heat buildings. Currently the City of Oslo is running an information campaign about grants to encourage the removal of oil-fired boilers from privately-owned buildings. It is important that the municipality positions itself at the forefront of this work and sets a good example by phasing out all use of heating oil and paraffin in its own buildings well before the ban comes into effect. Bio-oil is not considered an optimal substitute, and efforts should be made to transition to other energy sources. Oslo's Environment and Climate Report 2017 reported that there were 15 oil-fired boilers in municipal buildings (owned and rented) in 2017, as against 23 in 2016.

Figures in Oslo's KOSTRA reporting to the national government showed that emissions from municipal buildings totalled 74.2 tonnes CO₂e in 2016. Figures supplied for the Environment and Climate Report suggest that actual emissions are higher, and that Oslo's KOSTRA reporting is defective in this area.

1.2. CALCULATION OF EFFECT

On the basis of figures supplied for the Environment and Climate Report 2017, we have identified an emissions reduction of 248 tonnes CO₂e from 2016 to 2017. In 2016, emissions totalled 439 tonnes CO₂e, while the total for 2017 was 191 tonnes CO₂e. This corresponds to a 57 percent reduction in emissions. In addition, we have assumed reductions in the remaining emissions of 33 percent in 2018 and 66 percent in 2019. For 2020, we have assumed that there will be basically zero emissions from the use of heating oil and paraffin. Our calculation was based on the emission level in 2016, and assumed no changes in activity over the period, apart from changes resulting from the measure.

1.3. UNCERTAINTY AND RISK FACTORS

The source of data for GHG emissions from municipal buildings is the municipality's KOSTRA reporting statistics. Accordingly, the effect should be apparent directly in the statistics. However, as

mentioned above, there is a discrepancy in this area between the municipality's KOSTRA reporting and its Environment and Climate Report. As a result, the effect of this measure may not be visible in the statistics.

It is possible to apply for an exemption/dispensation from the ban. Accordingly, the effect of this measure may be somewhat lower than calculated.

1.4. REFERENCES/SOURCES

- City of Oslo, Environment and Climate Report 2017: <https://www.klimaoslo.no/rapporter/>
- National regulation: <https://www.regjeringen.no/no/aktuelt/forbud-mot-bruk-av-mineralolje-til-oppvarming-av-bygninger-fra-2020-vedtatt/id2606491/>

2. Phasing-out of oil-fired heating in privately-owned and commercial buildings

Effect of measure 2016-	69,000 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	MOS/STAT/KLI

2.1. DESCRIPTION OF MEASURE

The government has decided to ban the use of heating oil and paraffin to heat building from 2020, cf. Regulations concerning a ban on the use of mineral oil to heat buildings. Currently the City of Oslo is running an information campaign about grants offered by both the municipality and ENOVA to encourage the removal of oil-fired boilers from privately-owned buildings and housing cooperatives. Bio-oil is not considered an optimal substitute, and efforts should be made to transition to other energy sources.

The Agency for Fire and Rescue Services has a list of the addresses of large buildings (housing cooperatives and commercial buildings) where oil-fired boilers are in use. This list comprises approximately 300 addresses. Information has been mailed to these addresses regarding the impending ban.

In addition, the Agency for Urban Development maintains a larger register of households with oils tanks. This register has approximately 20,000 entries, including approximately 11,000 oil tanks recorded as being currently in use. This is most likely an over-estimate/out of date, due to a lack of reporting from private households about the use/dismantling/removal of tanks.

2.2. CALCULATION OF EFFECT

Emissions from the use of oil-fired heating appear under the sector titled "Heating" in Statistics Norway's emissions statistics by municipality. In addition to emissions from light heating oil and paraffin, this sector also includes a large proportion of emissions from gas (LPG). We have assumed that a large proportion of this LPG is being used in the building and construction sector, and not for heating existing buildings.

The effect of the measure has been assessed using figures from Statistics Norway for annual sales of petroleum by municipality in 2016 and 2017 (SSB, 2018). In addition, we have taken emissions factors from miljokommune.no for, respectively, light heating oil (0.0026 t CO₂/l) and paraffin (0.0026 t CO₂/l). In 2016, emissions from the use of heating oil and paraffin in Oslo totalled 69,463 tonnes CO₂e. From 2016 to 2017, these emissions fell by 2,086 tonnes CO₂e.

To calculate emissions from privately owned and commercial buildings, reported emissions from municipal buildings (as per the Environment and Climate Report) were deducted from the overall total. Emissions from privately owned and commercial buildings in 2016 and 2017 totalled, respectively, 69,463 tonnes CO₂e and 67,187 tonnes CO₂e. From 2016 to 2017, these emissions fell by 1,837 tonnes CO₂e. This corresponds to a reduction of 3 percent. We have assumed emissions reductions of 33 percent in 2018 and 66 percent in 2019. For 2020, we have assumed that there will be basically zero emissions from the use of heating oil and paraffin.

Our calculation was based on emission levels in 2016, and assumed no changes in the consumption of heating oil over the period, apart from changes resulting from the measure.

2.3. UNCERTAINTY AND RISK FACTORS

The source of data for GHG emissions from privately owned and commercial buildings is figures from Statistics Norway for sales of petroleum products by municipality, based on the delivery address. There is uncertainty about whether heating oil and paraffin are used in the same municipality as where delivery takes place. This factor, together with other uncertainties in the data, means that the emissions effect may not be reflected directly in the emissions statistics.

It is possible to apply for an exemption/dispensation from the ban. Accordingly, the effect of this measure may be somewhat lower than calculated.

2.4. REFERENCES/SOURCES

- National regulation: <https://www.regjeringen.no/no/aktuelt/forbud-mot-bruk-av-mineralolje-til-oppvarming-av-bygninger-fra-2020-vedtatt/id2606491/>
- Statistics Norway (2018): Salg av petroleumprodukt. <https://www.ssb.no/energi-og-industri/statistikker/petroleumsalg/aar>
- Norwegian Environment Agency (2018): Miljøkommune.no: Utslipp fra forbrenning, tabell. http://www.miljokommune.no/Temaoversikt/Klima/Klima--og-energiplanlegging/omregningsverktoy_tabeller/CO2-utslipp-for-ulike-energivarer-tabell/

3. Phasing out the use of fossil oil and gas for district heating during peak-load periods

Effect of measure 2016-	4,200 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	NOE

3.1. DESCRIPTION OF MEASURE

In the municipal emissions statistics, emissions from the use of fossil oil and gas in district heating (during peak load periods) are recorded under the sector titled “Energy supply” and the source “District heating, except for waste incineration”. In 2016, such emissions in Oslo totalled 4,557.5 tonnes CO₂e.

The “Regulations concerning a ban of the use of mineral oil to heat buildings” contain an exemption from the ban for large district heating plants. “Also exempt from the provisions of this regulation is the use of mineral oil in district heating plants with nominal thermal effects of at least 1 MW”. The assessment of this measure’s effect is based on Fortum Oslo Varme AS’s target of not using fossil energy sources (oil and gas) during normal operating conditions after 2020. Fortum Oslo Varme AS have informed us that they are working to replace all fossil energy in the mix, but they have not confirmed whether this will happen before the end of 2020.

3.2. CALCULATION OF EFFECT

Heating oil and natural gas comprise, respectively 0.1 percent and 1 percent, of the total energy used as production factors in district heating in Oslo. Fortum Varme AS’s Annual Report 2017 contains figures for the consumption of various energy carriers in MWh/year. The Climate Agency has calculated emissions from the consumption of, respectively, fossil oil and gas. In 2016, emissions totalled 4,150 tonnes CO₂e, while the total for 2017 was 4,449 tonnes CO₂e. In addition, there were some combustion-related emissions of methane and nitrous oxide.

From 2016 to 2017, emissions increased by 299 tonnes CO₂e, or 7 percent. We have assumed that emissions will fall in the period leading to 2020, by respectively 900 tonnes CO₂ (20 percent share) in 2018, 1,350 tonnes CO₂ (30 percent share) in 2019 and 2,250 tonnes CO₂ (50 percent share) in 2020. Accordingly, we have assumed that the use of fossil oil and gas for district heating in Oslo will cease before the end of 2020. Our calculation was based on the emission level in 2016, and assumed no changes in activity over the period.

3.3. UNCERTAINTY AND RISK FACTORS

This emissions effect is tinged with uncertainty, since it is based on a target rather than on direct instruments. The City of Oslo owns a 50 percent stake in Fortum Oslo Varme AS, and is working actively to ensure a rapid phasing-out of the use of fossil energy carriers during peak load periods. The district heating plants are subject to a supply obligation, however, so the effect of the measure may be somewhat lower than estimated if fossil energy sources continue to be used after 2020.

3.4. REFERENCES/SOURCES

- Key figures Hafslund: <https://www.hafslund.no/artikler/miljo-og-samfunnsansvar/nokkel-tall-2017/18gzje3rb44YGi4USygsIq>
- Key figures Fortum: <https://www.fortum.no/nokkeltall-miljo-og-klima-2018>
- Overview of Fortum's energy production: <https://www.fjernkontrollen.no/fortum-oslo-varme/>
- Energy content according to energy source: <https://www.ssb.no/a/magasinet/miljo/tabell.html>
- Energy carrier data: <https://gasnor.no/naturgass/typiske-data-energi/>

4. Road user payment system at the toll ring

Effect of measure 2016-	36,100 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	MOS

4.1. DESCRIPTION OF MEASURE

The system of road user payments implemented under Oslo Package 3 is one of the most powerful instruments for reducing GHG emissions from road traffic in Oslo. In the Climate Budget 2018, we assumed the measure would have an effect of reducing emissions from road traffic by 16 percent between 2015 and 2020. The Climate Agency has commissioned a new calculation of the effect of the new road user payment system at the toll ring. The new calculation suggests that the measure will reduce emissions by between 4 and 10 percent between 2016 and 2020.

The calculation was made by Multiconsult (in collaboration with NILU and Trafikkanalyse AS). During work on the new calculation, an error was discovered in the calculation of atmospheric emissions (COWI, 2017) on which the original calculation had been based.

The error had occurred in the transmission of data extracted for the calculation of atmospheric emissions for 2014: light vehicles = light vehicles + heavy vehicles ("light vehicles" = passenger cars and LCVs combined). As a result, COWI's analysis over-estimated the reduction in traffic work between 2014 and 2020, and consequently the reduction in emissions was over-estimated. The error does not affect traffic figures in general.

The new calculation of the measure's climate effects also considers new expert assessments of factors impacting on the measure's effects. The base year for the COWI (2017) study was 2014, with electric vehicles accounting for 2.5 percent of passenger cars and 0.5 percent of LCVs. In the Multiconsult study (2018), these figures were updated. In 2016, electric vehicles accounted for well over 6.6 percent of passenger cars and 1.2 percent of LCVs.

As part of this work, the emissions factors for various vehicles were reassessed. In the new calculation, the emissions factor for light vehicles is, on average, about 20 percent lower than the factors used in COWI (2017). For HGVs, the emissions factor is approximately 20 percent higher in the new calculation than in COWI (2017).

Due to uncertainty surrounding some of the factors in the study, we have subjected the effect to a sensitivity analysis. There is particular uncertainty about the extent of the negative impact of the introduction of low toll fees on the increase in the percentage of electric cars. The method applied in the Multiconsult report exaggerates this negative impact. In addition, there is uncertainty about the proportion of heavy vehicles in Oslo.

We have calculated that GHG emissions from road traffic in the City of Oslo will be reduced by between 4 and 10 percent from 2016 to 2020 as a result of the instruments in Oslo Package 3. The reduction is attributable mainly to the increase in the share of electric passenger cars, which will result in a reduction in emissions from light vehicles of between 12 and 17 percent. Emissions from heavy vehicles, excluding buses, will change by between -1 and 4 percent. We have not made new assessments of the traffic-reducing of the measure.

4.2. CALCULATION OF EFFECT

On the basis of Multiconsult's report on the emissions reductions resulting from the revised Oslo Package 3, this Climate Budget contains the first assessment of this measure's effect. The effect has been calculated by deducting the positive net effect of the measure between 2016 and 2020 for light and heavy duty vehicles from the figure for road traffic emissions for 2016. The report shows a 4-10 percent net reduction in emissions between 2016 and 2020.

In the Climate Budget, we assume that it is possible to achieve a 6 percent total reduction in emissions from road traffic in the Norwegian Environment Agency's emissions statistics by municipality between 2016 and 2020⁴. Six percent is the average of 4 percent (the lowest estimate) and 8 percent, which is the remaining change following adjustment for the error in the COWI report from 2017. This gives an emissions-reducing effect of 36,100 tonnes CO₂e in the period 2016-2020.

We assume that the effect of the measure will have a linear distribution over the years 2017-2020. The effect will probably be slightly lower in 2017 and higher in the subsequent years, due to the implementation of the new system of differentiated toll-ring charges on 1 October 2017. In addition, the introduction of tolls fees for electric cars at the toll ring may flatten out the trend for increasing electric car ownership, which would mean a potential delay to the emissions reduction.

In the Climate Budget, we explain that the effect of the road-user payment system measures, including new toll stations in 2019, is dependent on the implementation of the following measures:

- adequate battery-charging infrastructure for passenger cars
- continued implementation of local and regional instruments to promote the use of zero-emission cars.
- continued implementation of national instruments to promote the use of zero-emission cars.
- increased public transport capacity to cope with population growth and reduced use of private cars.
- implementation of the Package of 100 initiatives to reduce delays on public transport.

4.3. UNCERTAINTY AND RISK FACTORS

Such calculations are tinged with uncertainty. In particular, the assumptions regarding the effects of the proportions of electric vehicles and heavy vehicles are uncertain. To allow for this uncertainty, the Climate Agency has elected to use the average of the potential reductions identified in the report. The actual effect may be higher or lower, and there is also much uncertainty about the timing of the

⁴ The figures from the Multiconsult report cannot be used directly, since NILU's method for calculating road traffic emissions was not identical to the current statistical method.

emissions- reducing effect/ We do not show an estimated effect for 2022 or for the period leading up to 2030, since the uncertainty calculation in the report was performed only for the period 2016-2020.

4.4. REFERENCES/SOURCES

- COWI report (2017): COWI, Transportanalyse AS and NILU (2017) Virkninger av revidert avtale Oslopakke 3 https://www.vegvesen.no/_attachment/1997877/binary/1205065?fast_title=12.09.17.+Rap%ADport+om+virkning+av+revidert+O3%ADavtale.pdf
- Multiconsult report (2018): Multiconsult, Transportanalyse AS og NILU (2018) Reduserte klimagassutslipp som følge av revidert Oslopakke 3. Available via: <https://www.klimaoslo.no/rapporter/>

5. Implementation of the 20 percent national biofuel blending requirement in 2020

Effect of measure 2016-2020	30,600 tonnes CO ₂ e
Effect of measure 2020-	0 tonnes CO ₂ e
	Central government

5.1. DESCRIPTION OF MEASURE

The Products Regulation imposes requirements regarding the blending of biofuels into petrol and diesel sold for road transport in Norway. In 2020, the biofuel-blending requirement will be set at 20 percent. Advanced biofuels are double-counted in the fuel blending regulations, which means that the actual volume of blended biofuels is expected to be 16 percent in 2020, not 20 percent.

The purpose of the biofuel-blending requirement is to promote the sale of biofuels for road traffic and promote sustainability for biofuels and liquid biofuels. Biofuels are categorized as zero-emission in the national emissions accounting system. Although GHG emissions result from the value chain for the production and transport of biofuels, the actual combustion of biofuel in vehicles is assumed to be emission-free.

5.2. CALCULATION OF EFFECT

In order avoid double-counting, the emissions-reducing effect of the biofuel-blending requirement is calculated as the residual road traffic emissions following the deduction of the effect of other road traffic measures (measures to reduce traffic generally and technological measures such as measures to encourage the transition to electric vehicles).

In the Climate Budget, the effect of the measure has been assessed based on the gradual increase of the biofuel-blending requirement, from a physical blending requirement of 10 percent in 2016 to 20 percent in 2020 (or 16 percent when corrected for double-counting in relation to advanced biofuels). The biofuel-blending requirement will cause a 6 percent reduction in residual road traffic emissions from 2016 to 2020.

This calculation assumes that the road traffic emissions from light and heavy vehicles remain constant at 2016 levels, and that there is a linear annual trend. As we do not know whether there will be further increases in the biofuel-blending requirement after 2020, no effect has been calculated for the period after 2020.

5.3. UNCERTAINTY AND RISK FACTORS

The actual effect of the measure may deviate from the calculated effect. Either more or less biofuel may be blended into fuel sold in Oslo. It is also possible that there will be over-compliance with the requirement in 2020. It is important to note that the effect of this measure has been assessed only in relation to Scope 1 (direct GHG emissions in Oslo).

5.4. REFERENCES/SOURCES

- The Norwegian Products Regulation: <https://lovdata.no/dokument/SF/forskrift/2004-06-01-922?q=20040601922>

6. Better provision for cyclists

Effect of measure 2016-2020	1,600 tonnes CO ₂ e
Effect of measure 2020-	Not quantified
	MOS/BYM/KLI

6.1. DESCRIPTION OF MEASURE

The City of Oslo has an active commitment to cycling in the form of a broad range of measures (Oslo Cycling Strategy 2015-2025). Encouraging more people to choose to cycle is fundamental to many of the city's most important goals, such as the goals to reduce GHG emissions, reduce noise, improve air quality, improve the quality of urban life, and improve public health. In order to calculate the climate effect of this commitment, ideally, we would have assessed the direct effects of the measures and instruments. Currently we do not have satisfactory tools, however, to allow us to calculate the effects of these measures. Even so, it is well known that such efforts are effective.

The first calculation of the effect of the climate measure "Better provision for cyclists" was included in the Climate Budget 2018, and we have adjusted this calculation for the Climate Budget 2019. The calculation of the effect of the commitment to cycling assumes that the City of Oslo attains its goal for the proportion of weekday journeys made by cycle in 2020. It also assumes that the same growth in the proportion of journeys made by cycle will be achieved for weekends. The most recent survey of travel habits in Oslo, conducted in 2017, showed that 7.3 percent of journeys were made by bicycle. Due to weaknesses in the data about the proportion of journeys made by bicycle previously in Oslo, it is difficult to assess the rate at which this proportion is changing. Accordingly, we have assumed that 10 percent of journeys will be made by bicycle in 2020. In the calculation of the climate effect in 2020, we have however considered the effect of how different proportions of the new cycle journeys have replaced car journeys. This approach has been adopted to highlight the uncertainty of the

calculations. We do not consider any assessment of the effect of this measure beyond 2020 to be useful until a new survey of travel habits provides better knowledge about changes in the proportion of journeys made by bicycle.

6.2 CALCULATION OF EFFECT

If 10 percent of journeys are made by bicycle in 2020, this will result in an emissions reduction from 2016 to 2020 of 800 tonnes CO₂, assuming that 11 percent of these journeys would previously have been made by car. If 34 percent were previously made by car, the reduction is 2,400 tonnes. As explained above, we have examined various assumptions in order to highlight the uncertainty attached to this calculation.

Since it has not been possible to calculate the effect of these instruments precisely, we have elected to assess their emissions-reducing effect by taking the average of our two calculations for the rate of substitution of car journeys by bicycle journeys. The result is an effect of 1,600 tonnes CO₂ in the period 2016-2020.

We assume that the effect will have a linear development during this period. In other words, the annual emissions reducing effect is approximately 400 tonnes CO₂. This is a simplified assessment, and it may be that the trend will increase over time.

The calculation of the effect of the measure assumes the following:

1. Oslo achieves its goal of 10 percent of weekday journeys being made by bicycle in 2020.

Oslo's Cycling Strategy 2015-2025 (City Council Proposition 258 of 19 December 2014) set a goal of 16 percent of weekday journeys being made by bicycle in 2025, but the City of Oslo's Climate and Energy Strategy sets a goal of increasing the percentage of weekday journeys being made by bicycle to 16 percent by 2020 and 25 percent by 2025. In consultation with the Agency for Urban Development, the Climate Agency has calculated the effect of the measure on the assumption that 10 percent of weekday journeys will be made by bicycle in 2020.

Oslo's Cycling Strategy assumes a base point in 2013 of 8 percent of weekday journeys being made by bicycle. The survey of travel habits conducted for the Agency for Urban Development in 2017 suggests that 8 percent was something of an over-estimate. Accordingly, we have used the figure from the Agency for Urban Development's travel habits survey in autumn 2017 as the basis for our calculation. This found that 7.3 percent of weekday journeys were made by bicycle on weekdays, and 3.6 percent at weekends.

2. We expect the percentage of weekend journeys made by bicycle to increase to 8 percent in 2020.

Oslo's cycling goal applies to weekday journeys, not weekend journeys. Our calculation assumes that the increase in the proportion of weekday journeys being made by bicycle will be accompanied by a similar increase at the weekends. Since the proportion of cycling journeys is lower at weekends than on weekdays, we have assumed that 5 percent of weekend journeys will be made by bicycle in 2020, compared to 3.6 percent currently.

3. There are 230 weekdays and 135 weekend days in the year.

We have based our assessment of the number of weekdays and weekend days on the Norwegian Tax Administration's assumption that a full-time employee completes 230 working days each year. This implies a total of 135 weekend days.

4. We have taken as our starting point the changes in travel habits among Oslo's population in 2016.

The population figure is taken from the City of Oslo's own statistics. In 2016, the population of Oslo was 658,390. In 2020, the population is expected to rise to 690,135. However, emissions reductions can only be caused by alterations in the travel habits of people who lived in Oslo in 2016. Accordingly, we have based our calculations on the population figure for 2016.

5. A person living in Oslo makes an average of 3.4 journeys on weekdays and 2.7 journeys at weekends.

In our calculation, we assume that a person living in Greater Oslo makes an average of 3.4 journeys on weekdays, 3.1 journeys on Saturdays, and 2.2 journeys on Sundays. In our calculations for weekends, we have assumed an average figure of 2.7 journeys. These figures are based on Prosam Report 218 (Ellis et al. 2015).

6. We have assumed that the length of a cycle journey is 3 kilometres.

The travel habits surveys conducted for the Agency for Urban Development both found that the median length of a cycle journey was 3 kilometres. The reason for using the median journey length rather than the average journey length is that training trips increase the average length, and training trips do not replace journeys made using fossil fuels.

Overall, these assumptions produce the following calculation for 2016:

Population 2016 * no. daily journeys per person * percentage by bicycle * journey length
* no. days = aggregate daily cycle journey length in 2016

658 390 people * 3.4 daily journeys * 7.3 percent * 3 km * 230 days
= aggregate daily cycle journey length in 2016

The same calculation is made for 2020, with equivalent calculations for weekends.

7. It is uncertain how many of the new cycle journeys would previously have been made by car.

An increase in cycling may be attributable to a transition from journeys made by walking, public transport or car, and it is uncertain how many replace car journeys. We have calculated the following two variants:

Variant 1: 11 percent of cycling journeys would otherwise have been made by car (and correspond to 11 percent of the distance that is transferred from car journeys). This is based on a finding that currently 11 percent of people cycling in Oslo state that a car is their alternative means of transport.

Variant 2: We have assumed that the transfer from car journeys is proportional to shares of transport means. Based on Ruter's survey of travel habits, the share of car journeys is assumed to be 34 percent in 2016 following deduction of people who cycle (the share of car journeys was 32 percent and the share of cycle journeys was 7 percent).

8. Average emissions for the cars that are replaced and adjustment for the proportion of electric cars.

We have assumed that the cars that have been replaced have emissions of 161 g/CO₂ per kilometre, based on the analysis by Multiconsult, NILU and Transportanalyse (2018) of the Norwegian Environment Agency's statistics for 2016. We have assumed that 15 percent of the car journeys that have been replaced are electric car journeys.

6.3 UNCERTAINTY AND RISK FACTORS

Cycling measures affect the proportion of journeys made by bicycle, while a number of other measures are also significant in this respect. The decisive factor is the attractiveness of using other means of transport. This means that the implementation of increased toll-ring charges for road users and street-parking measures will make cycling more attractive. Better public transport may contribute to making cycling less attractive. Since it has not been possible to conduct a direct analysis of these measures and instruments, this analysis does not take them into the account. However, we have included the effect of different proportions of cycle journeys in order to take some account of this uncertainty in our calculation.

6.4 REFERENCES/SOURCES

- Loftsgarden, T., Ellis, I., and Øvrum, A. 2015. "Målrettede sykkeltiltak i fire byområder." UA Report 55/2015: Urbanet Analyse. <https://urbanet.no/publikasjoner/malrettede-sykkeltiltak-i-fire-byomrader-resultater-fra-et-transnova-prosjekt>
- Ellis, I., Haugsbø, M., Berglund, G. Kjørstad, K.N. and Johansson, M. 2015. "Reisevaner i Osloområdet. En analyse av den nasjonale reisevaneundersøkelsen 2013/14." Prosam Report 218. Oslo: Urbanet Analyse. <http://www.prosam.org/index.php?page=report&nr=218>
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7. Introduce new taxi licensing regulations: zero-emission vehicles by 2022

Effect of measure 2016-2020	6,900 tonnes CO ₂ e
Effect of measure 2020-2030	13,200 tonnes CO ₂ e
Effect of measure 2020-2030	MOS/BYM/KLI

7.1. DESCRIPTION OF MEASURE

This measure is intended to ensure the replacement of all fossil-fuel taxis in Oslo by zero-emission vehicles. The preparatory study for the Taxi Licensing Regulation (Report on environmental requirements in taxi licence regulations) assumed a total emissions-reducing effect of 19,440 tonnes CO₂e in 2022 (Agency for Urban Development, 2017). Emissions were assessed in relation to emissions in 2015, based on mileage data from Statistics Norway in conjunction with emissions factors in a report by the Institute of Transport Economics (TØI) (2011).

7.2. CALCULATION OF EFFECT

The preparatory study put emissions in 2015 at 20 027 tonnes CO₂. We assume that emissions in 2022, given a scenario with a trend towards zero-emission vehicles,⁵ would total 19,440 tonnes CO₂. We have used interpolation to identify the base point for this calculation of effect, which puts emissions at 19,943 tonnes CO₂ in 2016. This gives a natural reduction, without implementation of measures, of 500 tonnes CO₂ between 2016 and 2022. In 2020, the natural reduction would be 335 tonnes CO₂e. Given that the Taxi Licensing Regulation will be adopted in 2018, the effect of the measure will be 19,440 tonnes CO₂ in 2016–2022. The total effect of the measure plus the natural reduction will be 19,943 tonnes CO₂ in 2022.

The assumption in the Climate Budget 2018 was that two-thirds of licence-holders would have switched to a zero-emission taxi by 2020. We now consider that this was somewhat optimistic, and accordingly have assumed that one-third of the effect will come in 2020, one-third in 2021/2022 and one-third in 2023. The timing is dependent on when the licence-holders replace their cars, and we now assume that the final 33 percent will not replace their cars until late 2022. The total effect of the measure plus the natural reduction will be 6,815 tonnes CO₂ in 2020, 13,528 tonnes CO₂ in 2022, and 19,943 tonnes CO₂ in 2023.

In light of the fact that the study of the taxi-licensing regulation only considered CO₂ emissions, the Climate Agency has increased the final effect of the measure by 1 percent to take account of nitrous oxide (N₂O) and methane (CH₄) emissions, in accordance with the method used in the study of the effect of the Oslo Package 3. The total effect of the measure plus the natural reduction will be 6,883 tonnes CO₂ in 2020, 13,663 tonnes CO₂ in 2022, and 20,142 tonnes CO₂ in 2023. The effect of the measure has been rounded to 6,900 tonnes CO₂e in 2020, and 20,100 tonnes CO₂e in the period to 2030.

In consultation with the Agency for Urban Development, the Climate Agency has assessed this adjusted forecast as a reliable and more realistic forecast. The proposal to amend the regulation is

⁵ Scenarios for the composition of the taxi fleet in 2022: 100 % zero-emission vehicles

planned to be put before the City Council in 2018. It is doubtful whether significant numbers of licence-holders will switch to zero-emission taxis before the regulation is adopted. The plan is to present the proposal for political consideration towards the end of 2018. Implementation of the measure will also depend on the provision in Oslo of adequate battery-charging and fuelling infrastructure for taxis. Such provision is a municipal responsibility.

Preconditions for implementation and assessment of effect:

- Provision of battery-charging and fuelling infrastructure (electricity/hydrogen)
- Installation of home charging facilities

7.3. UNCERTAINTY AND RISK FACTORS

The calculation of effects assumes that the amended regulation will be adopted during 2018, so that it can come into force in 2022. The calculation also assumes that the number of taxis, the ratio of taxis running on diesel and petrol respectively, and mileage in 2022 is the same as in 2015 (constant). We refer to the comprehensive overview of the assumptions underlying the figures for 2015 and 2022 in the original study of the consequences of the measure (Agency for Urban Development 2017).

7.4. REFERENCES/SOURCES

- Agency for Urban Development, 2017. Study of environmental requirements for the taxi sector in Oslo
- Hagman, Rolf, K.I. Gjerstad, A.H. Amundsen (2011): NOx utslipp fra kjøretøyparken i norske storbyer. Utfordrin ger og muligheter frem mot 2025. Institute of Transport Economics (TØI) report 1168/2011.

8. The municipal light vehicle fleet to run on zero-emission/sustainable biofuels

Effect of measure 2016-	1,000 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	All (UKE)

8.1. DESCRIPTION OF MEASURE

During 2020, the City of Oslo's goal is to ensure that all municipal vehicles and motorized machinery are zero emission, including the use of sustainable biofuels. The municipality should prioritize transport using zero-emission technology or biofuels for all work-related journeys or journeys made under the auspices of the municipality, and should take active steps to encourage the implementation of renewable solutions where they do not exist today.

The City of Oslo's procurement strategy specifies that "In general, vehicles and building and construction machinery used in connection with the performance of work for the City of Oslo should have zero-emissions technology. Where a procurement process allows for the use of different technology, this should be justified specifically in the contract strategy. For vehicles and machinery where zero-emission technology is not available, biofuels (preferably biogas) should be used."

The Agency for Improvement and Development (UKE) maintains records of the proportion of zero-emission vehicles in the municipal fleet. These records cover the years 2014-17 and include the following categories: passenger cars, LCVs, minibuses, trucks, buses and MCs/ATVs/snowmobiles. In this context, passenger cars and LCVs are defined as "light vehicles".

The first significant procurement of electric vehicles occurred in 2015. In 2016, emissions from light vehicles totalled approximately 1,000 tonnes CO₂e.

The assumptions underlying the emissions reducing effects have been developed by the Climate Agency in collaboration with the Agency for Improvement and Development, and the estimates are based on a joint assessment of emissions factors and annual mileage. Emissions from MCs/ATVs/snowmobiles are excluded from the calculations of emissions and emissions-reducing effects.

8.2. CALCULATION OF EFFECT

Records kept by the Agency for Improvement and Development show that emissions from municipal light vehicles, calculated according to average mileages and emissions factors, fell by approximately 131 tonnes CO₂ from 1,046 tonnes CO₂ in 2016 to 915 tonnes CO₂ in 2017. This corresponds to a reduction of 12 percent. We have assumed that emissions will fall by, respectively, 183 tonnes CO₂ (20 percent share) in 2018, 275 tonnes CO₂ (30 percent share) in 2019 and 458 tonnes CO₂ (50 percent share) in 2020. We assume that all municipal light vehicles will be zero-emission by the end of 2020. We have also assumed no change in mileage during this period. The Climate Agency has assumed that fossil-fuel non-specialist vehicles will be replaced at rates of, respectively, 20 percent, 30 percent and 50 percent in the years 2018-2020.

8.3. UNCERTAINTY AND RISK FACTORS

Given that the target is for the fleet to become fossil-free during the course of 2020, emissions will be reduced to zero and this figure will be recorded in the 2021 statistics.

The effect of this measure has been calculated on the basis of records kept by the Agency for Improvement and Development of the number of vehicles in the municipal fleet and annual mileage. The City of Oslo's Statistics Bank (City of Oslo, 2018) has statistics for CO₂ emissions for municipal transport vehicles. The emissions calculations performed by the Statistics Bank are based on energy-consumption reporting from the various municipal bodies. There are some discrepancies between the results of the emissions calculations. According to data from the Agency for Improvement and Development, emissions from heavy and light vehicles totalled approximately 1,900 tonnes CO₂, while data from the Statistics Bank suggests total emissions of 2,400 tonnes. This difference illustrates the uncertain nature of the figures.

There are also elements of risk relating to the implementation of the measure. The municipality has contracts for the purchase of vehicles, and it is likely that zero-emission alternatives for all types of municipal vehicles will exist by 2020. However, the rate of vehicle replacement is currently too low for all municipal vehicles to be zero-emission by the end of 2020. The use of sustainable biofuels will then offer an alternative solution, but there is some uncertainty about whether existing vehicles can use biofuels and about whether there will be access to adequate quantities of biofuels.

8.4. REFERENCES/SOURCES

- City of Oslo, Environment and Climate Report 2017: <https://www.klimaoslo.no/rapporter/>

9. Package of measures to encourage climate-friendly commercial/utility transport

Effect of measure 2016-2020	17,600 tonnes CO ₂ e
Effect of measure 2020-	MOS/FIN

9.1. DESCRIPTION OF STUDY AND MEASURES

The Climate Agency has headed work on the package of measures to encourage climate-friendly commercial and utility transport. Utility transport is defined as transport used by tradespeople and providers of similar services, while commercial transport characteristically involves the delivery of goods to businesses and private individuals.

The Climate Agency commissioned the Institute for Transport Economics (TØI) to assess the level of greenhouse gas emissions from commercial and utility transport (Caspersen and Ørving, 2018). The Institute's calculations show that LCVs are the source of emissions totalling 112,000 tonnes CO₂e per annum. Heavy duty vehicles/trucks are the source of emissions totalling 75,500 tonnes CO₂e per annum. The total for both categories of vehicle is 187,500 tonnes CO₂e per annum.

The technical potential for reducing emissions from LCVs and trucks in Oslo in 2020 is estimated at approximately 80,000 tonnes CO₂e. The potential lies in two general measures to reduce emissions from LCVs and HGVs: more efficient driving; and a transition from fossil vehicles to zero-emission vehicles/sustainable biofuels. Under these two general measures, we have developed various packages of instruments targeted at two groups of actors:

- 1) Utility transport with LCVs
- 2) Goods transport with LCVs
- 3) Transport with HGVs/heavy vehicles

The estimates in the Multiconsult report show that the packages of instruments could potentially achieve aggregate emissions reductions of 35,100 tonnes CO₂e in 2020, if all the suggested instruments were to be implemented with full effect. To achieve the emissions reductions, all the instruments should be implemented in 2019, 2020 and 2021.

The measures targeted at transport with HGVs/heavy vehicles are described in Attachment 2, Measure 21.

9.2. CALCULATION OF EFFECT

Multiconsult has provided us with a model that makes it possible to quantify the effects of measures targeted at utility transport (Multiconsult 2018). Multiconsult notes that the basis for calculating the effects of the measures is uncertain, but in the opinion of the Climate Agency, this is the best basis of knowledge that is available. Accordingly, the assumptions and parameters included in the calculation in the model are used as a starting point for the calculation of the effect of the measure, but are adjusted to take account of the fact that the measure is being implemented over a somewhat longer period than that assumed in Multiconsult's calculations. The City of Oslo has assessed the timing of the effect based on the introduction of instruments in the period 2018-2022. The effect of the measure has been calculated only for CO₂, i.e., not CH₄ or N₂O.

Utility transport – 17,600 tonnes CO₂e in the period 2016-2020

This effect is conditional on:

- Dedicated parking spaces with battery-charging infrastructure, reduced access to street parking.
- Subsidy scheme; battery-charging infrastructure
- Standardized municipal procurement requirements

The calculated effect of the measures targeted at utility transport assumes that, inside Ring 2, 100 parking spaces with battery-charging infrastructure are allocated exclusively for the use of zero-emission service vehicles over a four-year period. A parallel reduction in street-parking opportunities in Oslo will contribute to making these dedicated parking spaces more attractive.

On the basis of assessments of the number of electric LCV's sold so far in Oslo and Akershus in 2018, the Climate Agency considers it overly optimistic to assume full achievement of this effect by the end of 2020. Accordingly, our calculations assume that this measure will take effect gradually in the period to 2022. Looking forwards, there is reason to anticipate non-linear growth in sales of electric vehicles.

In addition, the effect of the measure has been adjusted to take account of the fact that some of the effect has also been included in the effect of the new road-user payment system at the toll ring (Attachment 1, Chapter 4). We have also scaled back the effect of the measure by 10 percent to reflect our rough estimate of uncertainty regarding the market's response to the incentives in the measures.

The establishment of one or more freight consolidation centres and the imposition of standardized municipal procurement requirements will contribute to ensuring achievement of the effect of this measure, and is considered an important instrument. In April 2018, the Norwegian Environment Agency announced the approval of a new subsidy scheme designed to reduce emissions from

commercial transport. The government will provide a grant of NOK 13,000 to purchase or lease a zero-emission LCV to replace a fossil LCV sent for scrappage. It may be reasonable to assume that these grants will reduce emissions from LCVs in Oslo more rapidly than Multiconsult's calculations would suggest. The effect of this subsidy scheme has not been quantifiable for Oslo.

The adjustment will take time due to available technology and supply of zero-emission freight vehicles. The effect may come earlier through the application of ITS, subsidies for the expansion of battery-charging infrastructure, standardized municipal procurement requirements, and information campaigns.

In our calculations, figures for the number of vehicles and mileage in Oslo are taken from the Institute of Transport Economics (TØI) report 1622 /2018 (Caspersen and Ørving, 2018). In addition, we have factored in a weighted average of emissions of CO₂ using emissions levels taken from HBEFA (The Handbook Emission Factors for Road Transport, 2018). The HBEFA emissions table shows emissions levels in grams/kilometre for different road types and different speeds. The table does not have figures showing the proportions of different types of vehicles, so in our model we have assumed a uniform division of emissions for different GHG gases, speeds and types of road. In addition, in our calculation of GHG emissions we have only considered emissions of CO₂. The level of emissions depends on whether the engine powering the vehicle is diesel or petrol.

Figures from the Institute for Transport Economics show that approximately 95 percent of utility vehicles run on diesel. Accordingly, we have calculated a weighted average of this. Based on, among other things, estimates from NELFO that there are 226 working days in a year, in this report we have assumed that there are 230 working days in a year.

The following factors are significant for achieving an update to the utility vehicle fleet within a specific three-year time limit:

- Leasing contracts: three-year contracts will mean that a third of the leased vehicle fleet is replaced each year.
- The supply of electric vehicles meets demand. Vehicle manufacturers succeed in supplying the types of electric vehicle demanded by the market.

9.3. UNCERTAINTY AND RISK FACTORS

Multiconsult's accounting examples assume that the phasing-in period, or transition from fossil LCVs to electric LCVs, will take three years. In our calculation of effects for the Climate Budget, however, we have assumed a phasing-in period of four years. Given this assumption, the measure will not take full effect until after 2022. In addition, there is considerable uncertainty about the parameters included in the model.

The calculations in Multiconsult's accounting examples assume rather high emissions factors for both light and heavy duty vehicles in order to take account of the fact that driving within Ring 2 produces higher levels of emissions than average driving on Norwegian roads. If these emissions factors have been over-estimated, the outcome will be that the effect is over-estimated.

We can also envisage increased sales of new LCVs in Oslo/Akershus in the period to 2020. This may

be attributable to a significant increase in the attractiveness of using electric vehicles (some of the business sectors in this segment operate with very slim margins), the provision of dedicated parking spaces/service bays, and it still being possible to sell existing fossil vehicles to other counties and regions. In other words, the national figures for new vehicle registrations may remain reasonably stable, but with local/regional variations.

9.4. REFERENCES/SOURCES

- Caspersen, E. and Ørving, T. (2018) *Kunnskapsgrunnlag for mer klimavennlig næringstrafikk i Oslo* Institute of Transport Economics Report 1622/2018. <https://www.toi.no/publikasjoner/kunnskapsgrunnlagformerklimevennlignaringstrafikkiosloarticle348198.html>
- Multiconsult (2018): *Effekt av nye virkemidler for å redusere utslipp av klimagasser fra vare og nyttetransporten i Oslo kommune*. Håland, M., Halvorsen, K. W. and Mehammer, B. S. Available via <https://www.klimaoslo.no/rapporter/>
- City of Oslo, Climate Agency (2018): *Mer effektiv og klimavennlig vare og nyttetransport* Available via <https://www.klimaoslo.no/rapporter/>

10. Fossil-free public transport by 2020

Effect of measure 2016-	27,700 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	MOS /Ruter

10.1. DESCRIPTION OF MEASURE

Ruter’s project Fossil Free 2020 aims to run all public transport in Oslo and Akershus using renewable energy sources by the end of 2020. As part of this project, a plan has been developed whereby Ruter’s public transport vehicles will run exclusively on renewable energy by the end of 2020. This measure covers fossil-free solutions for buses operating within the City of Oslo. It can include transitions from diesel to electricity, hydrogen, biogas and sustainable biodiesel. As of 31 December 2016, the status of the project was that 28 percent of buses in Oslo were running on renewable fuel. The percentage had increased to 41 percent as of 31 December 2017.

10.2. CALCULATION OF EFFECT

Ruter’s annual environmental reporting for 2016 states that total emissions in 2016 from the fossil bus fleet in Oslo were 27,700 tonnes CO₂. The equivalent report for 2017 states that emissions from buses in Oslo had been reduced by 7,800 tonnes CO₂ to 19,900 tonnes CO₂ in 2017. We have assumed that this measure will be phased in at a relatively even pace during 2018-20. We have also assumed that from 2021, public transport services provided by Ruter will be fossil free.

10.3. UNCERTAINTY AND RISK FACTORS

Given that the target is for the fleet to become fossil-free during the course of 2020, emissions will be reduced to zero and this figure will be recorded in the 2021 statistics.

10.4. REFERENCES/SOURCES

- Ruter Annual Report 2016: <https://ruter.no/globalassets/dokumenter/aarsrapporter/ruter-arsrapport-20161.pdf>
- Ruter Annual Report 2017: <https://ruter.no/globalassets/dokumenter/aarsrapporter/ruter-arsrapport-2017-korr.pdf>

11. Use of zero-emission vehicles/sustainable biofuels in the municipal heavy duty fleet

Effect of measure 2016-	900 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	All (UKE)

11.1. DESCRIPTION OF MEASURE

During 2020, the City of Oslo's goal is to ensure that all municipal vehicles and motorized machinery are zero emission, or if necessary powered with sustainable biofuels. The municipality should prioritize transport using zero-emission technology or biofuels for all work-related journeys or journeys made under the auspices of the municipality, and should take active steps to encourage the implementation of renewable solutions where they do not exist today.

The City of Oslo's procurement strategy specifies that "In general, vehicles and building and construction machinery used in connection with the performance of work for the City of Oslo should have zero-emissions technology. Where a procurement process allows for the use of different technology, this should be justified specifically in the contract strategy. For vehicles and machinery where zero-emission technology is not available, biofuels (preferably biogas) should be used."

The Agency for Improvement and Development (UKE) maintains records of the proportion of zero-emission vehicles in the municipal fleet. These records cover the years 2014-17 and include the following categories: passenger cars, LCVs, minibuses, trucks, buses and MCs/ATVs/snowmobiles. In this context, heavy duty vehicles are defined as minibuses, trucks and buses. In 2016, emissions from heavy duty vehicles totalled 900 tonnes CO₂.

The assumptions underlying the emissions reducing effects have been developed by the Climate Agency in collaboration with the Agency for Improvement and Development, and the estimates are based on a joint assessment of emissions factors and annual mileage. Emissions from MCs/ATVs/snowmobiles are excluded from the calculations of emissions and emissions-reducing effects.

11.2. CALCULATION OF EFFECT

Records kept by the Agency for Improvement and Development show that emissions from municipal heavy duty vehicles, calculated according to average mileages and emissions factors, increased by approximately 80 tonnes CO₂ from 900 tonnes CO₂ in 2016 to 980 tonnes CO₂ in 2017. This corre-

sponds to an increase of 9 percent. We have assumed that emissions will fall by, respectively, 20 percent in 2018, 30 percent in 2019, and 50 percent in 2020. We assume that all heavy duty vehicles will be zero-emission by the end of 2020, or alternatively will run on sustainable biofuels. We have also assumed no change in mileage during this period. The Climate Agency has assumed that fossil-fuel non-specialist vehicles will be replaced at a rate of, respectively, 20 percent, 30 percent and 50 percent in the years 2018, 2019 and 2020.

Given that the target is for the fleet to become fossil-free during the course of 2020, emissions will be reduced to zero and this figure will be recorded in the 2021 statistics.

11.3. UNCERTAINTY AND RISK FACTORS

The effect of this measure has been calculated on the basis of records kept by the Agency for Improvement and Development of the number of vehicles in the municipal fleet and annual mileage. The City of Oslo’s Statistics Bank (City of Oslo, 2018) has statistics for CO₂ emissions for municipal transport vehicles. The emissions calculations performed by the Statistics Bank are based on energy-consumption reporting from the various municipal bodies. There are some discrepancies between the results of the emissions calculations. According to data from the Agency for Improvement and Development, emissions from heavy and light vehicles totalled approximately 1,900 tonnes CO₂, while data from the Statistics Bank suggests total emissions of 2,400 tonnes. This difference illustrates the uncertain nature of the source data.

There are elements of risk relating to the implementation of the measure. Such zero-emission vehicles are still at an early stage of development, so until zero-emission vehicles become available, the most practical option will be to use sustainable biofuels to operate existing vehicles and to procure biogas vehicles. There is uncertainty both as to whether the existing vehicles can run on biofuels, and as to whether sufficient sustainable biofuels are available.

11.4. REFERENCES/SOURCES

- City of Oslo (2018). City of Oslo Statistics Bank: <http://statistikbanken.oslo.kommune.no/webview/>

12. Package of measures to encourage the use of zero-emission construction machinery

Effect of measure 2016-2020	26,000 tonnes CO ₂ e
Effect of measure 2020-	Not quantified
	FIN/NOE

12.1. DESCRIPTION OF STUDY AND MEASURES

The Climate Agency has headed the development of a package of measures to encourage the use of zero-emission construction machinery. In the Norwegian Environment Agency’s emissions statistics by municipality for 2016, Oslo’s emissions from “Other mobile combustion” totalled 91,850 CO₂e.

This figure was extrapolated from sales on red diesel (gas oil). That statistics showed a 45 percent reduction in emissions between 2015 and 2016, and the level of uncertainty was assessed as high.

The City of Oslo's Climate Agency commissioned DNV GL to estimate the amount of fossil fuel consumed to heat buildings and to power construction machinery in Oslo, and to calculate the associated levels of emissions. The annual emissions from the buildings and construction sector in Oslo were estimated on the basis of data from four reference projects. The resulting annual total was estimated at 76,950 tonnes CO₂e (2017). This was comprised of buildings-related activities (55,450 tonnes CO₂e) and construction site activities (21,500 tonnes CO₂e).

12.2. SSCALCULATION OF EFFECT

In collaboration with other relevant municipal bodies, the Climate Agency has considered various measures to reduce emissions from the buildings and construction sector in Oslo.

12.2.1. STANDARDIZED MUNICIPAL PROCUREMENT REQUIREMENTS AND ACTIVE USE OF INCENTIVES AND AWARD CRITERIA

The greatest potential for cutting emissions in the period to 2020 lies in a more proactive and targeted use of procurement requirements when the City of Oslo is the construction client or is awarding a contract. Requirements have already been implemented regarding fossil-free buildings and construction projects commissioned by the City of Oslo, and the effect of this measure has been quantified. In practice, these requirements involve the replacement of fossil diesel with biofuels in all possible areas of the buildings and construction sector. In addition, we have studied how procurement requirements and award criteria can be further developed to promote a transition to zero-emission building and construction sites.

In the knowledge base underlying the Climate Budget 2018, there was an assumption that the City of Oslo was responsible for 20 percent of emissions from building and construction activities in Oslo. As part of the work on the package of measures, DNV GL was commissioned by the Climate Agency to calculate emissions of GHG gases per unit area of new buildings. For construction projects, DNV have estimated GHG emissions per "contract krone". The figure below shows estimated emissions linked to planned building and construction activities commissioned by the City of Oslo in the period to 2020. The estimates assume that the activities are carried out in a traditional manner with fossil energy. These estimates are based on historical figures derived from a small number of actual projects, and the calculations were performed by DNV GL.

The estimates are based on planned building and construction projects that have been contracted by the City of Oslo. The figures for the Agency for Water and Wastewater Services and the Agency for Urban Development are based on the agencies' own estimates for total planned construction contracts, while the buildings agencies and municipal undertakings have provided figures for the expected area of new buildings in m².

All contributions were based on unit values "tonnes CO₂e/m²" for building projects and "tonnes CO₂ per contract krone" for construction projects as specified in the DNV GL report:

-
- Construction: 3,230 kg CO₂/MNOK contract krone
 - Building: 47 kg CO₂/ m² of new buildings

All emissions are distributed over the duration of the respective building and construction projects, and actual emissions result from the execution of the projects may deviate from this distribution. Since current projects have been excluded, the estimate for emissions in 2018 and 2019 is to a lesser extent representative of actual emissions. The calculations include direct CO₂ emissions at building and construction sites. Emissions from transport to and from a building site are not included.

Construction work on the Fornebu Light Railway and the new tunnel to supply drinking water from Holsfjord was excluded. Emissions from the execution of these projects may come in addition, but current plans suggest that emissions from these projects will be small in the period to 2020.

On the basis of these assumptions, the fossil-free or zero-emission execution of the building and construction projects planned for the City of Oslo could reduce the city's GHG emissions by approximately 12,000 tonnes CO₂e in 2020. This overview includes contracts awarded to municipal building and construction services. Emissions from the use of construction machinery for operational activities such as the preparation of ski trails, clearing snow or forestry are not included.

12.2.2. FACILITATION OF SUPPLIES OF RENEWABLE ENERGY FOR BUILDING SITES

In this sector, economic incentives to reduce emissions are weak. DNV GL report that the nature of the requirements imposed by construction clients in the years to 2020 and 2030 will determine the trend in this sector. If construction clients impose requirements, and are willing to meet the additional costs, change will be rapid. The report also notes to importance of stronger economic incentives to boost demand for zero-emission construction machinery.

Several industry participants have indicated difficulties with supplying electricity to building sites. If machines responsible for the most emissions are to be replaced with electric machines, there needs to be more investment in temporary infrastructure to supply electricity to building sites.

Enova does not provide grants for temporary infrastructure to provide electricity to building sites. The Climate Agency will continue work on the establishment of a limited and targeted scheme to provide funding for the establishment of infrastructure to supply electricity and hydrogen to building and construction sites in Oslo. Consideration should be given as to whether any such scheme should also cover infrastructure for the supply of biogas or other sustainable biofuels.

The effect a such a scheme is uncertain, and would depend on levels of interest in the market. As a basis for calculating the effect of this measure, we have assumed that a new funding scheme would result in approximately 80,000 m² of new buildings being constructed using fossil-free or zero-emission machinery in 2020. Use of such machinery instead of traditional fossil-fuelled machinery would reduce emissions by around 4,000 tonnes CO₂ each year.

12.2.3. EMISSIONS CUTS THROUGH A VOLUNTARY EMISSIONS-CUTTING AGREEMENT WITH BUSINESSES

Nationally, we expect a gradually increasing focus on emissions not covered by the EU Emissions Trading Scheme, including emissions from construction machinery. Both industry organizations and

other central representatives of the building and construction industries, as well as local and national authorities have stated support for cutting emissions and the imposition of actual requirements for fossil-free building sites. This provides a good basis for collaboration between the industry and the authorities in the Oslo region. This kind of collaboration could cover joint emissions targets, the coordinated implementation of binding measures, and improving the basis of knowledge.

In 2017, total emissions from building activities in Oslo were estimated at approximately 55,000 tonnes CO₂ in 2017, cf. report from DNV GL. If one considers buildings erected for non-municipal clients, total emissions totalling approximately 50,000 tonnes resulted from building work for private-sector and national-government clients.

The package of measures estimates potential emissions cuts of 24,000 tonnes CO₂ in 2020, which would correspond to approximately half of the planned new private-sector and national-government buildings in Oslo being built without the use of fossil energy. In light of uncertainty about the level of support for any such voluntary agreement, the effect of this measure has been scaled back in the Climate Budget to approximately 10,000 tonnes in 2020.

12.3. UNCERTAINTY AND RISK FACTORS

There is a large gap between Statistics Norway's emissions figures, which are based on sales figures for red diesel, and the calculations made by DNV GL, which are based on activity data and emissions factors from a small number of sample projects. The historical figures used to calculate the emissions factors are to some extent incomplete. These projects are not representative of all building and construction activity in Oslo. Due to this uncertainty, estimates for emissions of GHG gases from building and construction activities in Oslo should be used with caution. There is a high level of uncertainty regarding both the actual emissions and the effects of the measures.

The building and construction market is characterized by major fluctuations in levels of activity, and this adds further uncertainty to emissions trends and the effect of measures than already exists in the Norwegian Environment Agency's emission statistics. There has been no assessment of the effectiveness of a funding scheme.

12.4. REFERENCES/SOURCES

- DNVGL report: <https://www.klimaoslo.no/rapporter/>
- The Climate Agency (2018): Tiltakspakke utslippsfrie anleggsmaskiner. Available via <https://www.klimaoslo.no/rapporter/>

13. Municipal construction machinery to be zero-emission or use sustainable biofuels

Effect of measure 2016-2020	1,400 tonnes CO ₂ e
Effect of measure 2020-	0 tonnes CO ₂ e
Effect of measure 2020-	All (UKE)

13.1. DESCRIPTION OF MEASURE

During 2020, the City of Oslo's goal is to ensure that all municipal vehicles and motorized machinery are zero emission, including the use of sustainable biofuels.

The City of Oslo's procurement strategy specifies that "In general, vehicles and building and construction machinery used in connection with the performance of work for the City of Oslo should have zero-emissions technology. Where a procurement process allows for the use of different technology, this should be justified specifically in the contract strategy. For vehicles and machinery where zero-emission technology is not available, biofuels (preferably biogas) should be used."

There is no general overall of municipal construction machinery, but reporting by municipal bodies in connection with the Environment and Climate Report includes fuel consumed by their own machinery. Overall, this measure estimates the effect of replacing diesel machinery, such as tractors, chainsaws, leaf blowers, lawn mowers, strimmers, hedge trimmers and other "diesel-driven machinery" with alternatives that are either electric or run on sustainable biofuels.

13.2. CALCULATION OF EFFECT

Emissions from municipal machinery in 2016 were estimated to total 1,410 tonnes CO₂, increasing by 10 percent to 1,544 tonnes CO₂ in 2017. We have assumed that emissions will fall by, respectively, 20 percent in 2018, 30 percent in 2019, and 50 percent in 2020. We have assumed that all machines will have zero-emission technology or will run on sustainable biofuels by the end of 2020. We have also assumed no change in mileage during this period.

13.3. UNCERTAINTY AND RISK FACTORS

Given that the target is for the fleet to become fossil-free during the course of 2020, emissions will be reduced to zero and this figure will be recorded in the 2021 statistics.

13.4. REFERENCES/SOURCES

- City of Oslo, Environment and Climate Report 2017: <https://www.klimaoslo.no/rapporter/>

14. Installation of shore power facilities

Effect of measure 2016-	2,300 tonnes CO ₂ e
2020	Not quantified
Effect of measure 2020-	NOE/HAV

14.1. DESCRIPTION OF MEASURE

Shore power facilities have already been installed for Color Line ferries at Filipstad, and Color Line's cruise ferries to Kiel have been using the shore power facility on the quay at Filipstad since 2011. This measure concerns the installation of shore power facilities at Vippetangen (by Utstikker II) and at Sydhavna. This will make it possible to use zero-emission solutions to cover the relevant ships' electrical power requirements when in port. The measure will address the requirements of three international ferries, two owned by DFDS and one by Stena Line. In addition, the measure will reduce emissions from ships calling at Sydhavna, including container vessels, tankers, bulkers, car transporters and so on. Work on the Vippetangen measure has been started and will be completed in the summer of 2018.

14.2. CALCULATION OF EFFECT

The calculation of an emissions-reducing effect of 2,300 tonnes CO₂e is based on the use of shore power by international ferries. The shore power facilities at Sydhavna will also reduce emissions once they are operational, but these effects have not been quantified for 2020.

The estimated effect of shore power on emissions from the international ferries has been allocated as follows: Stena Saga, 300 tonnes CO₂e per annum; Crown Seaways and Pearl Seaways, 2 000 tonnes CO₂e per annum. These figures assume that all three vessels continue to make full use of the facility. The calculation is based on reported consumption figures supplied by the ferry operators.

In the case of cruise ships and international ferries, shore power covers approximately 50 percent of total fuel consumption while in harbour, since it is not possible to use electrical power to replace a large part of the sources of their emissions (use of steam for onboard heating etc.). The measure will also reduce local pollution and noise levels in the port area.

14.3. UNCERTAINTY AND RISK FACTORS

The contract for the installation of a shore power facility at Vippetangen was drafted so that all international ferries would have access to shore power well before 2020. Stena Line has converted its ferry serving Oslo and Frederikshavn to use shore power. DFDC, which operates ferries between Oslo and Copenhagen, will carry out the necessary work on its ships in January 2019 and 2020 respectively. Accordingly, there is no uncertainty about the time at which all ferries will be using the facility.

14.4. REFERENCES/SOURCES

- City of Oslo 2018). Oslo Port Authority as a zero-emission port. Extracted from City Council Proposition 168/18.

15. Zero-emission public transport: Nesodden ferries

Effect of measure 2016-	4,200 tonnes CO ₂ e
2020	0 tonnes CO ₂ e
Effect of measure 2020-	MOS/Ruter

15.1. DESCRIPTION OF MEASURE

Ruter's project Fossil Free 2020 aims to have all public transport in Oslo and Akershus running on renewable energy sources by the end of 2020. As part of this project, a plan has been developed whereby Ruter's public transport vehicles will run exclusively on renewable energy by the end of 2020, including fossil-free solutions on ferries within the City of Oslo.

This measure covers the establishment of the shore-side electrical supply and battery-charging infrastructure necessary for the electrification of the Nesodden ferries, and engaging in a dialogue and negotiations with Norled regarding the conversion of existing vessels serving this route to electrical operation during the current contract.

The shore-side battery-charging infrastructure necessary to allow this route to be served by electric ferries would be installed either at Aker brygge or at Nesoddtangen. The three LNG-fuelled ferries (Kongen, Dronningen and Prinsen) that serve this route will have to be converted to run on batteries.

15.2. CALCULATION OF EFFECT

We estimate that the conversion of all three Nesodden ferries to fully electric operation would reduce emissions by a total of approximately 4,200 tonnes CO₂ each year. The measure would also reduce GHG emissions in the harbour by 100 percent, as well as reducing local pollution and noise.

The calculation of the effect of the measure is based on AIS data, and corresponds well (with only a marginal discrepancy) with Ruter's annual reporting for the route in 2017, which is based on Norled's reported fuel-consumption data.

15.3. UNCERTAINTY AND RISK FACTORS

Possible barriers or delaying factors for implementation relate to the installation and location of an electrical supply to charge the ferries, a substation and shore-side battery-charging infrastructure, due to the clarifications necessary to obtain planning approval and the technical and economic challenges linked to making the necessary power inputs available on the quay, among other things.

15.4. REFERENCES/SOURCES

- City of Oslo 2018). Oslo Port Authority as a zero-emission port. Extracted from City Council Proposition 168/18.

Attachment 2

Measures without quantified emissions reductions

16. Landfill gas extraction

16.1. DESCRIPTION OF MEASURE

This measure is intended to ensure that landfill gas is extracted from landfill sites. The extraction of landfill gas will reduce emissions from the “Waste and wastewater” sector, and the “Landfill gas” source. At the same time, the gas can be used to generate energy and thus reduce emissions from other sectors, assuming that this energy is used to replace fossil energy sources.

The City of Oslo has been ordered by the County Governor to implement measures at landfill sites to reduce emissions of methane, which are caused by decomposing organic waste. The effect included in the Climate Budget 2018 assumed that gas was being extracted at the landfill sites at Grønmo and Rommen. The calculation of the effect did not take into account flaring or energy exploitation.

The emissions statistics by municipality show a rise in emissions of landfill gas between 2015 and 2016, and in retrospect we have attempted to update the calculated effect of this measure due to uncertainty surrounding the implementation of measures at the landfill sites. Measures that maintain or increase landfill gas extraction will be captured in the statistics through the City of Oslo’s reporting to the County Governor and the Norwegian Environment Agency. The rise in emissions between 2015 and 2016 was caused by operational problems at Grønmo, which reduced extraction capacity. A further rise in emissions is expected in 2017.

The Climate Agency, in consultation with the Agency for Waste Management and the Agency for Real Estate and Urban Renewal, has contacted Statistics Norway and the Norwegian Environment Agency in an attempt to quantify the effect of this measure at Oslo’s landfill sites. Estimating the effect of this measure with certainty has proved challenging, since there is uncertainty about the amount of waste that formed the basis of the emissions calculation in the statistics. Accordingly, the measure “Landfill gas extraction” has been moved from the table of measures with quantified effects to the table of measures whose effects are unquantified but likely to cut emissions.

If this measure is to continue to have an effect in the years to 2020, existing levels of gas extraction must be maintained and increased in the future. Given that waste has a natural rate of decomposition (in the case of Grønmo estimated at approximately 7 percent per annum), each year there will be less waste available to decompose and produce gas. This means that in practice it will not be possible to increase the rate of gas extraction. Gas extraction will be reduced every year, unless operational problems arise, causing an actual increase in the subsequent year.

The implementation and follow-up of this municipal measures is a three-part process:

- 1) Maintain optimal gas extraction at Grønmo (REN/EBY)
- 2) Maintain optimal gas extraction at Rommen (EBY)
- 3) Minimize downtime at the extraction plant at Grønmo and install a new solution to exploit the gas for energy (EGE).

During 2019, the Agency for Real Estate and Urban Renewal will study short- and long-term measures that could be implemented at the Stubberud landfill site, with the intention of reducing methane emissions. The study is intended to show whether there is potential for gas capture at the site. If there is potential for capturing gas, this could result in additional emissions reductions in the years to 2030.

17. Increased extraction of plastic from household waste

17.1. DESCRIPTION OF MEASURE

This measure is designed to ensure increased material recycling of plastic wrapping in household waste. Increased material recycling will reduce the proportion of plastic that is incinerated as residual waste, and this reduction in direct emissions will be attributed to the Energy supply sector. In addition, the material recycling of plastic has a climate benefit, since recycled plastic replaces the use of new raw materials, although this benefit is realized outside Oslo.

The Agency for Waste Management (REN) has prepared estimates for plastics sorted by households and plastics remaining in residual waste that is sent for incineration at the Haraldrud Waste-to-Energy Facility in the years 2015-2022. The estimates have been prepared on the basis of the Agency's reported tonnage of collected waste and unsorted plastic, as well as the Agency's annual waste analyses, which state the quantity and composition of residual household waste and the content of the blue bags, including the amount of plastic, among other things. We note that these estimated figures carry a high level of uncertainty, since it is difficult to know how waste-sorting behaviour will develop in the future. There is also uncertainty as to whether the negative focus on plastic in 2018 will affect the total amount of plastic in the market in the future.

The estimates for the years 2018 to 2022 are projected on the basis of historical data from the period 2015-2017. These estimates vary, but the general trend is that the amount of plastic that is incinerated will increase, rather than decrease, in the period 2016-2022. This is regardless of any increase in the amount of unsorted plastic. An increase in the amount of plastic sorted from household waste will mean that emissions from waste incineration will not increase as much as they would have done if the plastic had not been sorted. In the absence of drastic new measures, there will not be a reduction in CO₂ emissions from the incineration of residual waste in 2020, compared with 2016.

The Agency for Waste Management is working to increase the sorting of plastic from household waste. However, the Agency lacks the budget to implement large-scale measures in the short term. It will be difficult significantly to increase the material sorting of plastic without some kind of technology for the post-sorting of residual waste. This kind of measure cannot be implemented before 2022. This means that any increase in the rate of plastic sorting is expected to be low in the next few years, but with the possibility for a rapid increase at a later time if new technology becomes available.

In the opinion of the Climate Agency, the instruments available to increase the material sorting of plastic waste are too weak to cause a reduction in emissions from the incineration of residual waste in 2020, compared with 2016. Since the Agency for Waste Management's estimates show that the net effects for direct GHG emissions in Oslo in the period to 2020 are zero or negative (emissions from waste incineration will not decline) this measure has been moved from the table of measures with quantified effects to the table of measures whose effects are non-quantified but likely to reduce emissions.

It is not known whether or how measures to increase extraction of plastic could affect emissions from the Klemetsrud waste-to-energy plant.

18. Package of measures to encourage climate-friendly travel to and from work

18.1. DESCRIPTION OF MEASURE

Journeys to and from work account for a significant proportion of traffic, and accordingly GHG emissions, in Oslo. Accordingly, measures to encourage more climate-friendly journeys to and from work could contribute significantly to reducing emissions.

The Climate Agency has headed the development of a package of measures to encourage climate-friendly travel to and from work and climate-friendly work-related travel. In order to obtain a better basis for the assessment of potential climate benefits, as well as practical factors associated with the use of climate-friendly modes of transport (cycling, walking, public transport), the Institute for Transport Economics (TØI) has conducted a survey of travel habits and infrastructure (Lunke et al., 2018), and measures have been assessed by a municipal working group (Climate Agency, 2018).

In light of the results of its survey of travel habits, the Institute for Transport Economics has calculated that annual GHG emissions attributable to municipal employees' travel to and from work, and work-related travel (including air travel) total 9,100 tonnes CO₂. The Institute found that each year, travel to and from work accounts for emissions of 7,400 tonnes CO₂. In addition, work-related trips within the municipality using fossil-fuelled cars, account for emissions of 1,120 tonnes CO₂ each year. The Institute also used data supplied by the City of Oslo to calculate that emissions of 580 tonnes CO₂ are attributable to work-related air travel each year.

If these findings for employees of the City of Oslo are also true for all public- and private-sector employees in Oslo, this implies that emissions totalling 80,000 tonnes CO₂ are attributable to travel to and from work. In addition, emissions of 12,000 tonnes CO₂ each year are attributable to work-related travel, excluding air travel. These estimates are very uncertain, partly because we do not know to what extent the travel patterns of municipal employees are representative of those of other people working in Oslo. Taking as our starting point the recommendations in the study of the package of measures to encourage climate-friendly travel to and from work, the Climate Budget 2019 includes several measures targeted at municipal and non-municipal workplaces.

Funds will be allocated to facilitate climate-friendly travel to and from work (e.g. secure cycle parking, lockers, etc.) at municipal workplaces. Funding will be allocated in response to applications from individual workplaces. Funding will be conditional on measures being taken to reduce car use.

The measure also requires the municipality to engage in dialogue with union representatives to identify and discuss other measures that could encourage more climate-friendly travel to and from work. The effect of this measure is not quantified in the Climate Budget, as there has not yet been a final decision as to how this measure should be implemented in practice.

The measure also requires the municipality to engage in dialogue with businesses in Oslo regarding measures that could reduce the number of people driving to work at private-sector workplaces. Existing fora for dialogue with businesses, such as “Businesses for the Climate” will be used to encourage and challenge businesses to exchange experiences of specific measures.

As part of the measure, we will also establish a subsidy scheme so that businesses can apply for grants for measures that promote climate-friendly travel to and from work. Funding will be conditional on measures being taken to reduce car use.

The study of this package of measures also includes a suggestion to reduce the number of parking spaces at municipal workplaces. Another suggestion is to limit mileage allowances, in order to reduce the use of privately owned, fossil-fuelled cars on work-related journeys. These measures are not included in the Climate Budget 2019.

The study of a package of measures to encourage climate-friendly travel to and from work, proposed three packages of measures:

- Measures to encourage climate-friendly travel to and from work. This proposal involved limiting parking opportunities and improving provision for cyclists at municipal workplaces by providing subsidies to municipal bodies for the installation of secure cycle parking and changing facilities. The Climate Budget 2019 proposes a subsidy scheme for municipal bodies and a grant scheme for private businesses. The Climate Budget does not include a proposal to reduce parking opportunities.
- Measures to encourage climate-friendly work-related travel. Emissions from work-related travel are caused by employees’ use of fossil-fuelled cars in the course of their employment. The City of Oslo has already implemented a measure to replace the cars in its own fleet with zero-emission cars. A proportion of the emissions are attributable to the use of private cars in the course of employment. We assume that individual municipal bodies will be able to limit payments of mileage allowances for fossil-fuelled cars. One instrument that was assessed as potentially emissions-reducing was to draft internal guidelines or rules for municipal bodies to limit payments of mileage allowances. The Climate Budget 2019 does not include changes in mileage allowances.
- A package of measures to motivate employees to choose climate-friendly modes of travel to and from work. This motivational package includes a contract-based element targeted at employees who are willing to consider changing their travel habits, allowing them to test a climate-friendly mode of travel. Employees undertake to try a different mode of travel for a specific period, and in return are given a free loan of an electric bicycle or a free one-month travelcard. The remainder of the package consists of participation in cycle-to-work campaigns and similar measures.

18.2. REFERENCES/SOURCES

- Erik Bjørnson Lunke, Kåre H. Skollerud Petter Christiansen, Tom Erik Julsrud and Iratxe Landa Mata. Institute for Transport Economics (TØI), 2018. Klimavennlige jobbreiser i Oslo kommune. Oslo. Available via <https://www.klimaoslo.no/rapporter/>
- The Climate Agency (2018): «Tiltakspakke for klimavennlig jobbreiser» Available via <https://www.klimaoslo.no/rapporter/>

19. Package of measures to encourage climate-friendly transport of goods

19.1. DESCRIPTION OF MEASURE

In connection with the study of the package of measures to encourage climate-friendly transport of goods, we studied measures targeted at utility transport (described in Attachment 1, measure no. 9) and goods transport. The measure to reduce emissions attributable to the transport of goods aims to reserve a specific number of loading spaces for zero-emission vehicles. The effect of this measure was calculated by Multiconsult, at the request of the Climate Agency. The method used for the study is described in more detail in Attachment 1, measure no. 9, and in Multiconsult's report (Multiconsult 2018).

The effect of the measure will be dependent on, among other things:

- the number of loading spaces reserved for zero-emission vehicles
- the possible establishment of freight consolidation centres
- the establishment of adequate battery-charging infrastructure
- the use of grant schemes for the installation of battery-charging infrastructure
- the imposition of standardized municipal procurement requirements.

In the Climate Budget 2019, the following activities are planned in relation to this measure regarding loading spaces:

1. In 2019, we will pilot zero-emission commercial deliveries in two or three areas/streets outside the Car-free City Life zone.
2. Starting from 2019, further areas within the Car-Free City Life zone will be reserved for deliveries by zero-emission vehicles.
3. We will conduct a survey of suitable areas for a zero-emission delivery initiative inside Ring 3, with a view to implementation in 2019 or 2020. The effect of this measure has not been quantified, as the final design of the instruments will need to be clarified after the survey has been completed.

19.2. REFERENCES/SOURCES

- Multiconsult (2018): *Effekt av nye virkemidler for å redusere utslipp av klimagasser fra vare og nyttetransporten i Oslo kommune*. Håland, M., Halvorsen, K. W. and Mehammer, B. S. Available via <https://www.klimaoslo.no/rapporter/>
- The Climate Agency (2018): *Mer effektiv og klimavennlig vare og nyttetransport* Available via <https://www.klimaoslo.no/rapporter/>

20. Street parking measures (including resident-only parking)

20.1. DESCRIPTION OF MEASURE

The objective of resident-only parking schemes is to optimize the availability of street-parking spaces for people living within a limited area. The introduction of a resident-only parking scheme in Oslo was ratified by the adoption of City Council Proposition 405 of 15 December 2010 – Evaluation of a pilot resident-only parking scheme in Oslo, and City Council Proposition 19 of 13 June 2012 – Regulations concerning Resident-only Parking in Oslo.

A resident-only parking scheme also has the effect that people who live outside an area must pay to park within it. The implementation of resident-only parking is progressing rapidly, and should be completed in all city districts included in the current plan by the end of 2018 (City of Oslo, 2018). The scheme will make it more expensive for people who do not live in an area to use a car, making driving less attractive. When parking costs money, people are more likely to use alternative modes of travel.

Limiting access to parking at the start and end of a journey is an effective way of reducing car use. The effect is greatest in densely populated urban areas where people live close to important facilities and public transport is good (<https://www.tiltak.no/>). Removing parking places involves assigning a different use to areas of land previously used by cars. Currently, the City of Oslo is using the plots released by the removal of parking places to benefit cyclists, pedestrians, to promote a more vibrant urban environment, and for public transport (Ellis and Øvrum 2015). With regard to public transport, the Package of 100 initiatives to reduce delays on public transport ('kraftfulle fremkommelighets-tiltak') has been of crucial importance for improving punctuality and shortening journey times. At the same time, driving has become less attractive because parking is difficult. Overall, the result has been that more people are choosing to cycle or to travel by public transport than to drive. This is reducing GHG emissions.

As of today, there has been no assessment of the aggregate climate effect of the City of Oslo's parking-related measures. The effect of the parking-related measures is tightly interwoven with other measures targeted at road traffic. Accordingly, the effect could not be isolated in the Climate Budget 2019.

20.2. REFERENCES/SOURCES

- Catalogue of measures (2018). <https://www.tiltak.no/aktuelt/parkering/?highlight=parkering>. Accessed 19 September 2018
- City of Oslo 2018, resident-only parking: <https://www.oslo.kommune.no/gate-transport-og-parkering/parkering/beboerparkering/>
- Ellis, Ingunn, and Arnstein Øvrum. 2015. "Parkering som virkemiddel. Trafikantenes vektlegging av ulike parke ringsrestriksjoner." UA Report 64/2015: Oslo: Urbanet Analyse. <https://urbanet.no/publikasjoner/parkering-som-virkemiddel-trafikantenes-vektlegging-av-uli-ke-parkeringsrestriksjoner>

21. Package of measures to encourage climate-friendly heavy freight transport

21.1. DESCRIPTION OF MEASURE

In connection with the study of the package of measures to encourage the climate-friendly transport of goods, we studied measures targeted at utility transport (described in Attachment 1, measure no. 9) and at the transport of goods (described in Attachment 2, measure no. 19). In addition, we assessed possible measures targeted at heavy freight transport.

Report 1622/2018 from the Institute of Transport Economics (TØI) states that heavy vehicles transported a total of 35 million tonnes of bulk freight to, from, or within Oslo in 2016. Of this total, bulk freight transport comprised 16.7 million tonnes divided between 870,000 journeys. Given the assumptions made in the report, the Institute found that heavy vehicles driving in Oslo were the source of emissions totalling 75,000 tonnes CO₂e each year.

In the Climate Budget 2019, the following activities are planned in relation to this measure:

- Pilot project for bulk freight transport
- Standardized municipal procurement requirements
- Pilot for a zero-emission transport route.

The effect of this measure has not been quantified, since the final design of the necessary instruments will be clarified following completion of the pilot projects.

21.2. REFERENCES/SOURCES

- Caspersen, E. and Ørving, T. (2018) *Kunnskapsgrunnlag for mer klimavennlig næringstrafikk i Oslo* Institute of Transport Economics Report 1622/2018. <https://www.toi.no/publikasjoner/kunnskapsgrunnlag-for-mer-klimavennlig-naringstrafikk-i-oslo-article34819-8.html>
- Multiconsult (2018): *Effekt av nye virkemidler for å redusere utslipp av klimagasser fra vare og nyttetransporten i Oslo kommune*. Håland, M., Halvorsen, K. W. and Mehammer, B. S. Available via <https://www.klimaoslo.no/rapporter/>
- The Climate Agency (2018): *Mer effektiv og klimavennlig vare og nyttetransport* Available via <https://www.klimaoslo.no/rapporter/>

Attachment 3

Grant funding in the Climate Budget 2019

We propose the inclusion of new funding for climate measures in the Economic Plan for 2019-2022. The activities are linked to the measures in the Climate Budget, and are direct or indirect preconditions for achieving the effects of the measures listed in Table 2.2.A, and the potential emissions reductions in the periods to 2020 and 2030 listed in tables 2.2.B and 2.3 in Proposition to the City Council 1.

Sector/category	Activity	Affects measure
Heating	Replacement of remaining oil-fired boilers (investment) Cultural properties	1
Waste and wastewater	Stubberud - study to identify required measures (operational)	16
Road traffic	More efficient and climate-friendly commercial transport. (operational) ITS in commercial transport Zero-emission final mile city distribution (freight consolidation centre) Pilot for bulk freight management	9, 21, 0
Road traffic	Battery-charging infrastructure to encourage adoption of e-taxis and eLCVs. Pilot study of e-taxis in Olav Vs gate Pilot project to install rapid battery chargers - electric taxis and commercial vehicles Installation of dedicated charging stations for electric LCVs	7, 9
Road traffic	Municipal fleet to be zero-emission Replace fossil-fuelled vehicles with zero-emission vehicles by 2020 Procure electric street-sweepers	8
Road traffic	Establishment of new traffic management system prioritizing public transport	N
Road traffic	Increased planning and investment activity for cycle routes	6
Road traffic	Increased subsidy requirement for Ruter	4
Road traffic	Subsidies for municipal workplaces - follow-up of climate-friendly travel to and from work (Subsidy scheme/common fund for municipal workplaces)	18
Road traffic/ Other mobile combustion	Increase the funding ceilings for road traffic and building/construction in the Climate and Energy Fund (operational) <i>- Grants for cycle parking infrastructure at private-sector businesses</i> <i>- Grants for cycle parking infrastructure at housing cooperatives and similar residential properties</i> <i>- Grants for battery-charging infrastructure for e-LCVs and charging points for electric taxis</i> <i>- Grants for battery-charging infrastructure for electric vehicles owned by businesses</i> <i>- Grants for infrastructure for battery-charging and hydrogen fuelling for zero-emission construction sites</i> <i>- Grants for the upgrading of petrol stations to energy stations</i>	6, 7, 9, 12, 18, 19, M

Sector/category	Activity	Affects measure
Road traffic/ Other mobile combustion	Increase proportion of low- zero-emission machinery on construction sites (investment) Risk fund for zero-emission construction sites Pilot zero-emission construction site at Olav Vs gate Transition to eco-friendly machinery and equipment Tank facility for renewable diesel/biodiesel Standardized requirements for building and construction sites (dedicated position at UKE)	12, 13
Road traffic/ Other mobile combustion	Misc. projects/misc. collection	11, 13
Maritime traffic	Install shore power infrastructure at Sydhavna (incl. Norcem)	14
Study/Plan/Pilot	Facilitation of smarter transport systems Smarter transport in the Oslo region (collaborative project) More effective traffic management (including of exceptional traffic) Optimal management of signalling equipment for pedestrians, cyclists, and public transport	N
Study/planning/ pilot	Pilot project – Electrification of an entire housing cooperative (in compliance with EU – Green Charge)	P
Communication/ mobilization	Climate communications targeted at children and teenagers Climate House and school climate ambassadors	D
Communication/ mobilization	Climate House – educational initiatives for kindergartens, schools and the general population in Oslo	D

Attachment 4

Changes compared to the Climate Budgets 2017 and 2018

CHANGES IN THE STATISTICAL BASIS AND THE FORMULATION OF GOALS

The Norwegian Environment Agency's publication of new emissions statistics by municipality means that the entire time series presented in this Technical Report is different to that presented in the Technical Report for the Climate Budget 2018. The sectors are classified somewhat differently, and new emissions sectors have been added (maritime traffic and aviation). However there has been no significant change to the emissions trend described in the previous Technical Report.

The Technical Report for the Climate Budget 2018 used emissions data going back to 1991. The new statistics from the Norwegian Environment cover the years 2009, 2011, 2013, 2015 and 2016. The statistics for earlier years are recorded in Statistics Norway's statistics bank as a completed time series. The completed time series for the earlier years and the new time series for the years after 2009 are not comparable, since the methods, delimitations and data sources are different. The Norwegian Environment Agency is also planning further improvements to the new statistics. These improvements may further increase the differences between the completed time series and the new statistics. Accordingly, it is not possible to make a certain assessment of emissions going further back than 2009.

Accordingly, the figure for the climate goal has been calculated on the basis of the emissions statistics by municipality at the start of the period, and the formulation of the goal has been amended so that the new statistics can be used to assess whether the goal has been achieved, cf. Chapter 1.

CHANGES IN ASSESSMENTS OF MEASURES

During the preparation of the Climate Budget 2019, the effects of all measures included in last year's budget were reassessed. These new assessments of effects form part of our efforts to improve the technical quality and accuracy of the Climate Budget year to year. One outcome of this quality upgrade is that expected emissions reductions from several measures in the Climate Budget have been downgraded. This is the result both of methodological changes and reductions in the periods over which the effects are analysed, due to the fact that 2016 is one year closer to the time for goal attainment than 2015.

The most important changes in the assessments of effects are as follows:

- the anticipated effect of the road user payment system at the toll ring been downgraded by nearly 60,000 tonnes CO₂e. About half of this downgrade is due to the discovery of an error in the original analysis of the road-user payment system, which was conducted by the consultancy firm COWI for the Oslo Package 3 Secretariat. The new estimates are also based on new knowledge about emissions factors relating to heavy duty and light vehicles, as well as changes in the passenger car fleet

between 2014 and 2016. The estimates have also been corrected to allow for the fact that emissions from road traffic declined from 2015 to 2016. The measure is discussed in Attachment 1.

- In the Climate Budget 2018, the assessment of measures to increase the exploitation of landfill gas estimated that the effect would be to reduce emissions by approximately 6,900 tonnes CO₂e in the period 2015-2020. We have discovered that the source data underlying this estimate was incomplete. Accordingly, the effect of this measure is not included in the Climate Budget 2019, and the measure is included in Table 2.2.B in City Council Proposition 1. There is an ongoing dialogue between Statistics Norway, the Norwegian Environment Agency, the Agency for Waste Management, the Agency for Real Estate and Urban Renewal and the Climate Agency regarding the source data for emissions from landfill sites. The measure is discussed in Attachment 2.
- In the Climate Budget, the measure to increase material recycling of household waste and boost re-use was assessed on the basis of the quantity of unsorted plastic and food waste to have an emissions-reducing effect of 4,300 tonnes CO₂e in the period 2015-2020. We have re-calculated the effect of this measure on a more restrictive basis, in order to isolate the effect of the direct GHG emissions in Oslo. Accordingly, the sorting of food waste has been removed from this measure. New estimates from the Agency for Waste Management suggest that the amount of plastic going to incineration is likely to increase between 2016 and 2020, even though the amount of unsorted plastic waste is increasing. Accordingly, it is uncertain whether this measure will result in a net reduction in direct emissions in Oslo in 2020. The measure is discussed in Attachment 2.
- The modification of Alfaset Crematorium to run on renewable energy was included in the Climate Budget 2018, and the emissions-reducing effect of the measure was estimated at 250 tonnes CO₂e in the period 2015-2020. We have determined that this effect is reflected in the measure to phase out oil-fired boilers in municipal buildings. Accordingly, the measure has been put in Table 2.3 in City Council Proposition 1.
- We have determined that the measure to “Establish a low-emission zone for heavy duty vehicles in Oslo” cannot be not quantified for this submission. Currently we are updating our calculations of this measure’s effects on atmospheric emissions. Until these results are available, the timing for the implementation of this measure will remain uncertain. The Climate Agency is awaiting more information about how effectively the instrument is being implemented by this measure. Accordingly, the measure is omitted from the Climate Budget 2019. In the Climate Budget 2018, the measure was estimated to have an emissions-reducing effect of 2,800 tonnes CO₂e in the period 2015-2020.

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- In 2018, the Agency for Water and Wastewater Services has been responsible for “concluding documentation of nitrous oxide volumes in wastewater, with the aim of correcting emissions figures from Statistics Norway’. The measure is designed to improve our knowledge of actual emissions from wastewater, and in the best case scenario there will be a technical adjustment to the calculations resulting in a downgrading of emissions from this source. The implementation of this measure will not however cause emissions reductions in relation to the reference value. Accordingly, the measure has been omitted from the Climate Budget 2019. In the Climate Budget 2018, the emissions-reducing effect was put at 20,500 tonnes CO₂e for the period 2015-2020.

NEW MEASURES

The Climate Agency has developed four packages of measures as a follow-up to the Climate Budget 2018. The packages are designed to promote climate-friendly travel to and from work; a fossil-free city centre; the climate-friendly transport of goods; and zero-emission construction machinery. This work has resulted in many new measures and instruments, which are summarized in Chapter 4.2 and Attachments 1 and 2.

During our work on the Climate Budget 2019, as part of the consultation process for the Oslo Port Authority’s Action Plan for a zero-emission port in the future, we also considered measures targeted at maritime traffic. These measures are described in Attachment 1.

During the budget process we conducted assessments of all budget proposals where the owner of a measure had indicated the presence of a climate effect both to assess the magnitude of the effect and the time at which it would occur. Several of these measures have effects on emissions trends in the period to 2030 and support measures that have already been quantified. Several of these measures are summarized in Chapter 4.3 and in Attachment 3.

City of Oslo
Climate Agency
Olav Vs gate 4
N-0037
Oslo Norway

E-post postmottak@kli.oslo.kommune.no
Web www.oslo.kommune.no
www.klimaoslo.no