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CLIMATE AND ENVIRONMENT

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Norway's Fourth Biennial Report

Under the Framework Convention on Climate Change

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1 Introduction

This report is Norway's fourth biennial report related to climate change under the Framework Convention on Climate Change (UNFCCC). The previous biennial reports were submitted in, 2014, 2016 and 2018 respectively. The latest National Inventory Report (NIR) for greenhouse gases was submitted in April 2019. Norway ratified the UNFCCC on 9 July 1993. Norway ratified the Kyoto Protocol on 30 May 2002 and became a Party when the Protocol entered into force on 16 February 2005, and ratified the Doha amendment in June 2014. In addition, Norway ratified the Paris Agreement on 20 June 2016.

Norway's fourth Biennial Report (BR4) has been prepared in accordance with the "UNFCCC biennial reporting guidelines for developed country Parties" as contained in annex 1 to decision 2/CP.17. The common tabular format (CTF) tables have been prepared to be in accordance with the common tabular format for "UNFCCC biennial reporting guidelines for developed country Parties" as specified in decision 19/CP.18.

This BR4 is submitted as a stand-alone report and focuses on progress towards Norway's 2020 target and provision of support since what was reported in BR3.

The expert review team (ERT) of Norway's BR3 found that the reporting was mostly in adherence with the UNFCCC reporting guidelines on BRs as per decision 2/CP.17. In the review report[a], the ERT had three recommendations for improving the completeness and transparency of the reporting. In this report, it is sought to follow-up the recommendations to the extent it has been practically possible. The preparation of the BR4 also draws on the questions formulated and answers provided prior to the multilateral assessment and the multilateral assessment itself.

2 Information on greenhouse gas emissions and trends

2.1 Emissions trends for aggregated greenhouse gas emissions

The Norwegian National Inventory Report (NIR) has been prepared in accordance with the UNFCCC Reporting Guidelines on Annual Inventories, and the estimation methods generally follow the Guidelines for National Greenhouse Gas Inventories published by the Intergovernmental Panel on Climate Change (IPCC). The latest inventory with the National Inventory Report (NIR) and Common Reporting Format (CRF) covering the years 1990-2017 was submitted to the UNFCCC Secretariat 12 April 2019.

Chapter 2 of Norway's 2019 NIR provides detailed information on the greenhouse gas emissions and removals trends for gases and sectors. Therefore, only a short summary of the GHG emissions and removals trends for the years 1990-2019 is included here in BR4.

As required by the revised reporting guidelines, Norway's greenhouse gas inventory includes four different national totals. This includes total GHG emissions expressed in CO_2 equivalent with and without LULUCF, and with and without indirect CO_2. In the following chapters, if not specified otherwise, emission figures include indirect CO_2 emissions, but not LULUCF.
In 2017, total greenhouse gas (GHG) emissions in Norway were 52.7 million tonnes of carbon dioxide equivalents, which is a decrease of 0.9 million tonnes compared to 2016. Preliminary

[a] https://unfccc.int/sites/default/files/resource/TRR3_NOR.pdf

figures for 2018 show 52.04 Mt. Over the last two decades total emissions have been relatively stable. Total greenhouse gas emissions were approximately 1.5 million tonnes CO_2- equivalent, or 3 per cent, higher in 2017 than in 1990. Emissions reached their peak at 57.0 million tonnes in 2007. The net greenhouse gas emissions, including all sources and sinks, were 27.7 million tonnes of CO_2 equivalents in 2017 as compared to 41.2 Mt in 1990. The total emissions distribution among the main CRF categories from 1990 to 2017 is illustrated in Figure 2.1

Figure 2.1 *Total emissions of greenhouse gases by sources and removals from LULUCF in Norway 1990-2017 (Million tonnes CO_2 equivalents). 2018 estimate is preliminary. Source: Statistics Norway/Norwegian Environment Agency/ Norwegian Institute of Bioeconomy Research*

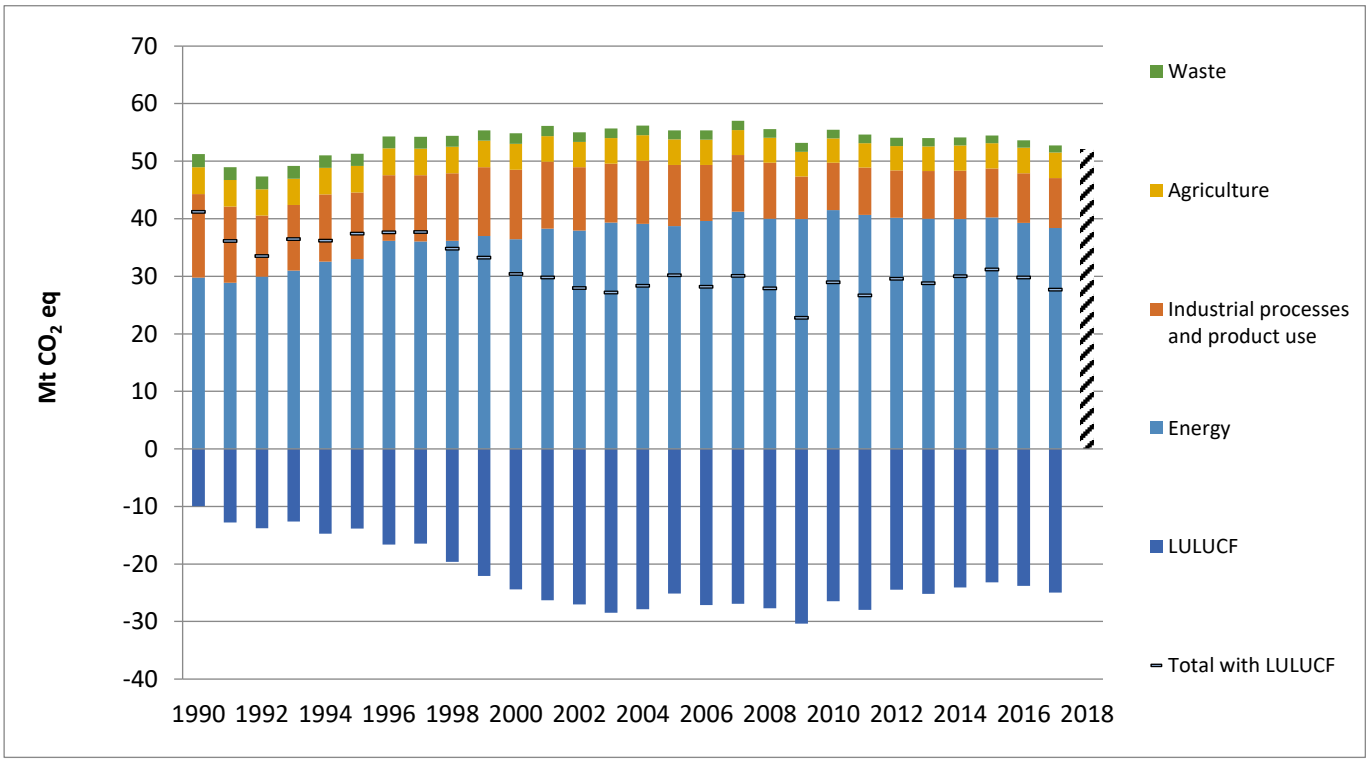


Table 2.1 presents the total emissions including indirect CO_2 emissions and its distribution among the main CRF categories from 1990 to 2017, and a preliminary estimate of the total for 2018. The total indirect CO_2 emissions are also presented in this table.

Table 2.1 *Total emissions of greenhouse gases by sources and removals from LULUCF in Norway 1990-2017. Emissions are given in million tonnes CO_2 equivalents*

Year	Energy	Industrial processes and product use	Agriculture	LULUCF	Waste	Total with indirect CO_2 and without LULUCF	Total with indirect CO_2 and with LULUCF	Indirect CO_2 emissions
1990	29.8	14.5	4.7	-10.0	2.2	51.2	41.2	0.6
1995	33.0	11.6	4.6	-13.8	2.1	51.3	37.5	0.9
2000	36.4	12.1	4.5	-24.4	1.8	54.8	30.4	1.0
2005	38.7	10.6	4.5	-25.1	1.6	55.4	30.2	0.5
2008	40.0	9.7	4.3	-27.7	1.5	55.6	27.9	0.4
2009	39.9	7.4	4.3	-30.3	1.5	53.2	22.8	0.3
2010	41.5	8.2	4.2	-26.5	1.5	55.5	29.0	0.3
2011	40.7	8.2	4.2	-28.0	1.5	54.6	26.7	0.3
2012	40.2	8.2	4.2	-24.5	1.5	54.1	29.6	0.3
2013	40.0	8.3	4.3	-25.2	1.4	54.0	28.8	0.3
2014	40.0	8.4	4.4	-24.1	1.4	54.1	30.1	0.4
2015	40.2	8.5	4.4	-23.2	1.3	54.5	31.2	0.4
2016	39.3	8.6	4.5	-23.8	1.3	53.6	29.8	0.3
2017	38.4	8.6	4.5	-25.0	1.2	52.7	27.7	0.3
2018*						52.04		

Source: Statistics Norway/ Norwegian Environment Agency/ Norwegian Institute of Bioeconomy Research. 2018 estimate is preliminary.*

Since 1990 Norway has experienced strong economic and population growth as well as expansion of petroleum extraction. These factors have led to increased use of fossil fuels, and consequently higher CO_2 emissions. However, the growth in CO_2 has been almost fully offset by reductions in other gases and sectors.

In 2017, the net greenhouse gas removals in the LULUCF sector was 25.0 million CO_2 equivalents, which would offset almost half of the total greenhouse gas emissions in Norway that year. The average annual net removals from the LULUCF sector was about 23.7 million tonnes of CO_2 equivalents for the period 1990-2017. It should be noted, however, that the accounting rules under the Kyoto Protocol, which would be relevant for the targets through 2020, will probably result in a minor removal from LULUCF. The calculated changes in carbon stocks depend upon several factors such as growing conditions, harvest levels, age-class effects and land use changes. In particular, variations in annual harvest will in the short term directly influence the variations in changes in carbon stocks and dead organic matter.

CTF table 1 with the trends for the gases is reported through the CTF application.

2.2 National inventory arrangements and changes

2.2.1 Current national inventory arrangements

The national system for greenhouse gas inventories is based on close cooperation between the Norwegian Environment Agency, Statistics Norway and the Norwegian Institute of Bioeconomy Research (NIBIO). Statistics Norway is responsible for the official statistics on emissions to air. NIBIO is responsible for the calculations of emission and removals from Land Use and Land Use Change and Forestry (LULUCF). An overview of institutional responsibilities and cooperation is shown in Figure 2.2.

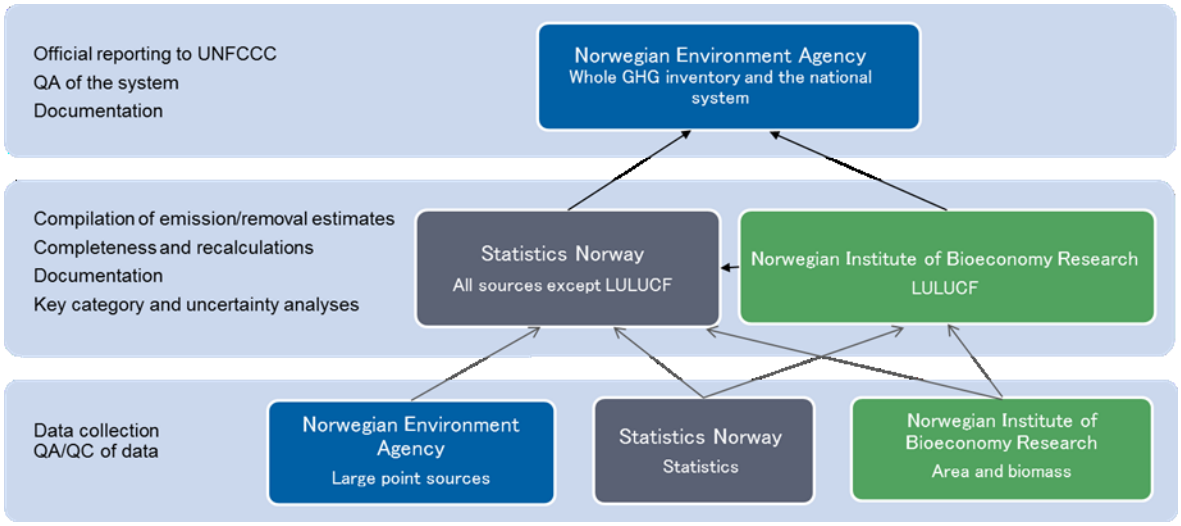


Figure 2.2: Overview institutional responsibilities for GHG inventories, Norway.

The Norwegian Environment Agency was appointed by the Ministry of Climate and Environment as the national entity pursuant to the Norwegian government`s Parliament budget proposition for 2006. This appointment was renewed in 2015 through the budget proposition from the Ministry of Environment and Climate to the Norwegian parliament. The budget proposition stated that *"The Norwegian system will build on existing organization and cooperation between the Norwegian Environment Agency, Statistics Norway and the Norwegian Institute of Bioeconomy Research. These three institutions are held individually responsible that their own contributions to the national system are in line with the guidelines from the climate convention on the calculation and archiving of emissions and removals of greenhouse gases. The Norwegian Environment Agency is still appointed as a national entity with overall responsibility for the inventory and reporting"*. (St. prop. Nr. 1 (2014-2015)). As the national entity, the Norwegian Environment Agency is in charge of approving the inventory before official submission to the UNFCCC.

To ensure that the institutions comply with their responsibilities, Statistics Norway and NIBIO have signed agreements with the Norwegian Environment Agency as the national entity. Through these agreements, the institutions are committed to implementing Quality Assurance/Quality Control (QA/QC) and archiving procedures, providing documentation, making information available for review, and delivering data and information in a timely manner to meet the deadline for reporting to the UNFCCC.

The most updated information about the methods and framework for the production of the emission inventory, as well as changes performed since the previous emission inventory, are

given in the Norwegian Inventory Report "Greenhouse Gas Emissions 1990-2019, National Inventory Report" (Norwegian Environment Agency Report M-1271).

The main emission model has been developed by - and is operated by - Statistics Norway. Emissions from road traffic, methane from landfills and emissions of HFC, PFC and SF_6 from products and some agriculture emissions are calculated by side models, and are incorporated into the main model along with emissions from point sources collected by the Norwegian Environment Agency.

NIBIO is in charge of estimating emissions and removals from LULUCF for all categories where area statistics are used for activity data. The National Forest Inventory (NFI) database contains data on areas for all land uses and land-use conversions as well as carbon stocks in living biomass, and are, supplemented by some other activity data, the basis for the LULUCF calculations. The NFI utilizes a 5-year cycle based on a re-sampling method of the permanent plots.

Norway has implemented the formal QA/QC plan, according to which all three institutions prepare a QA/QC report annually. On the basis of these reports, the three institutions collaborate on which actions to take to further improve the QA/QC of the inventory.

The UNFCCC biennial reporting guidelines calls for Parties to provide summary information on the changes to the national inventory arrangements since their last national communication or biennial report. Each year, Norway reports the changes in the national system in chapter 13 of the NIR. For BR4, Norway therefore includes the changes as reflected in the NIRs reported in 2019 and 2018. Comprehensive information regarding the national system is reported annually in Annex V of the NIR.

2.2.2 Changes in the national inventory arrangements reported in the 2019 NIR

Statistics Norway, one of the three parts in the Norwegian National System, has undergone a reorganization of staff and work areas between its two offices/locations; Oslo and Kongsvinger. The experts compiling the emission inventory for all sectors except LULUCF, was up to 2018 located in Oslo. This group of experts has through 2018 been replaced by a new staff located in Kongsvinger. The long term goal of this relocation is to improve data quality by increasing the contact and collaboration between the departments producing the input (activity) data and the inventory compilers.

2.2.3 Changes in the national inventory arrangements reported in the 2018 NIR

Statistics Norway is undergoing a reorganization of staff and work areas between its two offices/locations; Oslo and Kongsvinger. The experts compiling the emission inventory for all sectors except LULUCF, have up to now been located in Oslo. This group of experts will through 2018 be replaced by a new staff located in Kongsvinger. The long-term goal of this relocation is to improve data quality by increasing the contact and collaboration between the departments producing the input (activity) data and the inventory compilers.

3 Quantified economy-wide emission reduction target

Norway’s climate policy is founded on the objective of the UN Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement. The scientific understanding of the greenhouse effect set out in the reports from IPCC is an important factor in developing

climate policy. Thus, the policies and measures reported are seen as modifying long-term trends in anthropogenic greenhouse gas emissions and removals. Section 4.1 of Norway's seventh National Communication describes inter alia the Norwegian policy-making process, Norway's climate targets and the policy instruments.

Reduce emissions by 30 per cent by 2020

In 2012, this target was made operational through the legally binding commitment for 2013-2020 under the Kyoto Protocol. The commitment means that Norway must ensure that annual greenhouse gas emissions for the period 2013–2020 does not exceed an average of 16 per cent lower than in 1990. This establishes an emission budget for Norway for the period 2013–2020 under the Protocol consistent with Norway's 2020 target of cutting global greenhouse gas emissions by the equivalent of 30 per cent of its 1990 emissions by 2020. Norway ratified the Doha amendments 12 June 2014. Thus, compliance with the commitment under KP will also imply that the 30 per cent target for 2020 is achieved.

Within the framework of the Kyoto Protocol, Norway has long experience of using flexibility mechanisms, particularly project-based cooperation in developing countries under the Clean Development Mechanism (CDM). By using these mechanisms, Norway can fund reductions in greenhouse gas emissions in developing countries, and be credited for these reductions in its greenhouse gas inventory under the Kyoto Protocol. Since climate change is a global problem, it does not matter whether emissions are reduced in Norway or in other countries. What matters is the overall reduction in global emissions. By using these international mechanisms, Norway has been able to assume targets that are more ambitious than if it had to do all reductions domestically and so far more than met its commitments under the Kyoto Protocol. This is done through contributions reflecting flows of units in the European Emissions Trading System and the Norwegian carbon unit purchase program.

Reduce emissions by at least 40 per cent by 2030

Norway has through its National Determined Contribution (NDC) under the Paris Agreement committed to a conditional target of at least 40 per cent emissions reduction by 2030 compared to 1990. Norway's NDC is economy wide, covering all sectors and greenhouse gases[a]. The 2030 target has been established by law in the Norwegian Climate Change Act. Norway will strengthen its nationally determined contribution under the Paris Agreement in 2020.

In October 2019 the EU, Iceland and Norway formally agreed to cooperate on fulfilling our respective greenhouse gas emission reduction targets for 2030. Norway has been a part of the EU Emission Trading System (ETS) since 2008, and in Decision No 269/2019 of 25 October 2019 the EU, Iceland and Norway formally agreed to extend their cooperation, for the period 2021-2030, the climate cooperation with the EU by including the Effort Sharing Regulation[a] and the Regulation on greenhouse gas emissions and removals from land use, land use change and forestry (the LULUCF-regulation)[a], into Protocol 31 of the EEA Agreement. By this decision, Iceland and Norway take part in all three pillars of the EU climate policies, thereby taking action to fulfil our respective emission reduction targets of an at least 40 per cent reduction of greenhouse gas emissions by 2030 compared to 1990 levels.

According to the agreement, Norway will fulfil its respective greenhouse gas emission reduction target for the period 1 January 2021 to 31 December 2030 in accordance with the ETS-directive, LULUCF-Regulation and the Effort Sharing Regulation.

Under the Effort Sharing Regulation, Norway will have a commitment to reduce emissions in the non-ETS-sectors by 40 per cent in 2030 compared to 2005. Under the LULUCF-regulation, Norway will have a commitment to reach a net-zero emissions for this sector. In the Government's most recent political platform (Granavolden-platform), it is stated that the government intends to reduce emissions in the non-ETS-sectors by 45 per cent in 2030 compared to 2005-levels.

Climate neutrality by 2030

In connection with its consent to ratification of the Paris Agreement, the Norwegian Parliament asked the Government to work on the basis that Norway is to achieve climate neutrality from 2030. This means that from 2030, Norway must achieve emission reduction abroad equivalent to remaining Norwegian greenhouse gas emissions.

The Solberg Government will provide the Norwegian Parliament with an account of its follow-up at a suitable time.

Low-emission society by 2050

In June 2017, the Norwegian Parliament adopted an Act relating to Norway's climate targets (Climate Change Act), which establishes by law Norway's target of becoming a low-emission society by 2050. The purpose is to promote the long-term transformation of Norway in a climate-friendly direction. The Act describes a low-emission society as one where greenhouse gas emissions, on the basis of the best available scientific knowledge, global emission trends and national circumstances, have been reduced in order to avert adverse impacts of global warming, as described in the Paris Agreement. In quantitative terms, the target is to achieve emissions reductions of the order of 80–95 per cent from the level in the reference year 1990. The effect of Norway's participation in the EU Emission Trading System is to be taken into account in assessing progress towards this target. The interval specified above is the same as that used in the EU's conditional goal for reduction of EU-wide emissions by 2050. As a small open economy, Norway is dependent on a similar shift in other countries if it is to maintain its ability to make full, effective use of labour and other resources and achieve its climate and environmental policy goals.

The Government recently presented a low emission strategy for 2050. In this Strategy the Government announced that they will increase the climate target for 2050 to represent an emission reduction of the order of 90 – 95 per cent from the reference year 1990.

In this BR4, Norway reports on the target for the period through 2020. By 2020, Norway is committed to reduce global emissions of greenhouse gases equivalent by 30% relative to Norway's emission level in 1990. The target was set by the Government in 2007, agreed by the Norwegian Parliament and sets the overall ambition level. It was reported pursuant to the Copenhagen Accords. In 2012, this target was made operational through the legally binding commitment for 2013-2020 under the Kyoto Protocol where average emissions in 2013-2020 shall not exceed 84% of the 1990 level. Norway ratified the Doha amendments 12 June 2014. Thus, compliance with the commitment under KP will also imply that the 30% target for 2020 is achieved. Norway explained the relation between the target and a quantified emissions reduction commitment for an 8 years period in its submission under the KP the 8th of May 2012[b] and in the subsequent presentation to the AWG KP on the 16th of May[c].

In April 2016, Norway submitted its report to facilitate the calculation of its assigned amount pursuant to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol for the second commitment period and to demonstrate its capacity to account for its emissions and assigned amount (hereinafter referred to as the initial report) to facilitate the calculation of the assigned amount. The report has been reviewed and Norway is thus ready to issue its assigned amount.

Through the initial report Norway made a number of choices with regards to the implementation of the Kyoto Protocol's second commitment period. CTF table 2 describes relevant information for Norway's implementation of the second commitment period under the Kyoto Protocol and the most important aspects are summarised here in textual form.

Norway reports and will account for all the mandatory gases or groups of gases. The year 1990 will be used as the base year, with the exception of NF_3 which has 2000 as the base year. All mandatory sectors are included and the global warming potential values from the Fourth Assessment Report of the IPCC are used.

Pursuant to the accounting rules under the Kyoto Protocol, Norway uses an activity-based approach for the LULUCF sector through 2020. For the Kyoto Protocol's second commitment period, Norway will continue to report on emissions and removals from Deforestation and Afforestation/Reforestation under Article 3.3 and Forest Management under Article 3.4 in accordance with paragraph 7 in Annex I to decision 2/CMP.7. In addition, Norway has elected to include emissions and removals from the voluntary activities Cropland Management and Grazing land Management under Article 3.4 for the current period. Norway will account for all the activities under Articles 3.3 and 3.4 at the end of the commitment period.

As a supplement to domestic action to reduce emissions and enhance removals, Norway will use CERs acquired through its procurement program and AAUs reflecting net transfers under the European ETS from the EU to Norway. Norway will also use about 9 million Kyoto units that are carried over from the first commitment period (see CTF table 2(e)I). 3 million units were acquired by the procurement program, and the 6 million AAUs refer to a swap where the

[b] FCCC/KP/AWG/2012/MISC.1 at http://unfccc.int/resource/docs/2012/awg17/eng/misc01.pdf
[c] http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_norway_ppt.pdf

CERs and ERUs used by the ETS installations to offset their emissions in 2013 and 2014 were retired pursuant to the KP 1, and a similar amount of AAUs are carried over. See further information in chapter 4.5

The information provided in CTF table 2 does not prejudge Norway's post-2020 approach.

CTF table 2a. *Description of quantified economy-wide emission reduction target: base year*

NORWAY		
Base year/base period	1990	
Emission reduction target	% of base year: 30%	% of 1990: 30%
Period for reaching target	2020	2020

CTF table 2b. *Description of quantified economy-wide emission reduction target: gases and sectors covered*

Gases covered	**Base year for each gas (year):**
CO_2	1990
CH_4	1990
N_2O	1990
HFCs	1990
PFCs	1990
SF_6	1990
NF_3	2000
Other gases	NA
Sectors covered	**Covered**
Energy	Yes
Transport	Yes
Industrial processes	Yes
Agriculture	Yes
LULUCF	Yes

Waste	Yes
Other (specify)	NA

Abbreviations: LULUCF = land use, land-use change and forestry.

CTF table 2c. *Description of quantified economy-wide emission reduction target: global warming potential values (GWP)*

Gases	**GWP values**
CO_2	Fourth Assessment Report of the IPCC
CH_4	Fourth Assessment Report of the IPCC
N_2O	Fourth Assessment Report of the IPCC
HFCs	Fourth Assessment Report of the IPCC
PFCs	Fourth Assessment Report of the IPCC
SF_6	Fourth Assessment Report of the IPCC
NF_3	Fourth Assessment Report of the IPCC
Other gases	NA

Abbreviation: GWP = global warming potential

CTF table 2d. *Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector*

Role of LULUCF	LULUCF in base year level and target	Included in target year
	Contribution of LULUCF only in target year	Activity-based approach with accounting rules as applied under the Kyoto Protocol

Abbreviation: LULUCF = land use, land-use change and forestry.

CTF table 2(e)I. *Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention* [a]

	Possible scale of contributions
CERs	Mechanisms under the Kyoto Protocol will be used to meet the target. The net contribution of units acquired through the mechanisms could be about 74 million tonnes for the whole 2013-2020 period including possible contributions from LULUCF. This includes actual carry-over of 2.25 million CERs and 0.74 million ERUs to Norway's party holding account and planned carry-over of 5.98 million AAUs.
ERUs	
AAUs [b]	
Carry-over units [c]	
Other mechanism units under the Convention (specify) [d]	

Abbreviations: AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] AAUs issued to or purchased by a Party.

[c] Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision XX /CMP.8.

[d] As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17.

CTF table 2(e)II. *Description of quantified economy-wide emission reduction target: other market-based mechanisms*

	Possible scale of contributions
NA	Norway will not use other market mechanisms than those eligible for meeting Norway's commitment under the Kyoto Protocol. For practical purposes this means planned acquisitions of AAUs through international emissions trading and CERs through the Clean Development Mechanism.

4 Progress in achievement of quantified economy-wide emission reduction targets and relevant information.

4.1 General overview on mitigation actions and their effect

The polluter pays principle is a cornerstone of the Norwegian policy framework on climate change. Our policies are designed to yield the greatest possible emission reductions relative to cost, and should result in emission reductions both in Norway and abroad. Furthermore, our policy will be based on the responsibility to help safeguard the planet and on the precautionary principle.

General policy instruments are a key element of domestic climate policy. Cross-sectoral economic policy instruments that put a price on emissions (i.e. the CO_2 tax and the emission trading system) form the basis for decentralised, cost-effective and informed actions, where the polluter pays. In areas subject to general policy instruments, additional regulation should as a main rule be avoided. At the same time, the possibility of employing other policy instruments in addition to emission trading and taxes is to be continued, also in these sectors. In its White Paper on the 2030 climate strategy (Meld St. 41 (2016-2017) the Government states that it will promote the use of cost-effective mitigation measures to meet the 2030 commitment. For non-ETS emissions, a tax on greenhouse gases would be the main mitigation measure. If the CO_2 tax is not considered to be an adequate or appropriate instrument, other instruments that provide equally strong incentives to reduce emissions will be considered, including direct regulation under the Pollution Control Act and voluntary agreements.

The broad political agreement on climate of 2012, measures that are cost-effective in the light of expectations of rising emission prices over the lifetime of the investments, and which are not necessarily triggered by current policy instruments, should be given special consideration. This applies particularly to measures that promote technology development and to measures that mobilise earlier adoption by the population of consumer patterns that yield lower emissions. More than 80 per cent of domestic greenhouse gas emissions are from 2013 either covered by the emissions trading scheme, subject to a CO_2 tax or other taxes directed to reduce greenhouse gas emission. Certain sources of emissions may be difficult to incorporate into the emissions trading scheme or to make subject to a CO_2 tax. In such cases, other instruments to reduce greenhouse gas emissions may be more appropriate.

In addition to the emission trading system and taxes, support to research on and innovation of climate-friendly technologies will provide complementary support where markets do not provide the solutions.

The text in chapter 4 reflects the most recent developments in policies focusing on Norway's 2030 targets. The 2020 target is made operational through the commitment under the Kyoto Protocol for 2013-2020. Most of this period is now history. Policies implemented since BR3 will also have some effects on domestic emissions through 2020 and how the achievement of the 2020 target is achieved through domestic measures, cooperation with the EU through the emissions trading system and acquisition of units from the Clean Development mechanism. Thus, compared to BR3, some updates to the figures are given in chapters 4.5. These show that assuming the entry into force of the Doha amendments, Norway will comply with its 2013-2020 commitments and thus the 2020 target.

4.2 Information on specific areas of mitigation actions – policies and measures and their effects

The UNFCCC reporting guidelines for the biennial report call for information on mitigation actions, including the policies and measures that have been implemented or are planned to be implemented since the last national communication or biennial report. Norway's previous biennial report, BR3, was reported in conjunction with Norway's seventh National Communication (NC7). In CTF table 3, Norway therefore includes the policies and measures reported in BR3 and NC7 in addition to new or changed mitigations and/or policies and measures. The effects for some of the previously reported policies and measures have been revised. The policies and measures in CTF table 3 are organized by sectors and by gases.

For some of the policies and measures in CTF table 3 the impact in terms of GHG reductions are not estimated (NE). The reasons for this are to the extent possible explained below. Thus, although no numerical effect has been estimated, the various policies and measures are likely to have an impact in terms of GHG reductions. It should also be noted that as most of the stationary energy consumption in Norway is based on electricity and the electricity supply in Norway is almost entirely based on renewable energy, enhancing energy efficiency and encouraging the use of new renewable energy sources do not necessarily have an impact on domestic emissions.

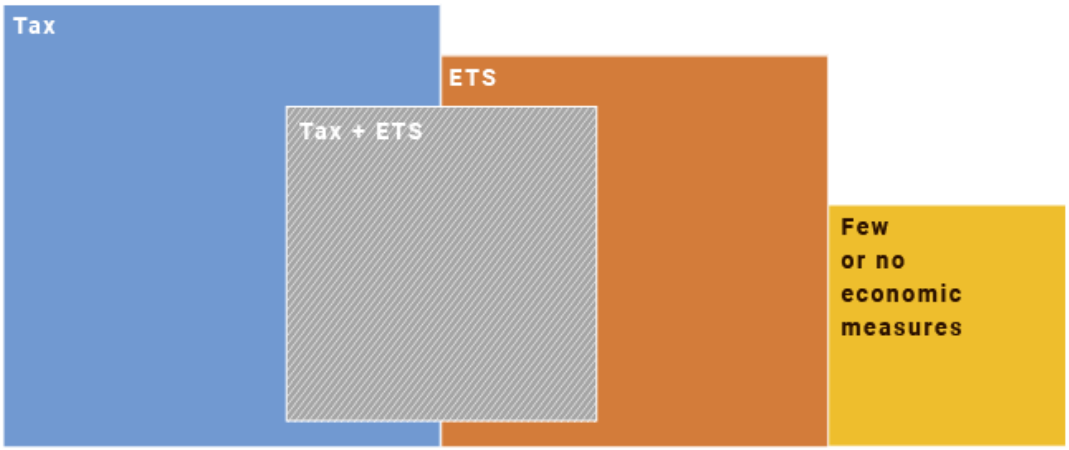
All in all, the sectoral and cross-sectoral measures that have been put in place since 1990 were in Norway's seventh National Communication estimated to have reduced greenhouse gases by 19.5-23.3 million tonnes CO_2 equivalents in 2020 and 21.3–25.7 million tonnes CO_2 equivalents in 2030. The CO_2 tax is the single measure that has contributed most to the reduction. Based on measures reported in this BR4, the reduced emissions in 2020 and 2030 are estimated to about 21.0-24.7 and 22.0-26.4 million tonnes CO_2 equivalents respectively.

4.2.1 Cross-sectoral economic policies and measures

4.2.1.1 *Introduction*

Cost-efficient policy instruments ensure that reductions in emission are implemented in a way that leads to the lowest cost to society as a whole. If policy instruments are not cost-effective, society must accept an unnecessary loss of welfare in other areas in order to achieve environmental goals. In the assessment of policies and measures, cross-sectoral effects and long term effects on technology development and deployment should be taken into consideration.

Figure 4.1 *Emissions covered by economic measures by instrument type*



Source: Statistics Norway /The Norwegian Environment agency /Ministry of Finance, 2018

4.2.1.2 *Green taxes*

Green taxes are imposed on activities that are harmful for the environment so that businesses and individuals are incentivized to take into account the environmental cost of their activities to society. Some of these taxes are levied on products that result in CO_2 emissions and have a climate motivation. There are also green taxes directed at other emissions and environmental effects, which have an indirect impact on greenhouse gas emissions. Table 4.1 gives an overview of the green taxes in Norway in 2019.

Table 4.1 *Norwegian green taxes. 2019. NOK*

Tax	**Tax rate**	**Introduced**
CO_2 tax	varies, see table 4.2	1991
Tax on CO_2 emissions in petroleum activities on the continental shelf	varies, see table 4.2	1991
Road usage tax on petrol, NOK/litre		1933
Sulphur-free	5.25	
Bioethanol[1]	0/5.25	
Road usage tax on auto diesel, NOK/litre		1993
Sulphur-free	3.81	
Biodiesel[1]	0/3.81	
Road usage tax on LPG, NOK/kg LPG	2,98	2016
Lubricating oil tax, NOK/litre	2.23	1988
Sulphur tax, NOK/litre per 0.25 weight per cent sulphur content above 0.05 weight per cent	0.133	1970
Tax on health- and environmentally damaging chemicals		2000
Trichloroethene, NOK/kg	73.37	

Tetrachloroethene, NOK/kg	73.37	
Tax on HFC and PFC, NOK/tonne CO_2 –equivalents	508	2003
Tax on emissions of NO_X, NOK/kg	22,27	2007
Environmental tax on pesticides	varies	1998
Environmental tax on beverage packaging[2]		1973
Carton and cardboard, NOK/unit	1.45	
Plastics, NOK/unit	3.55	
Metals, NOK/unit	5.88	
Glass, NOK/unit	5.88	
Electricity tax		1951
Standard rate, NOK/kWh	0.1583	
Reduced rate (manufacturing, etc.), NOK/kWh	0.0050	
Base-tax on mineral oils, etc.		2000
Standard rate, NOK/litre	1.665	
Reduced rate (pulp and paper, dyes and pigments industry), NOK/litre	0.21	
Motor vehicle registration tax	varies	1955
Annual tax on motor vehicles	varies	1917
Annual weight-based tax on vehicles	varies	1993

Source: Ministry of Finance

[1] Biodiesel and bioethanol included in the blending obligation are subject to the same tax rate as sulphur-free petrol and auto diesel, respectively. Other biofuels are not subject to road usage tax.

[2] These rates are reduced according to the amount of packaging collected for recycling.

In Norway, CO_2 taxes and quotas (EU ETS) cover more than 80 per cent of greenhouse gas emissions. In 2019, the standard CO_2 tax is 507 NOK and is levied on mineral oils, petrol and diesel. The tax on HFC and PFC is also NOK 508 per tonne CO_2 equivalents.

The price on greenhouse gas emissions varies considerably between sectors and sources. The price on emissions is highest in the petroleum sector and in domestic aviation, which are also part of EU ETS. Both sectors are subject to CO_2 tax in addition to the EU ETS, and the total price on emissions is about NOK 760 and NOK 710, respectively. See chapter 4.2.1.3below for more details on the Norwegian CO_2 tax system. Agriculture is not a part of the EU ETS, nor is it subject to tax on emissions of methane or nitrous oxide. However, standard rates of CO_2 tax and base tax on mineral oils apply to agriculture.

4.2.1.3 *The Norwegian CO_2 tax scheme*

CO_2 taxes on mineral oil, petrol and emissions from petroleum extraction on the continental shelf were introduced in 1991 to cost-efficiently limit greenhouse gas emissions. In addition to being subject to CO_2 taxes, emission from extraction of petroleum were also included in the European emission trading system (EU ETS) in 2008. CO_2 taxes on natural gas and LPG were introduced in 2010.

In 2017, the standard rate of CO_2 taxes is approximately NOK 510 per tonne of CO_2 (petrol, diesel, natural gas, LPG, and mineral oil). Some sectors and activities are exempt from carbon tax or pays a reduced tax, see below.

The standard CO_2 tax on *natural gas and LPG* amounts to approximately NOK 510 per tonne CO_2. If the fuel is used in land based manufacturing covered by EU ETS, the tax rate will either be reduced or the activities may be exempted from the tax. For the time being, other sectors and activities exempted from the CO_2 tax on natural gas and LPG include (list not conclusive) commercial fishing, commercial greenhouses, chemical reduction or electrolyses, metallurgical and mineralogical processes and international shipping and aviation.

The standard CO_2 tax on *petrol and mineral oil* amounts to approximately NOK 510 per tonne CO_2. Current exemptions include international aviation and shipping and offshore fishing.

Some taxes that do not target greenhouse gas emissions directly nevertheless increase the total tax on fossil fuels and therefore affect emissions. The road usage tax on fuels is levied to internalise the costs inflicted on the society in terms of accidents, congestion, noise, road wear and tear as well as health and environmentally harmful emissions other than CO_2. Moreover, there is a base tax on mineral oil, the purpose of which is to avoid substitution of electricity due to the electricity tax.

Table 4.1 contains all green taxes while table 4.2 shows all current CO_2 taxes. Below follows a description of the effect of green taxes on mainland emissions. Chapter 4.2.3discusses in more detail the CO_2 tax on petroleum activities and its effects on emissions off shore.

Estimated effect on national emissions (mainland)
Together with the base tax on mineral oil, the CO_2 tax on mineral oil constitutes a significant proportion – about 35 per cent – of the consumer price of heating oils. Emissions from heating purposes in households and industrial buildings under the CO_2 tax, account for about 2 per cent of the total national emissions of greenhouse gases. The taxes motivate households and industry to implement alternative heating systems, apply better insulation and use energy more efficiently. Since 1990, emission from heating in households and industrial buildings has declined by 40 per cent. Reductions in recent years may also reflect expectations that use of mineral oil for heating of building will be banned from 1st of January 2020.

For some products such as petrol, other tax elements (road usage tax) constitute a larger proportion of the price compared to the CO_2 tax. For example, in 2017 the road usage tax on sulphur free petrol is NOK 5.19 per litre, whereas the CO_2 tax is NOK 1.04 per litre. On mineral oils there is a base tax and also a sulphur tax on mineral oil with a sulphur content above 0.05 weight per cent. The total tax on such goods must be taken into account when comparing tax levels with other countries. While the total tax pressure will influence the effect on emissions, the estimates of the effect of the CO_2 tax only look at this element of the total taxes. To the extent that the CO_2 tax has increased the price of transport fuels, it is reasonable to assume that it must also have limited the increase in the volume of transport somewhat, resulted in some changes in choice of transport medium and encouraged the purchase of more fuel-efficient vehicles.

Norway's Sixth National Communication presented the estimated mitigation impact of the CO_2 tax in mainland sectors to be 0.9 million tonnes of CO_2 equivalents both in 2020 and 2030, compared with a scenario without CO_2 tax.

Since these calculations in January 2014, CO_2 taxes on mineral oil, natural gas and LPG have increased towards the level of petrol, cf. Norway's second Biennial Report and Norway's third Biennial Report. This is in line with the recommendations of the Green Tax Commission (NOU 2015:15). The tax increases, combined with a broadening of the tax base, are estimated to have strengthened the mitigation impact on CO_2 emissions to about 1.105 million tonnes in 2020 and 2030, again compared with a scenario without CO_2 tax.

These estimates are uncertain. In the longer run, emission reductions may become larger if the higher taxes stimulate a shift toward more environmentally friendly technologies.

Table 4.2 *Norwegian CO_2 taxes 2019*

	Tax rate NOK/litre, NOK/kg or NOK/Sm^3	Tax rate NOK/tonne CO_2
Petrol	1.18	509
Mineral oil		
- Standard rate, light fuel oil	1.35	507
- Domestic aviation	1.30	510
- Fishing inshore waters	0.29	109
Domestic use of gas		
- Natural gas	1.02	513
- LPG	1.52	507
- Reduced tax natural gas[1]	0.06	30
Petroleum activities on the continental shelf[1]		
Light fuel oil	1.08	406
Natural gas	1.08	462
- natural gas emitted to air	7.41	462

Sources: Ministry of Finance and Statistics Norway

[1] Most of these emissions are also covered by the EU ETS.

4.2.1.4 ***Emission trading***

Norway established a national emissions trading scheme in 2005. The scheme closely resembled the EU's emissions trading scheme (ETS) and covered 11 per cent of total Norwegian greenhouse gas emissions, mainly from industry. Emissions already subject to CO_2 tax were not included in the scheme.

From 2008 Norway became part of EU ETS phase II, which broadened the scheme to cover nearly 40 per cent of Norwegian greenhouse gas emissions. The petroleum sector and emissions from industries that had previously been subject to CO_2 taxes were included in the ETS at that stage. In addition to the sectors included in the ETS, Norway decided unilaterally in

February 2009 (effective from 1 July 2008) to include nitrous oxide emissions from the production of nitric acid in Norway. Such emissions constituted about 4 per cent of Norwegian greenhouse gas emissions in 2005.

Starting from 2012, the aviation sector was also included in the scope of the ETS. From 2013, phase III (2013-2020), the coverage of the ETS was further expanded, covering both new sectors (production of aluminium, petrochemical industry, mineral wool, ferroalloys, CCS) and gases (PFCs). From 2013, about 50 per cent of the Norwegian emissions are covered by the ETS.

Cap

Norway participates in the EU ETS. The aggregated future emissions covered by the scheme cannot exceed the EU-wide cap, which is set 21 per cent lower in 2020 compared with the emissions in 2005 from the covered sectors. Norwegian installations represent about 1 per cent of the total emissions. Norway's participation in the ETS from 2008 led to a tightening of the system, as Norwegian installations have had a higher demand for allowances than the amount of allowances added pursuant to this expansion of the system. The reduction rate for the cap is further increased from 2020 so that overall reduction of the cap in 2030 will be 43 per cent compared to 2005.

Legal basis

The legal basis for emissions trading in Norway is the Greenhouse Gas Emissions Trading Act which was adopted on 1 January 2005. The Act has been amended several times, notably in June 2007, February 2009 and May 2012. The amendments in 2007 and 2009 provided the basis for the emissions trading scheme in the Kyoto Protocol first commitment period (2008-2012). In July 2012, Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the EU ETS was incorporated in the EEA Agreement.

Allocation and emissions

In the first (2005-2007) and second (2008-2012) phases of the ETS, allowances were allocated based on rules developed nationally (see NC6). The average amount of Norwegian emissions covered by ETS was 6 and 19.1 Mt/year in the respective phases. The ETS entails acquisition of Kyoto units, and a total volume of about 15 million CERs and ERUs are surrendered directly from the installations for their compliance from 2008 through 2014, and there is also a net transfer of AAUs between EU and Norway, which has been used for compliance in the first commitment period under the Kyoto Protocol. A similar clearing mechanism will apply in the second commitment period under the Kyoto Protocol.

Installations in sectors that are considered to be at risk of carbon leakage receive some or all of their allowances free of charge. For phase III (2013-2020), the allocation methodology is harmonized across Europe. The general rule for allocation in phase III is based on performance benchmarks rather than historical emissions levels. From 2013, total free allocation to Norwegian installations will represent about 75 per cent of their 2012 emissions. Another measure aiming at preventing carbon leakage is that specific industries affected by higher electricity

prices caused by the allowance price, since 2013 can be granted economic compensation (see chapter 4.2.8.4).

Compliance and reporting requirements

Operators included within the scope of the emissions trading scheme must report their verified emissions yearly to the Norwegian Environment Agency by 31 March the following year. If an operator does not submit an emission report in accordance with the provisions on reporting by 1 April, the Norwegian Environment Agency may suspend the operator's right to transfer allowances to other account-holders. From the compliance year 2013, emissions reports from Norwegian installations must be verified by an accredited third party (verifier). Prior to 2013, the Norwegian Environment Agency performed the verification of the reports itself.

The Norwegian Environment Agency may impose coercive fines and even penal measures in the event of serious contravention of the provisions in the Greenhouse Gas Emissions Trading Act. A fine for failure to comply is imposed if an insufficient amount of allowances is surrendered by 30 April. In addition, the operator must surrender an amount of allowances equivalent to the deficit the following year.

Estimated effect on emissions

Because emission allowances in the EU ETS can be sold across borders between installations in the scheme, the effect of the scheme on national emissions depends on several factors in addition to the level of ambition of the EU-wide cap. A crucial factor is Norwegian industry's abatement cost relative to the abatement cost in industry located in other countries covered by the scheme, and relative to the carbon price. For this reason, in contrast to the Europe-wide effect, the scheme's effect at the national level is difficult to assess and quantify.

However, earlier estimates made by Statistics Norway show that the emission trading scheme in phase II may have led to overall national emission reductions of up to 0.3 million tonnes of CO_2 eq. per year.

Norway is an integral member of the EU ETS through the EEA Agreement. Norway's participation increases the overall tightness of the European scheme. The number of allowances in Europe attributed to Norwegian participation (excluding aviation) is about 18 Mt for the trading period 2013-2020, while demand from Norwegian installations is estimated to be about 25 Mt/year. The increased demand due to Norwegian participation will result in additional emission reductions within the scheme. These reductions may take place anywhere in the EU/EEA area.

4.2.2 Other Cross-sectoral policies and measures

4.2.2.1 *Regulation by the Pollution Control Act*

The Pollution Control Act lays down a general prohibition against pollution. Pollution is prohibited unless one has a specific permission to pollute according to law or a decision made by the relevant authority. The Pollution Control Act applies also to greenhouse gas emissions. Greenhouse gas emissions are however to a large extent covered by other specific policy instruments

such as the CO_2 tax, the EU ETS and specific agreements with the industry on reduction of emissions.

The relevant authority may lay down technology requirements relevant to emissions as conditions in the permit issued in accordance with the Pollution Control Act, for instance a requirement to implement carbon capture and storage. This is currently a prerequisite in a few cases, such as any new gas-fired power plants.

Several provisions have the objective of ensuring efficient enforcement of the Act, or regulations or decisions issued pursuant to the Act. For example, violation of provisions may result in closure, coercive fine or criminal liability.

In the waste sector, regulations under the Pollution Control Act are used to ensure minimum environmental standards of landfills and incineration plants, and to regulate the handling of certain waste fractions. The EU directives on waste are implemented through the Pollution Control Act and through different parts of the Waste Regulation under the Pollution Control Act. The Waste Regulation includes the following measures:

- Requirement to collect methane from landfills (gradually introduced from 1998).
- Prohibition of depositing biodegradable waste (introduced 1 July 2009 with an opening for exemptions until 2013).
- Requirement to utilise energy from incineration from incineration plants.

From 2002 landfilling of wet-organic waste has been prohibited. This prohibition was replaced by the wider prohibition of depositing (2009) that applies to all biodegradable waste.
The Waste Regulation includes a formulation that incineration plants should be designed and operated with a view to energy utilisation. This is normally followed up in the concessions of the plants by a condition that at least 50 per cent of the energy from the incineration should be utilised. For the effects of these measures, see 4.2.11.

Estimated effect on emissions
The effect in terms of emission reductions of the Pollution Control Act is not estimated since GHG emissions are to a large extent covered by other specific policy instruments.

4.2.2.2 *Enova*
Enova (www.enova.no) is a state enterprise, owned by the Ministry of Climate and Environment. The purpose of Enova is to contribute to reduced greenhouse gas emissions and strengthened energy security of supply, as well as technology development that also contributes to reduced greenhouse gas emissions in the longer run.

Enova provides funding and advice for energy and climate projects, and support both companies and individual households, as well as local and regional governments. Funding for projects is drawn from the Climate and Energy Fund, which Enova manages on the basis of four-year rolling agreements with the Ministry. Financing totals about NOK 3.2 billion in 2019. These financial arrangements make it possible for Enova to be a predictable and flexible source of funding for projects.

From 2017, Enova's focus has been shifted more towards climate-related activities and innovation, in line with the agreement for the period 2017–2020. This means that there is a greater emphasis on reducing emissions from the transport sector and other sectors, which are not part of the European emissions trading system, and on innovative solutions adapted to a low-emission society. The agreement between Enova and the Ministry gives high priority to reducing and eliminating barriers to new technologies and to promoting permanent market change. An aim is to achieve lasting market change and that climate-friendly and energy-efficient solutions should succeed in the market without government support.

The agreement grants Enova a wide degree of freedom to develop tools, set priorities for different sectors and allocate support to individual projects. Enova makes use of its expertise and experience from various markets to design its programmes to address the most important barriers to the introduction and deployment of energy and climate solutions and bring about permanent change.

Enova's support falls into one of two main categories: technology development and market change. Enova's programs deal with technologies and solutions at various stages of maturity. During the innovation process from technology development to market introduction, the goal is to reduce costs and the level of technological risk. Once a solution is technologically mature and ready for market roll-out, the goal is to achieve widespread deployment and market take-up. It is always necessary to overcome various market barriers as a solution proceeds through technology development and market introduction. Enova seeks to identify the most important of these, and designs its programmes for the introduction and deployment of energy and climate solutions to lower such barriers.

New energy and climate technology developed in Norway can also play a part in reducing greenhouse gas emissions at global level when deployed widely enough. Investment in new technology and innovation often carries a high level of investment risk. Using public funding to reduce risk is an important strategy, because a new technology often provides greater benefits for society than for individual investors. Enova therefore supports pilot and demonstration projects and full-scale introduction of energy and climate technologies. This helps to lay the basis for a more energy-efficient and climate-friendly business sector in the transition to a low-emission society.

It generally takes time for a new technology or solution to become established and diffuse through the market. The reasons for the delay may vary. New technology that will bring about cuts in greenhouse gas emissions or make energy use more efficient should be deployed as soon as possible, in the widest possible range of applications and by as many people as possible. Possible barriers to the spread of new technology and products include a lack of information, scepticism to new and relatively untried solutions, and prices. Enova's programmes for market change are designed to reduce these and other barriers and thus promote permanent market change.

Estimated effect on national emissions

Enova supports projects aiming to reduce non-ETS emissions, develop new energy and climate technology and improve the security of supply of energy, in line with its three main goals.

As Norwegian electricity production is almost entirely renewable, the projects aimed at improved security of supply are not necessarily relevant in the context of reduced greenhouse gas emissions.

The technology projects Enova supports are not intended to have significant immediate climate implications, but rather a long-term effect through dissemination and adoption of the new technologies also outside Norway. It is not possible to calculate these effects, but the potential impacts are vast. For example Enova supported the aluminium producer Hydro in developing a more energy efficient aluminium production technology which decreases energy use to 12.3 kWh per kilo aluminium, 15 per cent below the world average. Enova also supported REC Solar in the building of a pilot to increase material recycling in the production of solar silicon, which will reduce the need for the virgin material by 30 per cent. If such technologies become widespread, the impact on national and global greenhouse gas emissions would be significant.

Enova does not support projects in a policy vacuum. There are a variety of other policy instruments in Norway, which directly or indirectly aim to reduce domestic greenhouse gas emissions, support for R&D, taxes, regulations and various other instruments. In such a context it is hard to say which instrument contributed to which development or reduction. Enova estimates the direct reductions from each supported project, but these numbers will not represent the entire effect, nor can they be wholly attributed to Enova because the individual business cases build on and incorporate the incentives provided by other instruments. The reductions Enova calculate reflect the effects compared to the baseline in each project and only take into account the reduction of greenhouse gas emissions due to reduced consumption of fossil fuels such as coal, oil and natural gas. The reductions come as a result of improved efficiency of fossil sources and conversion from fossil to renewable energy.

The estimated contribution to reducing greenhouse gas emissions from Enova's project portfolio is about 1.8 million tonnes of CO_2 equivalents in 2020 and 2030, as reported in CTF table 3. As a result of the bottom-up method of calculation and the use of individual baselines there is no direct link between this number and the national environmental accounts. An additional result of the bottom-up method is the partial inclusion of the effects of other policies. It is important also to note that Enova works by reducing the barriers to adoption of energy and climate technologies with an aim to facilitating a lasting market shift towards such technologies. It is not practical to attempt to attribute such wider changes to Enova or any other policy instrument, so it is important to bear this in mind when contemplating the effects of Enova's support.

4.2.2.3 *Klimasats*

In 2016, the Solberg Government introduced a financial support scheme to promote emissions reduction projects in Norwegian municipalities and counties[d]. The scheme is called Klimasats and is administered by the Norwegian Environment Agency that assesses and prioritises the applications based on given criteria. The objective of Klimasats is to reduce emissions at the local level and contribute to the transition to a low emission society. Examples of supported projects are the use of climate friendly building materials in public buildings, reduction of food waste in local institutions, zero emission construction sites, reduction of methane emissions

[d] Norway is divided into 18 counties (reduced to 11 in 2020) and 426 municipalities (reduced to 356 in 2020). Municipalities are the lowest level of government.

from former landfills and infrastructure for electric vehicles. The municipalities can also apply for funding to strengthen the climate perspectives in urban planning, where local governments have a key role. Support is also given to networks of four or more municipalities with the aim of capacity building and sharing experiences on emission reduction.

In 2018, Klimasats allocated NOK 148 million to around 255 projects all over Norway. In 2019, another NOK 234 million was allocated to around 365 different projects

An additional NOK 25 million has been allocated during December 2019 to facilitate the introduction of zero- and low-emission solutions for high speed vessels in the public transport system.

Estimated effect on national emissions

The municipalities that have received funding report on the results and effects of the projects as well as their experiences from the implementation. The Environment Agency actively use and spread the reported results and experiences from the projects in order to facilitate the start-up of new projects in other municipalities.

The effects of the support scheme are both immediate emission reductions within areas such as transport, waste handling, buildings and public procurement. In addition, most projects contribute to the transition to a low emission society through increased focus on climate change and climate measures among local politicians, increased climate focus in urban planning, capacity building within the local administrations and cross-sectoral cooperation. The funding also provides a possibility of finding and testing new solutions, which in many cases are more expensive and the results uncertain.

An ongoing external evaluation of the Klimasats scheme has concluded that the funding to a large degree is contributing to the realization of local emission reductions projects that would not have been implemented without financial support. According to the evaluation, the support scheme stimulates local governments and administrations in identifying new emission reduction projects, it contributes to capacity building and to the dispersion of project ideas and experiences from projects among municipalities.

The effect in terms of emission reductions of the Klimasats scheme is not quantified.

4.2.2.4 *The environmental technology scheme – Innovation Norway*

The Environmental Technology Scheme was established in 2010. The overall target of the scheme is to encourage the Norwegian industry to introduce new and better products and processes related to environmental technology to the market. The scheme aims at promoting profitable business opportunities and helping to realize Norway's environmental goals.
In this context, the definition of environmental technology is all technology that directly or indirectly improves the environment, including technology and services that limits pollution through purification processes, more environmentally friendly products and production processes, more efficient handling of resources and technological systems that reduce the impact on the environment.

The Environmental Technology Scheme offers grants and other support for development and investments in pilot and demonstration projects for new Norwegian environmental technology.

It is a nationwide scheme to which all Norwegian companies can apply. The companies apply for grants related to the costs for planning and development of the project, investment costs during the development and pilot phase, and costs relating to start-up and testing after the initial work to establish the pilot. The criteria for receiving grants are related both to the projects' economic and commercial effects, environmental effect and level of innovation.
In 2018, NOK 522.7 million was granted from the environmental technology scheme to 225 projects. Total investments in these projects (including the companies' own funds) are NOK 2.64 billion. The projects are based across a range of different technologies, including metallurgic industry, bio-refinery, renewable energy, water treatment, maritime sector and aquaculture.

Estimated effects on national emissions
The environmental technology scheme supports projects in the demonstration and piloting phase, and it is difficult to quantify the results. The final product or process may not be taken up by the market until several or many years after the support is granted. In their applications, the companies indicate the expected environmental impact of the pilot and the expected effect if the new solution spreads. However, there is no requirement for the effects to be converted into CO_2 equivalents and climate-specific reporting.

4.2.2.5 *Nysnø Klimainvesteringer AS (Nysnø)*
Nysnø Klimainvesteringer AS (Nysnø) is an investment company wholly owned by the Norwegian State, through the Ministry of Trade, Industry and Fisheries. Nysnø was established in December 2017 in order to contribute to reducing greenhouse gas emissions through investments with such an effect directly or indirectly. Nysnø invests in non-listed companies, and funds aimed at non-listed companies that have operations in Norway. Nysnø focuses on early-stage companies and invests primarily in the transition from technology development to commercialisation. Nysnø has received NOK 725 million in capital during the period 2017 to 2019 and has made its first investments. In the budget for 2020, the Government has proposed NOK 700 million in additional capital to the company Capital and competence are drivers for developing and applying new technology for a low-emission society. Together with private investors, Nysnø provides both.

Estimated effects on national emissions
Nysnø's overall effect on greenhouse gas emissions will be determined by Nysnø's ability to identify and invest in high-return companies and funds, within its mandate.

4.2.3 Petroleum Sector
4.2.3.1 *General policy instruments*
Greenhouse gas emissions from Norwegian petroleum activities, including facilities on the continental shelf and from onshore facilities that come within the scope of the petroleum legislation, are regulated through several acts, including the Petroleum Act, the CO_2 Tax Act on Petroleum Activities, the Sales Tax Act, and the Greenhouse Gas Emission Trading Act. Emissions from the petroleum sector are directly regulated through requirements on the use of the

best available techniques (BAT) and specific emission limits in permits under the Pollution Control Act.

Requirements for impact assessments and approval of plans for new developments (PDOs/PIOs) are cornerstones of the petroleum legislation. Facilities onshore and within the baseline are also subject to the provisions of the Planning and Building Act.

Emissions from the petroleum sector in Norway are well documented. The industry's own organisation, the Norwegian Oil and Gas Association, has established a national database for reporting all releases from the industry, called EPIM Environment Hub (EEH). All operators on the Norwegian continental shelf report data on emissions to air and discharges to the sea directly in EEH.

4.2.3.2 *Climate policies that affect the petroleum sector*

The CO_2 tax and the Greenhouse Gas Emission Trading Act are Norway's most important cross-sectoral climate policy instruments for cost-effective cuts in greenhouse gas emissions. Both of these instruments apply to the petroleum industry, as opposed to most other sectors. A small part of emissions from the sector is not covered by the CO_2 tax or ETS.

4.2.3.3 *The CO_2 tax*

The CO_2 tax is levied on all combustion of natural gas, oil and diesel in petroleum operations on the continental shelf and on releases of CO_2 and natural gas, in accordance with the CO_2 Tax Act on Petroleum Activities. For 2019, the tax rate is NOK 1.08 per standard cubic metre of gas or per litre of oil or condensate. For combustion of natural gas, this is equivalent to NOK 462 per tonne of CO_2. For emissions of natural gas to air, the tax rate is NOK 7.41 per standard cubic metre, also equivalent to NOK 462 per tonne of CO_2.

4.2.3.4 *Emission Trading*

Norwegian installations in the petroleum industry are included in the EU ETS, and are subject to the same rules for emissions trading as those within the EU.

Emission allowances are allocated by auctioning or given free of charge. Sectors that are considered to be at risk of carbon leakage receive some or all of their allowances free of charge, following harmonised allocation rules. This applies to a certain proportion of petroleum-sector emissions to which the ETS applies. Allowances for emissions from electricity generation on offshore installations are not allocated free of charge.

The combination of the CO_2 tax and the emissions trading system means that emissions covered by the ETS on the Norwegian shelf, in 2019, face a price of approximately NOK 710 per tonne for their CO_2 emissions, which is very high compared with emission prices in most other countries.

4.2.3.5 *Permits and other requirements*

Before the licensees can develop a discovery, their plan for development and operation (PDO) must be approved by the Ministry of Petroleum and Energy. The PDO contains information on how the licensees intend to develop and operate the field. When proposals are made for new field developments or large-scale modification of existing facilities, the operator must as part

of the PDO include an overview of energy needs and an assessment of the costs of using power from onshore electrical grid rather than gas turbines to supply electricity.

Flaring of natural gas is only permitted when it is necessary for safety reasons. Permits for flaring are issued by the Ministry of Petroleum and Energy. A permit under the Pollution Control Act is required for greenhouse gas emissions to air from petroleum operations.

Estimated effect on national emissions

The CO_2 tax have a significant effect on emissions in the offshore petroleum sector. The combination of strict regulations of the petroleum sector and the price on CO_2 emissions have resulted in many CO_2-reducing measures in the sector.

Solutions that have been applied, to meet the conditions/permits and the price on CO_2 emissions are energy efficiency measures, CCS and power from the onshore electrical grid. These measures are attributed to the high Norwegian CO_2 price facing the sector; by the CO_2 tax and the ETS-system. It is emphasised that forecasts of the future effects of the CO_2 tax and the EU ETS are very uncertain. Based on reports from companies operating on the Norwegian Continental Shelf (NCS), it was reported in Norway's 5th and 6th National Communication, an estimate that emissions of CO_2 from the sector in year 2000 were 2 million tonnes lower than they would have been in the absence of the CO_2 tax. Measures such as energy efficiency measures, reduced flaring and supply of power from the onshore electricity grid is further assumed to have reduced emissions by 1.5 million tonnes annually from 2004-2007.

The CCS projects from natural gas on the Sleipner, Gudrun and Snøhvit petroleum fields are the only CCS projects currently in operation in Europe and the only projects in the offshore industry. See description in chapter 4.2.4.

In total, there are indications that annually the CO_2 tax and the ETS contribute to emission reductions of approximately 5 million tonnes CO_2 (2010). Furthermore, new or planned measures such as power from the onshore electricity grid, energy efficiency improvements, and technological advancements might raise this estimate to almost 7 million tonnes of CO_2 in 2020 and 2030. The ban on flaring of natural gas may have contributed to further reductions. From 2008, the petroleum industry has been included in the EU ETS.

4.2.3.6 *Indirect CO_2 emissions from offshore and onshore NMVOC regulation*

Emissions of non-methane volatile organic compounds (NMVOC) lead to indirect CO_2 emissions since NMVOC oxidises to CO_2 in the atmosphere. Measures taken to reduce the NMVOC emissions therefore also reduce CO_2 emissions.

In 2017, the petroleum sector accounted for 28 per cent of the total NMVOC emissions. The solvent industry contributed to approximately 30 per cent of total NMVOC emissions in 2017. The NMVOC emissions peaked in 2001. Since then, there has been a decline of 63 per cent until 2017. From the basis year 1991, NMVOC emissions have been reduced by 52 per cent in total.

The NMVOC emissions in the petroleum sector are mainly from storage and loading of crude oil offshore. The petroleum sector's share of total NMVOC emissions has decreased as a result

of the phasing in of vapour recovery units technology (VRU) to vessels loading and storing crude oil and because oil production has been reduced by approximately 50 per cent from 2001 to 2018. Starting from 2001, emissions of NMVOC linked to offshore loading and storage of crude oil have been governed under the emission permit system, pursuant to the Pollution Control Act.

Since 1 January 2003, it has been a requirement that all vessels are fitted with equipment for recovering NMVOCs, and ships are not normally granted access to the installation without the necessary equipment.

Several of the newer fields on the Norwegian Continental Shelf employ floating storage installations. This type of installation may produce higher emissions of NMVOCs than fields where the oil is stored in the base of the platforms (Statfjord, Draugen and Gullfaks). This is due to the fact that, in the case of floating storage installations, emissions will also occur between production and storage.

Norway has also regulated NMVOC emissions at land terminals in the Pollution Control Act. A recovery installation for NMVOCs was in operation at the crude oil terminal at Sture in 1996. The vapour recovery unit (VRU) at Mongstad crude oil terminal came into operation in June 2008.

Estimated effect on national emissions

The regulation on offshore loading and storage of crude oil has, compared to no regulation, reduced the indirect CO_2 emissions of NMVOC by nearly 0.3 million tonnes CO_2 in 2010 and almost 0.2 million tonnes CO_2 in 2015. The estimated effects are based on reported data from the oil fields operators to the Norwegian Environmental Agency. In 2020 and 2030 the projected effects are 0.13 and 0.11 million tonnes CO_2 respectively. The latter estimates are based on the assumption that it is the same relationship between oil production and emissions without VRU as in 2015 and VRU has an efficiency of about 60 per cent.

For NMVOC regulation on land terminals, the emissions from the two terminals are estimated with and without measures. The emissions in 2020 and 2030 without measures have been back-calculated from the projected amount of crude oil loaded and an IEF equal to the latest year ahead of the implementation. The emissions in 2020 and 2030 with measures have been calculated with an IEF equal to 2011, which is the most recent year with historical emissions data from the installation. The effect of the regulations is approximately 0.02 million tonnes of CO_2 equivalents.

4.2.4 Carbon Capture and Storage

Carbon capture and storage (CCS) is one of five priority areas for enhanced national climate action. The Norwegian Government's CCS strategy span a wide range of activities, from research, development and demonstration to large-scale projects and international work promoting CCS.

Carbon capture and storage, or CCS, comprises the capture, transport and permanent geological storage of CO_2 emissions from fossil-fuel combustion and industrial production. According to the Intergovernmental Panel on Climate Change (IPCC), CCS is a key measure for

reducing global greenhouse gas emissions. Hence, the Norwegian work focus on the development of technology in an international perspective and ways of reducing costs.

Norway has a lot of experience with CCS. Since 1996, CO_2 from natural gas production on the Norwegian Continental shelf has been captured and reinjected into sub-seabed formations. The CCS projects from natural gas on the Sleipner, Gudrun and Snøhvit petroleum fields are the only CCS projects currently in operation in Europe and the only projects in the offshore industry.

Nearly one million tonnes of CO_2 per year has since 1996 been separated during processing of natural gas from the Sleipner Vest field, and stored in the Utsira formation. Since 2014, CO_2 from natural gas production at the Gudrun field has also been separated out at the Sleipner Vest platform and stored in the Utsira formation.

The Snøhvit facility on Melkøya has since 2008 been separating CO_2 from the well stream before the gas is chilled to produce liquefied natural gas (LNG). The CO_2 is transported back to the Snøhvit field by pipeline and injected into a subsea formation. During normal operations, up to 700,000 tonnes of CO_2 is stored annually.

4.2.4.1 *CO_2 Technology Centre Mongstad (TCM)*

The Technology Centre Mongstad (TCM) is the world's largest facility for testing and improving CO_2 capture technologies. TCM has been operating since 2012, providing an arena for targeted development, testing and qualification of CO_2 capture technologies on an industrial scale. It is a collaborative project between the Norwegian Government, Equinor (formerly named Statoil), Shell and Total. From 2012 to 2017 the South African Company Sasol was a partner. It was designed for long-term operation, with two plants testing two different CO_2 capture technologies:

- Amine technology, in which CO_2 is captured by scrubbing flue gas with a water-based solution of amines.
- Ammonia technology, which uses chilled ammonia as the solvent for absorbing CO_2 from the flue gas.

The TCM facility was designed to be versatile enough to test CO_2 capture using flue gas either from the combined heat and power (CHP) plant or from the refinery at Mongstad. So far, the companies Aker, Alstom, Shell Cansolv, Carbon Clean Solutions, IoN Engineering and Fluor have all used the test facility.

4.2.4.2 *Research and technology development*

In Norway, funding for CCS research is provided through the CLIMIT programme and a Centre for Environmental-friendly Energy Research. The CLIMIT programme is a national programme for research, development and demonstration of technologies for capture, transport and storage of CO_2 from fossil-based power production and industry. The programme supports projects in all stages of the development chain, from long-term basic research to build expertise to demonstration projects for CCS technologies. Projects under the CLIMIT programme have yielded important results for the development of CCS in Norway and internationally.

In addition, a Centre for Environment-friendly Energy Research for CCS, NCCS, has been established. The centre is co-financed by the Research Council of Norway, industry and research partners.

4.2.4.3 *Large-scale CCS*

The Norwegian Government has an ambition to realize a cost-effective solution for full-scale CCS in Norway, provided that it leads to technology development internationally. This is a challenging task in Norway, partly because there are relatively few suitable large-scale point sources of CO_2 emissions. However, there are medium sized CO_2 emissions from some industrial facilities, sources that are part of the emissions trading system.

A new full-scale CCS project in Norway is currently under planning in an advanced study phase. The project has completed pre-feasibility-, feasibility- and concept studies. The project is a result of close cooperation between the Government and the industrial partners. The project consists of three individual sub-projects: two (formerly three) competing CO_2 capture facilities and a CO_2 transport and storage hub. Fortum Oslo Varme (waste-to-energy) and Norcem (cement) are planning to build CO_2 capture facilities connected to their plants and deliver CO_2 to the Northern Lights consortium (Equinor, Shell and Total) which will handle the transportation and permanent storage of the CO_2. Gassnova, the state enterprise for CCS, is responsible for coordination of the whole CCS chain. The project is currently at an advanced stage. After Front End Engineering and Design is finalized, the Government will decide whether to make a positive funding proposal to the parliament in 2020 or 2021. A positive funding proposal could include one or two capture projects.

4.2.4.4 *International support and activities*

In order for CCS to play an effective role in climate change mitigation, international cooperation on developing and commercialising new technology is essential. Norway collaborates with other countries through a number of bilateral relations as well as regional and international forums. Examples of such forums are North Sea Basin Task Force, Clean Energy Ministerial, Mission Innovation and The Carbon Sequestration Leadership Forum. Norway furthermore provides funding for CCS projects abroad in cooperation with other countries and through existing programmes and institutions. For example, Norway is currently supporting a CCS project in South Africa.

Estimated effect on national emissions

The Norwegian CCS policy will help to develop and demonstrate CO_2 capture and storage technologies with a potential for technology transfer. The new full-chain project in Norway should contribute to knowledge sharing and technology development in an international perspective. The Norwegian government's policy includes research, development and demonstration, an ambition to realize a full-chain demonstration facility, transportation, storage and alternative use of CO_2 and international work for the implementation of CCS as a mitigation measure. It is not possible to quantify the emission reductions that might be realized through this policy as it will for most parts take place in industry covered by the EU ETS. Additional measures for sectors subject to EU ETS may reduce national emissions, but will not reduce total emissions since emissions from other installations within the scheme will increase correspondingly, as long as the EU ETS emissions cap is not reduced.

4.2.5 Energy and transformation industries

Taxes and emission pricing through participation in the EU emissions trading system (ETS) are key tools of Norwegian climate policy. They raise the price of energy use that results in greenhouse gas emissions and encourage low-emission energy production. More than 80 per cent of Norway's emissions are taxed and/or regulated through the EU ETS.

The EU ETS also influences Norwegian electricity prices because Norway trades electricity with the rest of Europe. One of the effects of the EU ETS is to raise the cost of fossil electricity production in Europe, thus pushing up electricity prices. This has an effect on electricity prices in Norway as well, even though production is based on hydropower.

4.2.5.1 *Electricity tax*

A tax on consumption of electricity was introduced in 1951. At present, an excise duty is levied on electricity supplied in Norway regardless of whether the power is generated domestically or imported. Households, agriculture, service industries and the public sector are subjected to the ordinary rate, which in 2019 is NOK 0.1583 per kWh. Electricity used in chemical reduction and in electrolytic, metallurgical and mineralogical processes, greenhouses and rail transport, as well as households and public services in Finnmark county and seven municipalities in Troms county, is exempted from the electricity tax. Electricity used in other manufacturing industries, mining and quarrying, data centres, commercial shipping and district heating is subject to a reduced rate, which in 2019 is NOK 0.0050 per kWh.

Estimated effect on national emissions

The objective of the excise duty on electricity is mainly fiscal, but the tax also provides incentives for citizens and firms to reduce their consumption of energy. The supply of electricity in Norway comes primarily from hydroelectric power plants. Consequently, reduced consumption of electricity will not have a direct effect on greenhouse gas emissions in Norway.

4.2.5.2 *Base tax on mineral oils etc.*

An excise duty on mineral oils, comprising mostly fuel oils, was introduced in 2000. The intention was to avoid substitution of electricity in the heating market when the electricity tax was raised. Subsequently the base tax was raised to the same level as the electricity tax measured by the heat content of the fuel. In 2014 the base tax on mineral oils was raised further by approximately 50 per cent. Since this hike, energy taxation of mineral oils has exceeded that of electricity. As well as mineral oil for heating, the base tax applies to diesel used in agriculture, construction and other non-road machinery. Use of mineral oils in the transport sector and fisheries is exempted, but not leisure boats running on diesel. In 2019 the base tax is NOK 1.65 per litre, equal to approximately NOK 620 per tonne of CO_2. Reduced rate (in 2017 NOK 0.21 per litre) applies to the pulp and paper industry and dyes and pigment industry.

Estimated effect on national emissions

CO_2 tax is levied on mineral oils in addition to the base tax. Manufacturing and other onshore undertakings covered by the EU ETS are not exempted the base tax. The mitigation effect of the increase in the base tax on mineral products in 2014 is estimated to 50-100 kt. CO_2-eq in 2020 and 2030. The effect of the measure is estimated under Enova (see 4.2.2.2) and is therefore marked as IE (indicated elsewhere) in CTF table 3.

Table 4.7 *Norwegian green taxes. 2019*

Tax	**Tax rate (NOK)**	**Introduced**
Electricity tax		1951
Standard rate, NOK/kWh	0.1583	
Reduced rate (manufacturing, etc.), NOK/kWh	0.0050	
Base-tax on mineral oils, etc.		2000
Standard rate, NOK/litre	1.65	
Reduced rate (pulp and paper, dyes and pigments industry), NOK/litre	0.21	

Source: Ministry of Finance

4.2.6 Other relevant policies and measures in the energy and transformation industries

4.2.6.1 *Electricity Certificate Act*

1st January 2012 Norway and Sweden established a common market for electricity certificates. The goal of the two countries was to develop new energy production based on renewable energy sources amounting to 28.4 TWh by the end of 2020. Sweden will finance 15.2 TWh and Norway 13.2 TWh. In May 2019 Norway and Sweden achieved the goal of 28.4 TWh. Sweden has established an additional goal of 18 TWh in 2030, which will be financed by Sweden. Norway will not take part in the increased ambition from 2022. The electricity certificate market is a constructed market in the sense that the demand for certificates arises from a statutory obligation for specified electricity users to purchase them. Sales of electricity certificates give power producers a supplementary income in addition to that derived from sales of electricity. For more information about the electricity certificate scheme, see The Norwegian Water Resources and Energy Directorate's annual report for 2018[e].

Estimated effect on national emissions

The electricity certificate system is a market based support scheme to promote new electricity production based on renewable energy sources. The support scheme is technology neutral, which means that all energy sources defined as renewable energy sources in accordance with Directive 2009/28/EC on the promotion of the use of energy from renewable sources qualifies for the right to certificates. For Norway most of the electricity were already produced from renewable energy sources. The effects on national emissions are indirect, and not possible to calculate.

[e] http://publikasjoner.nve.no/diverse/2017/elsertifikat2016engelsk.pdf.

4.2.6.2 *Energy requirements in the building code*

The building code is the main legal instrument for improving energy efficiency. It was revised in 2015. The new and stricter requirements (passive house level) entered into force on 1 January 2016 (Byggteknisk forskrift - TEK17)[f]. The 2016 requirements was tightened such that dwellings became 26 per cent more energy efficient and office buildings 38 per cent more energy efficient compared to previous requirements.

The new energy requirements specify that installation of fossil fuel heating installations are not permitted and that larger buildings (more than 1000m^2 heated usable floor space) must have flexible heating solutions.

New buildings and buildings subject to major rebuilds must meet either a total net energy need for space heating, cooling and hot water lower than specified in the regulation (kWh per m2 of heated floor area per year) for 13 different building categories, as shown in table 4.8:

Table 4.8: *Total net energy requirements for various buildings according to the new building code of 2016*

Building category	***Total net energy requirement [kWh/m² heated gross internal area per year]***
Small houses and leisure homes with more than 150 m² of heated gross internal area	**100 + 1.600/m² heated gross internal area**
Block of flats	**95**
Kindergarten	**135**
Office building	**115**
School building	**110**
University/university college	**125**
Hospital	**225 (265)**
Nursing home	**195 (230)**
Hotel building	**170**
Sports building	**145**
Commercial building	**180**
Cultural building	**130**
Light industry/workshop	**140 (160)**

Residential buildings can also use a set of energy efficiency measures for individual building components to meet the energy efficiency requirements, as shown in table 4.9:

[f] https://dibk.no/globalassets/byggeregler/regulation-on-technical-requirements-for-construction-works--technical-regulations.pdf

Table 4.9 *Energy efficiency measures for individual building components*

	Energy-saving measures	*Small house*	*Block of flats*
1.	**U-value outer walls [W/(m² K)]**	**≤ 0.18**	**≤ 0.18**
2.	**U-value roof [W/(m² K)]**	**≤ 0.13**	**≤ 0.13**
3.	**U-value floors [W/(m² K)]**	**≤ 0.10**	**≤ 0.10**
4.	**U-value windows and doors [W/(m² K)]**	**≤ 0.80**	**≤ 0.80**
5.	**Proportion of window and door areas of heated gross internal area**	**≤ 25%**	**≤ 25%**
6.	**Annual mean temperature efficiency ratio for heat recovery systems in ventilation systems (%)**	**≥ 80%**	**≥ 80%**
7.	**Specific fan power (SFP) in ventilation systems [kW/(m³/s)]**	**≤ 1.5**	**≤ 1.5**
8.	**Air leakage rate per hour at 50 Pa pressure difference**	**≤ 0.6**	**≤ 0.6**
9.	**Normalised thermal bridge value, where m² is stated as heated gross internal area [W/(m² K)]**	**≤ 0.05**	**≤ 0.07**

Regardless of which option is chosen, all new buildings must meet minimum requirements for windows (U-value ≤ 1.2) roofs and floors facing free air (U-value ≤ 0.18), exterior walls (U-value ≤ 0.22) and air tightness (air change per hour at 50 Pa pressure difference ≤ 1.5).

Estimated effect on national emissions

As mentioned in 4.2.5, Norway is in a special position in relation to renewable energy use. Nearly all of Norway's electricity production is based on hydro power, hence the effect on emissions from the changes in energy use is moderate and will not directly affect greenhouse gas emissions in Norway. Over time, regulations of fossil fuel heating installations have become stricter. In 2016, a ban on installation of fossil heating in new buildings and after larger renovation was introduced. The gradual development, and stricter requirements on fossil fuel heating installations have limited the opportunity to use fossil fuel heating in new buildings. The impact on national CO_2 emissions are however limited, because estimations indicate that very few new buildings did install heating solutions for fossil fuels even before the ban. Ban on the *use* of fossil fuels for heating of buildings from 2020 are elaborated in 4.2.6.3.

4.2.6.3 *Ban on the use of mineral oil for heating of buildings from 2020*

In June 2018, the government adopted a regulation banning the use of mineral oil (fossil oil) for heating of buildings from 2020. The ban covers the use of mineral oil for both main heating (base load) and additional heating (peak load), in residential buildings, public buildings and commercial buildings. The use of mineral oil for heating of agricultural buildings and hospital buildings with 24-hour continuous patient care are exempt from the ban until January 1, 2025. The purpose of the ban is to reduce greenhouse gas emissions from heating of buildings.

Estimated effect on national emissions

Use of mineral oils for heating of buildings is regulated through different measures such as CO_2-tax, mineral oil tax, standards in the building code and support schemes from Enova and municipalities. Emissions from the consumption of fossil oils in the heating of households and businesses have thus declined by almost 60 per cent since 1990. If this development continues, emissions will be around 1 million tonnes of CO_2 equivalents in 2020 and 0.75 million tonnes in 2030. The ban on the use of mineral oil for heating of buildings from 2020 means that residential, public and commercial buildings already in 2020 will have phased out emissions from such use, although there will still be emissions from the use of gas and from wood burning. The ban will also accelerate the decline in the use of oil for heating in service industries. However, for energy security reasons the projection assume emissions at 0.6 million tonnes in 2020 and 0.5 million tonnes of CO_2 equivalents in 2030. It is difficult to separate the emission effect of different measure, but on the basis of assumption mentioned above the effect of the ban can be estimated to 0.4 million tonnes in 2020 and 0.2-0.3 million tonnes in 2030.

4.2.6.4 *Bioenergy Scheme*

The Ministry of Agriculture and Food offers funding for investments in small scaled bioenergy primarily based on forest biomass. Funding is provided through grants for investments, studies and training measures. The main objective is to encourage farmers and forest owners to produce, use and supply feedstocks for bioenergy or heating.

Estimated effect on national emissions

In 2018, installations funded through The Bioenergy Scheme had a production capacity of 433 GWh. This is estimated to have reduced emissions from fossil fuels by 81500 CO_2 eq. pr. year by 2018. Based on a presumption that the program will be continued towards 2030, and that the program contributes to emission reductions as observed so far, the estimated effect will be a reduction of 90 000 tonnes CO_2eq in 2020 and 140 000 tonnes CO_2eq in 2030.

4.2.7 **Transport**

Introduction

In April 2017, the Solberg Government submitted the white paper National Transport Plan 2018–2029 (Meld. St. 33 (2016–2017)) to the Norwegian Parliament. One of the main goals of this plan is *"Reducing climate emissions in line with the transition to a low-carbon society and reducing other negative environmental impacts"*, and for the 12-year period, the following goal has been adopted: *"Reducing climate emissions in line with the Norwegian climate targets"*. In a white paper from 2017 (Meld. St. 41 (2016–2017), the Government set a working target of a

cut of 35–40 % in emissions from the transport sector by 2030 compared with 2005 in order to support efforts to reduce emissions in the transport sector. This target is based on the assumption that the technological maturity of zero-emission solutions in different transport segments will improve so that they become competitive with fossil-based transport solutions. In their most recent political platform (Granavolden platform), the government has gone even further, and set as an ambition to reduce emissions from the transport sector by 50 % by 2030 compared to 2005. This ambition is also contingent on the technological maturity.

There are several measures in place that are affecting greenhouse gas emissions from the transport sector. The tax policy is central, and the most important measure is the CO_2 tax, which is a cross-sectoral measure (see chapter 4.2.1). In addition, the vehicle tax policy contributes to shifting vehicle demand towards low and zero emission vehicles. Norway also have a quota obligation for biofuels for road traffic, see chapter 4.2.7.3. In addition there are several other measures, such as Enova's grant schemes, requirements in public procurement processes etc.

4.2.7.1 *The Norwegian CO_2 tax scheme for the transport sector*

The tax system (CO_2 tax, motor vehicle registration tax, etc.) is the main instrument for limiting CO_2 emissions from the transport sector. As of 2019, the CO_2 tax rate on petrol is NOK 1.18 per litre. The tax on auto diesel is NOK 1.35 per litre, which equals the general tax on mineral oil. These rates corresponds to a tax rate of about NOK 510 per tonne CO_2. In addition, road usage tax is levied on fuel for road transport; see chapter 4.2.1.3. Domestic aviation pays a CO_2 tax of NOK 1.30 per litre jet kerosene, just below the general rate. Most domestic aviation is also included in the EU ETS. International aviation is exempted from CO_2 tax. Use of mineral oil in domestic shipping is subject to a CO_2 tax at the general level, while fishing and catching inshore waters pay a lower rate. Use of LNG in both international shipping and fishing in coastal waters is, in 2019, exempt from CO_2 tax, see 4.2.1.3.

4.2.7.2 *Vehicle taxes and other incentives*

The motor vehicle registration tax was introduced in 1955. The registration tax in Norway was high compared to other countries and has been a substantial source of tax revenue. Prior to the introduction of environmental differentiation in 2007 the purpose of the tax was mainly fiscal, and the tax base was weight, engine power and cylinder volume. From 2007 CO_2 emissions was introduced in the tax base. The main reason for including CO_2 emissions in the calculation of the registration tax was to reduce CO_2 emissions from new cars. In the years from 2009 to 2018, the registration tax has been shifted to place greater weight on CO_2 emissions. The registration tax on cars now depends on the weight, CO_2 and NOx emissions of the car. Changes in the motor vehicle registration tax towards a system that rewards vehicles with low CO_2 emissions and penalizes vehicles with high emissions have contributed to reduced emissions from new cars.

In a review of the taxation scheme for cars, that was presented in the revised budget for 2015, the Solberg Government decided to put more emphasis on emissions in the registration tax in the future. This was followed by changes in the budgets for 2016, 2017 and 2018 that phased out engine power as tax base, reduced the taxation of weight and increased the taxation of emissions of CO_2 and NO_X. In the review, it was also decided to prolong the tax exemptions for VAT and registration tax for electric vehicles.

The tax incentives for low and zero emission cars over the years has contributed to a reduction in the average CO_2 emission from new cars, from 177 g/km in 2006, to 71 g/km in 2018.

The target, adopted in the white paper on Climate Policy (Meld.St. 21 (2011-2012)) to the Norwegian Parliament, that average emissions from new passenger cars in 2020 on average should not exceed 85 grams CO_2/km, was reached already in 2017.

EU emission standards for motor vehicles have contributed positively to the reduction of CO_2 emissions. However, *Vista Analyse* found that the changes in the Norwegian motor vehicle registration tax, favoring low emission vehicles, may explain most of the reduction in emissions during the period 2006-2011.[g] In recent years, the increased numbers of EVs and PHEVs has been the most important factor explaining the reduction in the type approved average CO_2 emission from new passenger cars, see figure 4.2. In the three first quarters of 2019, around two out of three new cars registered were EVs, PHEVs or regular hybrids. EVs is the largest group, and EVs alone made up nearly 45 per cent of all new passenger cars registered in this period. It is reasonable to assume that the positive trend with lower emissions will continue.

The White Paper on Transportation (NTP) (Meld. St. 33 (2016–2017)) set new targets for the sales of zero emission vehicles. For instance, all new passenger cars and light vans should be zero emission in 2025. Improvements of technological maturity in the vehicle segment that makes zero emission cars competitive with fossil solutions is a prerequisite for the target figure.

[g] Report (in Norwegian) by Vista Analyse: https://vista-analyse.no/no/publikasjoner/evaluering-av-endringer-i-kjop-savgiften-for-nye-biler-fra-2006-2011/

Figure 4.2 *Development in average CO_2-emissions from new passenger cars in Norway and the EU (2001 - 2018). Gram per km.*

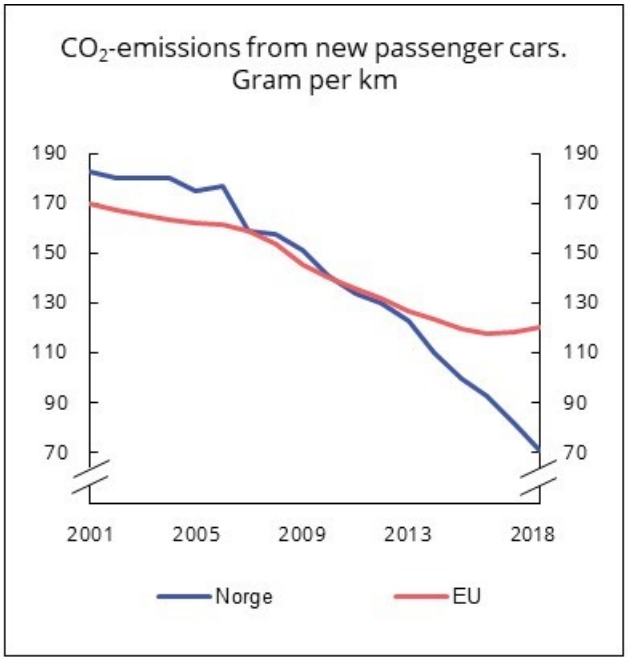


Figure Annual average CO_2-emissions from new passenger cars in Norway and the EU. 2001 til 2018. Gram per km

Sources: EEA and Norwegian Road Federation.

Sources: EEA and Norwegian Road Federation

Norway provides strong incentives for zero emission vehicles, both tax advantages and other user incentives. Electric cars (EVs), including both battery and fuel cell cars, are exempted from the motor vehicle registration tax. EVs also have an exemption for the traffic insurance tax and the re-registration tax. Moreover, the purchase of EVs and equipment are exempt from value added tax (VAT) and electric cars are also exempt from the road usage tax since electricity is not subject to this tax. In addition to the tax benefits, EVs have other benefits, such as free access to bus lanes (decided locally), reduced toll fares, a rebate on car ferry crossings, and reduced parking fees on public parking spots.[h] The Parliament has agreed on implementing a national rule, stating that EVs cannot be charged more than 50 % of the price for fossil fuel cars on ferries, public parking spots and toll roads. More than 13 000 public charging points have also been established. Enova has provided support to a network of fast charging infrastructure along the main highway corridors and has launched a support program for fast charging in municipalities with less than two fast charging points.

The incentive scheme, together with support for infrastructure, has had a major effect on the sale of electric vehicles. The share of new zero emission cars in the sales of new cars in 2018 was about 31 per cent, and currently Norway has around 250 000 electric cars. Almost 10 per

[h] There is a degree of local autonomy with regard to these user benefits, in particular they can be revised in light of the traffic development in the large urban areas.

cent of the Norwegian passenger car fleet is battery electric. This is the largest share of electric cars as percentage of the entire passenger car fleet in the world.

Figure 4.3 *Zero emission vehicles, share of new passenger cars and total number of passenger cars. Per cent.*
Figure 4.4 *Revenues from car related taxes Bill. 2018-NOK.*

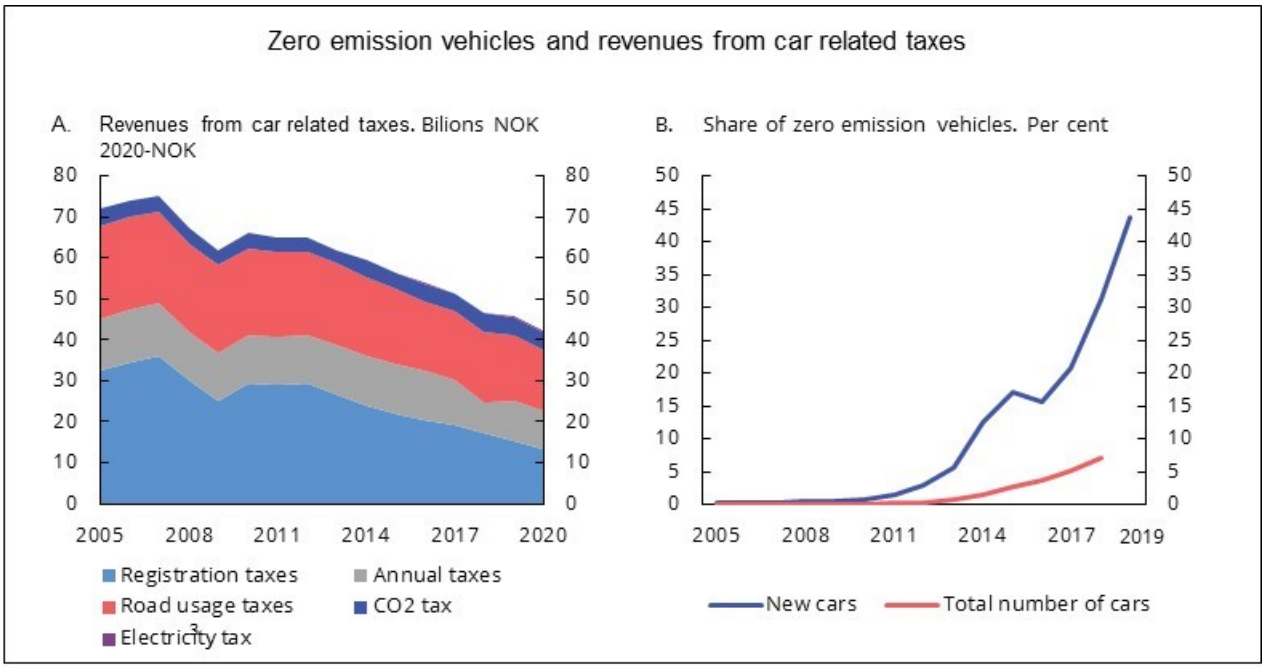
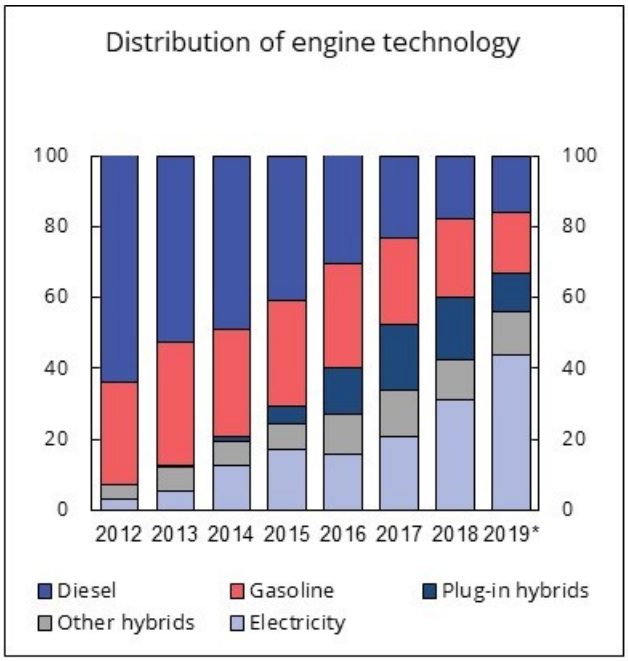


Figure Share of zero emission vehicles of new passenger cars and total number of passenger cars and revenues from car related taxes.

Source: Norwegian Ministry of Finance.

Plug-in hybrid electric vehicles (PHEVs) have a weight deduction in the motor vehicle registration tax set at maximum 23 per cent of the vehicle weight. An electric driving range of minimum 50 km is necessary to get the maximum deduction. For PHEVs with shorter electric driving range there is a proportionate reduction in the weight deduction. Hybrid electric cars are partly not levied road usage tax since electricity is not subject to this tax. Furthermore, they have relatively low CO_2 emissions and are therefore subject to a lower registration tax than comparable conventional cars. The share of hybrid electric vehicles as share of new first time registered cars increased from 4 per cent in 2012 to around 33 per cent in the three first quarters of 2019.

Figure 4.5 *Distribution of engine technology among new passenger cars. Per cent. 2012- august 2019**



Figur 13.10 Distribution of engine technology among new passenger cars. Per cent. 2012-aug 2019*

Source: Norwegian Road Federation.

On average, the motor vehicle registration tax for a new passenger car (including electric cars) is reduced by appx. 55,000 NOK since 2013. In the same period, the average annual total tax on owing and using a car is reduced by approximately NOK 3,000. Tax on purchase, ownership and use of a car have traditionally been an important source of income for the government. The shift in taxation towards emissions has reduced the tax for cars with low emissions. Combined with exemptions for zero emission vehicles and the progress in the development of new low and zero-emission cars this has reduced government revenues. In the peak year 2007, the car-related taxes contributed to financing the state's expenses corresponding to NOK 75 billion, see figure 4.5. After a temporary fall during the financial crisis, revenues increased again. In 2013, revenues from car-related taxes amounted to NOK 62 billion. After that, revenues from car-related taxes have fallen, and can be estimated at approximately NOK 42 billion in the budget proposal for 2020, nearly NOK 20 billion lower than in 2013. This corresponds to an average annual decline of approximately NOK 2.8 billion. This figure does not include loss of revenue from the VAT exemption for zero-emission cars and revenue loss due to lower road tolls and ferry rates for zero-emission cars than other cars.

Estimates for the value of the special tax advantages and user incentives for EVs in place are provided below (excluding the value of free/reduced parking fees and use of bus lanes). The numbers given are yearly value of each advantage based on estimates for 2019, unless stated otherwise:

- zero VAT rating for electric vehicles, including the leasing of electric vehicles and supply and import of batteries for electric vehicles: around NOK 7,7 billions per year
- exemption from the registration tax: around NOK 3,6 billions per year.
- Exemption for traffic insurance tax (replaced the annual vehicle tax): around NOK 700 millions per year.

- Exemption for re-registration tax: around NOK 185 millions per year.
- Favourable income tax calculation for employees using corporate electric vehicles: around NOK 200 millions per year.
- Revenue loss from road tolls: around NOK 1 200 millions in 2018.
- free boarding on classified national road ferries: around NOK 45 millions in 2019

Estimated effect on national emissions

When estimating the effect on emissions of the design and changes in the taxation scheme on vehicle (and other advantages) Statistic Norway's road model (see Annex III for a brief description) is used. The estimated effects are consistent and in accordance with the emission account and the projections. The calculations are done by altering the parameters in the model. The uncertainty is still however significant as both the without policies and measure and the reference scenario (with policies and measures) are uncertain.

In the projections, sale of electric vehicles (EV) is projected to increase from about 16 per cent in 2016 to 75 per cent of new total car sales in 2030. Continued strong incentives to choose EV will in the short run drive the increase, in the longer run technical improvements is assumed to make such cars competitive with fossil cars. Sales of plug-in hybrid vehicles (PHEV) are estimated to constitute about 25 per cent of new car sales. The high share of PHEV can be explained by the strong incentives in the vehicle registration tax to choose low emission cars and additional weight rebate for PHEVs. These assumptions imply that the share of new diesel and petrol cars (including non-plug-in hybrid cars) will decrease from about 70 per cent in 2016 to 0 per cent of new car sales in 2030. Traffic activity is assumed to trace population developments. Emissions from new cars per kilometre driven on the basis of fossil energy carriers are assumed to decline by about 1 per cent per year.

Electric vehicles

Norway is on top when it comes to EVs in the world. Without the incentives, EVs share would probably be more in line with what is observed in countries without incentives. We estimate the stock of EVs in Norway to be about 120 000 in 2030 without incentives as opposed to 1.25 million in our projections. Emissions would thus have been about 0.1 million tonnes higher in 2015, 0.4 million tonnes higher in 2020 and 1.6 million tonnes higher in 2030 without the measures. The estimate is based on the following. Sweden, with a population about twice as high as Norway, had a stock of 8000 vehicles in 2016. If we assume that Norway would have had about 4000 EVs in 2016, and we further follow IEA[i] in their New Policy Scenario and project that electric cars in Europe will reach 26 pct. of sales share in 2030, the stock of EVs would have been around 225 000. This is about 1 million lower than in the reference scenario.

Vehicle registration tax

In 2006, average type approved CO_2-emissions from new cars in Norway were higher (180 g/km) than in the EU (160 g/km), cf. figure 4.2. In 2007, CO_2-emissions was included as tax base in the vehicle registration tax and emissions from new cars fell. In the subsequent years more emphasis has been put on emission in the tax. In the analysis by Vista Analyse, see reference above, they find that the changes in vehicle registration tax could explain more than half of the observed emission reductions in the period 2006-2011. Part of the effect can be

[i] Global EV Outlook 2019. https://www.iea.org/reports/global-ev-outlook-2019

explained by the significant increase in the number of diesel cars. Based on the findings in the Vista report we estimate that emissions would then have been about 0.5 million tonnes higher in 2015 in a without policies and measure scenario than is observed. The impact is about 0.5 million tonnes in 2020 too, and somewhat lower in 2030, due to the increase in low emission cars also in a without policies and measure scenario. Based on the IEA report we have also tried to estimate the impact of the registration tax on plug-in hybrid vehicles (PHEVs). In 2016, about 13 per cent of new cars sold were PHEVs. The impact on emissions is modest, in the interval 0-0.005 in 2020 to about 0.1-0.2 million tonnes in 2030. This stems from the assumption that PHEVs are about 40 per cent more efficient than an average gasoline car. In addition, the impact on emissions is a comparison to the projections where PHEVs constitute about 20 per cent of new car sales in 2030.

4.2.7.3 ***Biofuels***

In order to increase the use of biofuels, there is a mandatory biofuels turnover in Norway. A quota obligation was introduced in 2009, committing the economic operators to sell at least 2.5 per cent biofuels as a share of the total yearly amount of fuel sold for road transport. The quota obligation has since been increased several times. As from October 1st 2017 the obligation was 8 per cent, increasing to 10 per cent from January 1st 2018, 12 per cent from January 1st 2019, and 20 per cent from January 1st 2020, including double counting of advanced biofuels. In the quota obligation in Norway 'advanced biofuels' means biofuels that are produced from the feedstock listed in Part A and part B of Annex IX in the EU ILUC-directive (Directive (EU) 2015/1513). This definition of advanced biofuels differs from both the ILUC-directive and the Renewable Energy Directive (Directive (EU) 2018/2001), where only biofuels from feedstock listed in Part A are considered 'advanced'. The Government has an ambition to increase the content of biofuels in fuels even more. As of January 1st 2014, sustainability criteria must be met by all biofuels and bioliquids included in renewable energy obligations or government support schemes. The sustainability criteria are the EU criteria implemented in the Fuel Quality Directive and the Renewable Energy Directive. Norway aims to promote development of the value chain for advanced biofuels. Since January 1st 2014 advanced biofuels are double counted towards the quota obligation. In addition, a subtarget was introduced in the quota obligation on January 1st 2017, requiring at least 0.75 percentage points of the quota obligation (without double counting) to be met by the use of advanced biofuels. This sub target was increased to 1.25 per cent from October 1st 2017, to 1.75 per cent from January 1st 2018, to 2.25 per cent from January 1st 2019 and increasing to 4 per cent from January 1st 2020.

The CO_2 tax is levied on mineral products. This entails that petrol and diesel are subject to CO_2 tax, whereas bioethanol, biodiesel and hydrogen are not. Before October 1st 2015, biodiesel that met the sustainability criteria was subject to a reduced road usage tax, corresponding to half of the rate for autodiesel. Bioethanol was exempt from the road usage tax in blends containing more than 50 per cent bioethanol. In lower blends, bioethanol had the same road usage tax as petrol. Since October 1st 2015 biodiesel and bioethanol are subject to a road usage tax at the same level as autodiesel and petrol when used to fulfil the quota obligation for biofuels. However, volumes of biodiesel and bioethanol sold beyond the level of the sales mandate has been exempted from the road usage tax since the same date. From July 1st 2020 all biofuels used in road transportation will be subject to the road usage tax.

From January 1st 2020, a requirement that 0.5 per cent of aviation fuel sold in Norway is advanced biofuels will be introduced, and the regulatory changes will be introduced in the Product

Regulation. Flights carried out by military aircrafts are exempted from the decision due to technical requirements in the defence sector.

Estimated effect on national emissions

The use of biofuels, blended or pure, has led to reduced CO_2 emissions from road vehicles. The content of bio fuels in petrol and auto diesel sold has increased since 2006, cf. Table 4.11. The estimated CO_2 effect is based on the consumption of bio fuel until 2017[j] and for 2020 and 2030 the projected consumption of bio fuels that was included in the national CO_2 projection published in October 2018.

In the calculation of the CO_2 effect it is taken into account that the energy content in bio fuel is lower than in fossil fuel i.e. 1 litre of bio fuel replaces less than 1 litre of fossil fuel. The CO_2 effect is increasing to 1.7 million tonnes CO_2 in 2020 and is then decreasing to 1.3 million tonnes CO_2 in 2030. This is due to the rapid increase in the number of electric vehicles from 2020 to 2030 that is assumed in the national emission projections.

The estimated effect has taken into account the latest adopted requirements to content of biofuel in fuels for road traffic, and the effect of the tax incentives introduced in October 2015. It is uncertain in what way the economic operators will meet the requirements. The double counting of advanced biofuels can possibly reduce the total amount of biofuels consumed, as the suppliers will be able to meet the sales mandate with a lower volume. The tax incentives have so far made biofuels volumes sold beyond the level of the sales mandate able to compete with fossil fuels. Particularly in 2017, and likely also in 2019, the volume of biofuels sold was significantly higher than the sales mandate.

Table 4.11 *Content of biofuels in petrol and auto diesel. 2005-2017. Per cent by volume.*

	2006	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2020-30**
Petrol	0.0 %	0.6 %	1.1 %	1.3 %	1.7 %	1.6 %	1.7 %	5.7 %	5.7 %	6.6 %
Auto-diesle	0.4 %	5.7 %	5.3 %	5.8 %	5.4 %	5.3 %	5.7 %	11.5 %	19.6 %	19.0 %

Source: Statistic Norway, Norwegian Environmental Agency and Ministry of Finance

4.2.7.4 *Zero growth in passenger traffic by car in major urban areas: Public transport, cycling, walking and traffic restrictions.*

The Solberg Government has increased its efforts to reach the goal that the growth in passenger traffic in urban areas shall be achieved through public transport, cycling and walking. Mobility in urban areas will be improved through targeted investments, better public transport and future-oriented solutions. The nine largest urban areas either have an urban growth agreement or a reward scheme for public transport. The agreements share the same common goal of zero growth in passenger traffic by car. This has contributed to stimulating zero growth in passenger traffic by car and a modal shift to public transport in general.

Appropriations to urban growth agreements and the reward schemes for public transport have increased over the last years from 1.8 billion NOK in 2016 to 5.4 billion NOK in 2020. The distribution of the funds is subject to negotiations of new agreements.

[j] Numbers for 2016 show that the content of biofuels in petrol and auto diesel was 5.9 per cent and 11.7 per cent respectively.

The urban growth agreements are concluded between the government, the municipality and the county council in urban areas. The agreements consist of specific measures and transport projects that are funded by both central, regional and local government, as well as road tolls. Examples of measures are; infrastructure investments, increased availability and frequency for public transport, and restrictive measures for passenger cars. Land use measures are also important.

Estimated effect on national emissions

It is very difficult to single out the effect of each measure. The estimated effect is therefore aggregated for all measures. For instance, the effect of investments in railways will have better effect if bus-lanes and bike infrastructure around the station are improved at the same time. The effect will further increase with road pricing and toll roads in and around the city. The level of each measure may vary over time, as the local municipalities will alter road pricing, queue pricing and low emission zones due to the development in traffic and pollution in the cities. The complexity also increases as these restrictive measures in addition to reducing traffic also will influence on the market share of low- and zero-emission vehicles. Measures may vary between cities. Revisions of old agreements and new agreements between state, county council and municipality are being negotiated, and details such as starting point and climate effect of each measure are not calculated. The estimates are based on calculations made by the Norwegian Environmental Agency.

The Norwegian Public Roads Administration has estimated that zero growth in passenger traffic by cars in the nine largest urban areas could reduce emissions by 38 000 tonnes CO_2 equivalents in 2020 and by 88 000 tonnes CO_2 equivalents in 2030, compared to the reference path. The reference path includes population growth, economic growth, and growth in electric car sales from 50% market share in 2020 to 75% in 2030.

The Norwegian Environmental Agency has estimated that the zero traffic growth for passenger cars in the nine urban areas, comprising 13 cities, could reduce emissions by about 580 000 tonnes CO_2 equivalents in the period 2021 to 2030.

4.2.7.5 *Zero emission ferries*

In 2021 one third of ferries that operate domestic ferry routes, both national and regional routes, will have batteries installed, operating either as all-electric or as hybrid ferries. This number is based on signed contracts with ferry operators and requirements in issued public tenders. Such a development is largely a result of requirements for zero and low-emission technology in tenders for public ferries, both on the national highways and on the regional road network. Financial support through government funding agencies and funding schemes play an important role in stimulating emission reduction measures in the existing and new contracts. The National Public Road Administration (NPRA), the body responsible for the procurement of ferry services on the national highways, considers that in 2030, two-thirds of domestic car ferry routes will be possible to operate with ferries powered by electricity.

Due to longer crossing time and high energy demand, there are a number of ferry routes that are not suitable for all electric operation. In their analysis, the NPRA expects that ferries powered by hybrid solutions or exclusively on other energy carriers such as biogas, biodiesel, and

hydrogen will operate the remaining one-third of the domestic ferry routes. The NPRA has announced a new development contract, with the ambition of an all-electric hybrid fuel cell battery powered car ferry in operation in 2021.The objective of the development contract is to make zero emission technology available for ferry routes that are not suitable for all-electric operation.

Estimated effect on national emissions

NPRA has estimated that the requirements for zero and low-emission technology in tenders for ferries on the national highways, on tenders that have been awarded and/or announced as of October 2017, will reduce the annual emission with approximately 90.000 tonnes CO_2 by 2020 and 2030. Analysis by NPRA of which ferry routes that can be suited for zero- or low-emission technology show a potential annual reduction of approximately 400.000 tonnes CO_2 in 2030, including ferry routes both on national highways and on the regional road network1. The NPRA analysis shows that an all-electric domestic ferry fleet will result in a reduction of approximately 600 000 tonnes CO_2 yearly, compared to the total ferry emissions in 2015.

4.2.7.6 *Discount in the pilotage readiness fee*

From January 1st 2015, ships with a score of 50 or more on the Environmental Ship Index (ESI) is awarded a 100 per cent discount in the pilotage readiness fee. The ESI identifies seagoing ships that perform better in reducing air emissions than required by the current emission standards of the International Maritime Organization (IMO). The ESI evaluates the amount of nitrogen oxide (NOx) and sulphur oxide (SOx) that is emitted by a ship, and it includes a reporting scheme on the greenhouse gas emission of the ship. However, the index score is predominantly due to reduced emissions of NOx and SOx. Hence, the ESI-based discount in the pilotage readiness fee is not primarily a climate mitigation action, but a reward to ships for their environmental performance and a broad incentive to promote clean ships.

Estimated effect on national emissions

The action was introduced in 2015 and first announced on October 30th 2014 when the Norwegian Coastal Administration (NCA) sent the pilotage fees for 2015 on consultation. The NCA considers it unlikely that this action alone should lead to the construction or retrofitting in 2015 of more climate and environment friendly vessels. The action's climate mitigation impact in 2015 is therefore considered to be non-existent.

In 2019 the ESI discount in the pilotage readiness fee amounted to 22 mill. NOK, which NCA expects to increase to 26 million NOK in 2020.

4.2.7.7 *Aid scheme for short sea shipping*

Starting in 2017, the Norwegian Coastal Administration (NCA) provides grants to projects that move freight from road to sea by establishing new short sea services between ports in the European Economic Area (EEA), or, under special conditions, the upgrading of existing services. The objective of the aid scheme is to transfer freight from Norwegian roads to maritime transport.

Estimated effect on national emissions

By using factors[k] for the emission of tonnes CO_2 per tonnes kilometre of, respectively, road transport and maritime transport, the net reduction in CO_2 emissions can be calculated. In order to estimate the climate mitigation impact in 2020 and 2030 we have made the following assumptions:

- The applications' estimations of the amount of freight to be transferred, will be realised 100 per cent according to the business plan.

- The maximum funding period is three years. Grants are awarded to projects that are expected to be viable in the long run, and therefore the estimated amount of freight transferred in the fourth year of the project is assumed to be constant in the following years up to 2030.

- Three new projects were awarded grants in 2018, none in 2019.

- The total budget for the scheme for the first two years amounts to 157 M NOK (82+75). No projects were accepted in 2019.

The table below illustrates net reduction in CO_2 emissions related to freight transport transferred from road to sea financed by the aid scheme, by calendar year (columns) and year of project acceptance (rows). The estimated effect from the aid scheme on emissions in 2030 is a reduction of approximately 24 110 tonnes CO_2.

Table 4.12 *Net emission reduction by year of project acceptance in 2018-2030. In tonnes CO_2.*

Application year	2018	2019	2020	2021	2022	2023	...	2030
2017	**-5 407**	**-6 599**	**-8 696**	**-8 696**	**-8 696**	**-8 696**		**-8 696**
2018		**-11 160**	**-14 472**	**-15 414**	**-15 414**	**-15 414**		**-15 414**
2019								
CO_2 reductions	**-5 407**	**-17 760**	**-23 168**	**-24 110**	**-24 110**	**-24 110**		**-24 110**

4.2.7.8 ***Increased investments in railways***

The broad political agreement on climate gives high priority to developing a competitive railway transport system for passengers and freight. Emphasis is placed on improving the passenger rail network around the big cities and improving capacity for freight transport. There have been substantial increases in funding for investment in new railways maintenance of existing railways. The railway sector was granted NOK 21.5 billion in 2015, NOK 23.1 billion in 2016, and NOK 23.5 billion in 2018. In 2019 it has been granted NOK 26.2 billion.

One of the main objectives for increased investments in railways is related to the goal "zero traffic growth for passenger cars" (see above 4.2.7.4) in the nine largest city-areas in Norway.

[k] Emissions from road transport are assumed to 0,000125 tonnes CO2 per tonne kilometre, and 0,0000125 per tonne kilometre for sea transport.

All these cities are working towards urban growth agreements with national authorities, which obliges them to reduce growth in passenger car transport.

Railway has an important role in fulfilling the zero growth goal in the largest city areas. At least 90 per cent of the travels by train have an end/starting point (or both) in an area of zero growth in passenger car transport.

Increased investments are also related to freight. The National Transport plan for 2018-2029 prioritises investing about 18 billion NOK in specific freight measures, such as crossings for trains on single track railway, electrification, and investments in terminals.

Estimated effect on national emissions

The National Transport Plan (2018-2029) estimate reduced emissions from freight transport to be approximately 123 000 tonnes CO_2-eq. In addition it is estimated approximately 88 300 tonnes CO2-eq from investing in infrastructure for passenger transport. By assuming that it is the same numbers in 2030 the total effect from investing in railway infrastructure will be 211 300 tonnes CO2-eq.

The emission reduction of building InterCity-projects from Oslo to Tønsberg, Hamar, and Sarpsborg is estimated in the National Transport Plan 2018-2029 to be about 48 000 tonnes CO_2-eq annually because traffic is transferred from road to railway. The plan and implementation of the different projects have to be decided upon in the annual budgets. A more rapid substitution of fossil fuels in road transport than what was anticipated in the National Transport Plan 2018-2029 will reduce the emission reduction potential of these measures. Therefore, estimated effects on national emissions have to be seen as a maximum.

4.2.7.9 *Maximum CO_2 emissions from the coastal route Bergen-Kirkenes in new tender*

The Ministry of Transport is the competent authority for issuing a licence for the coastal route from Bergen to Kirkenes, and for procuring sea transport services on the route. The current contract with Hurtigruten AS entered into force in 2012 and expires December 31, 2020. The Ministry of Transport launched the new tender for the coastal route in September 2017. The Ministry awarded two contracts to Hurtigruten AS for three and four vessels respectively, and one contract to Havila Holding AS for four vessels. The operation of the service is to have a duration of 10 years, covering the period from 2021-2030.

In order to reduce emissions from the service by 25 % on average during the contract period, compared with 2016, the contracts limit the maximum allowed CO_2 emissions from the vessels serving the Coastal Route. The annual maximum allowed emissions are 162 000 tonnes of CO_2 on average for the whole contract period. All vessels must also be equipped for receiving electric power from shore, which allows operation of the ship without the use of its own machinery when the ship is docked. Electric power from shore will be used in the ports where the infrastructure facilitates it. A maximum of 0.10% (wt. %) sulphur content of the fuel used is required. It is also not permitted to use heavy oil as fuel.

4.2.8 Manufacturing industry and industrial processes

4.2.8.1 *Introduction*

This sector covers primarily emissions from the manufacturing industry, but it also includes emissions of industrial processes. A number of policies and measures have been implemented over the years. From 2013, emissions from processes in the manufacturing industries are to a large extent covered by the EU Emissions Trading Scheme (EU ETS). Prior to the EU ETS, a number of agreements concerning the reduction of greenhouse gas emissions have been concluded between the industry and the Norwegian Government. HFCs are regulated through a tax and reimbursement scheme together with F-gas regulation and the Kigali Amendment.

4.2.8.2 *Arrangement to reduce emissions in the processing industry, 2004*

In 2004, the Ministry of Climate and Environment entered into an arrangement with the processing industry, with the exception of gas refineries and landing facilities, on the reduction of greenhouse gas emissions. Sources included were the aluminium, ferro-alloy, carbon, mineral fertiliser and silicon carbide industries that accounted for approximately 30 per cent of total Norwegian greenhouse gas emissions. This arrangement also included some installations covered by the EU emissions trading scheme, but for gases other than CO_2. According to the arrangement, total emissions of greenhouse gases in the process industry were not to exceed 13.5 million tonnes of CO_2 equivalents by the end of 2007.

Estimated effect on national emissions

The Norwegian industry has for many years reported their emissions to the Norwegian Environment Agency and these are reflected in Norway's GHG inventory. The emissions in 2007 from the industries covered by the arrangement were reduced by 1.11 million tonnes of CO_2 equivalents. The reduction in N_2O emissions from the production of nitric acid was enough to fulfil the arrangement, but the effect is reported as included elsewhere (IE) in CTF table 3 under the PaM N_2O reduction, production of nitric acid.

4.2.8.3 *Arrangement to reduce emissions in the processing industry, 2009*

In September 2009, the Ministry of Climate and Environment entered into an agreement with the processing industry that was not covered by the EU ETS. This agreement set a limit for total emissions of 6.2 million tonnes CO_2-equivalents per year for the years 2008-2012. The limit equalled a reduction of 44 per cent compared with the emissions in 1990.

Estimated effect on national emissions

In 2007, the emissions from the processing industry were 6.4 million tonnes CO_2-equivalents. The target of 6.2 million tonnes CO_2 equivalents was met, thus resulting in a reduction in emissions of 0.2 million tonnes of CO_2 equivalents from when the agreement was made. From 2013 onwards, nearly all the emissions from the processing industry are included in the emissions trading scheme.

4.2.8.4 *CO_2 compensation scheme*

In 2013, Norway established a CO_2 compensation scheme for the manufacturing industry. The purpose of the scheme is to prevent carbon leakage resulting from increased electricity prices due to the EU Emissions Trading System (EU ETS), and affected companies can apply for such compensation to the Norwegian Environmental Agency. Norway is part of the integrated Nordic electricity market and there are electricity cables linking our system to both Germany

and the Netherlands. Hence, increased electricity prices in Europe, due to the EU ETS, result in increased electricity prices in Norway as well. The result is a competitive disadvantage for the electricity intensive manufacturing industry in Norway, compared with businesses outside of Europe. The CO_2 compensation scheme is intended to partly counteract this disadvantage.

The compensation scheme is based on the EFTA Surveillance Authority's (ESA) state aid guidelines. The scheme is governed by the Norwegian Ministry of Climate and Environment, and administered by the Norwegian Environment Agency. The scheme applies from 1 July 2013 to 31 December 2020. The scheme includes all 15 sectors listed in the EU Guidelines, among others aluminium, ferro alloys, chemicals and pulp and paper.

Estimated effect on national emissions
Since the purpose of the scheme is to prevent carbon leakage, it is not relevant nor possible to estimate the effect on national emissions. The effect is therefore reported as not applicable (NA) in CTF table 3.

4.2.8.5 *Use of bio carbon in the production of cement and ferroalloys*
In the production of cement and ferroalloys, the sectors have replaced some of the coal consumption with bio carbon.

Estimated effect on national emissions

The estimated effects on the emissions from cement production were estimated by the producers and reported in Norway's fifth National Communication. The effect for 2010 (130 000 tonnes CO_2) has also been used for the years 2020 and 2030.

The estimated effects on the CO_2 emissions from the production of ferroalloys are based on the plants' reported use of biocarbon to the Norwegian Environment Agency. The consumption of biocarbon fluctuates between years, but the trend is increased use. The production in the sector is in the national emission projection anticipated to be at approximately same level as today. The CO_2 effect of the use of biocarbon in 2020 and 2030 is set equal to the estimated emissions from biocarbon in 2018 (340 000 tonnes CO_2).

4.2.8.6 *N_2O reduction, production of nitric acid*
In 2018, the N_2O emissions from the production of nitric acid equalled about 0.2 million tonnes CO_2 equivalents. The emissions from the production of nitric acid decreased by 93 per cent from 1990 to 2018. This is partly explained by the fact that one of the production lines was restructured in 1991, but mainly because more and more of the production from 2006 and onwards has been equipped with a new technology – N_2O decomposition by extension of the reactor chamber. As a result of the new technology, the implied emission factor (IEF) for nitric acid production decreased from 5.0 kg N_2O per tonne nitric acid in 1990 to 0.34 kg N_2O tonne of nitric acid in 2018.

Estimated effect on national emissions

The estimated effects on national emissions have been estimated by assuming a "business-as-usual" scenario from 1990 with no change in emission intensity since 1990, but with actual production levels. The effects in 2020 and 2030 are estimated based on production levels and

emissions consistent with the GHG projections. The effects for 2020 and 2030 are estimated to 2.8 million tonnes CO_2 equivalents.

The reduction in N_2O emissions from the production of nitric acid was enough to fulfil the 2004 arrangement between the Ministry of Climate and Environment and the processing industry, (see section 4.2.8.2). The production of nitric acid was opted-in to the EU ETS in 2008 and this has provided incentives for further emissions reductions.

4.2.8.7 *Agreement with the aluminium industry*

In 1997, the major aluminium producers signed an agreement with the Ministry of Climate and Environment to reduce emissions of greenhouse gases (CO_2 and PFCs) per tonne of aluminium produced by 50 per cent in 2000 and 55 per cent in 2005, compared with 1990 levels. The agreement was followed by a new agreement with the industry for the years 2005-2007. In 2005 the CO_2 equivalent emissions of PFCs per tonne of aluminium produced were 85 per cent lower than in 1990 and 84 per cent lower in 2007. The emissions covered by this agreement were included in the 2009 agreement with the processing industry, see section 4.2.8.3, and from 2013 they are covered by the EU emission trading scheme. The emission intensity has continued to decrease and the PFC emissions were 96 per cent lower in 2018 than in 1990.

Estimated effect on national emissions

The reduced emission intensity is a result of the sustained work and the strong attention on reduction of the anode effect frequency and time in all these pot lines and the shift from the Soederberg production technology with high emission intensity to prebaked technology with considerably lower emission intensity. The emphasis on reducing anode effect frequency started to produce results from 1992 for both technologies.

Since it is somewhat difficult to separate the effects of the agreement from other effects, two scenarios have been applied. The upper range of effects assumes a “business-as-usual” scenario from 1990, with no change in emission intensity since 1990 but with actual production levels. The lower range of effects assumes a “business-as-usual” scenario from 1997, with no change in emission intensity since 1997 but with actual production levels. The same scenarios have been used to estimate the effects in 2020 and 2030, where the production levels and emissions are consistent with the latest GHG projections. The effects for 2020 are estimated to 2.6-5.8 million tonnes CO_2 equivalents and to 2.9-6.4 million tonnes CO_2 equivalents in 2030.

4.2.8.8 *Agreement on SF_6 reductions from use and production of GIS*

In June 2001, a non-profit trust, which by an agreement with the Government is in charge of the collection, recirculation and destruction of discarded electric and electronic equipment, established a SF_6 recovery facility. In March 2002, this was followed up by a voluntary agreement between the Ministry of Climate and Environment and the business organisations representing most users of gas-insulated switchgear (GIS) and the single producer. According to this agreement, emissions were to be reduced by 13 per cent by 2005 and 30 per cent by 2010 relative to base year 2000. By the end of the agreement period in 2010, emission were 45 per cent lower than the base year emissions in 2000. Although the formal agreement was terminated in 2010 the intentions and practical implications of the agreement are still in place, since the

emission reduction measures and close cooperation between the trust and the Government has continued uninterrupted up until this day. Although the installed amount of gas in GIS has increased, the emissions from GIS in use has decreased.

Estimated effect on national emissions

Emission estimates from the Norwegian inventory have been used to calculate the emission reductions resulting from the agreement. For 2020 and 2030, projections are compared to the emission estimates for the base year 2000. The effects for 2020 and 2030 are therefore estimated to 59 000 and 58 000 tonnes CO_2 equivalents respectively.

4.2.8.9 *Tax and reimbursement scheme of HFC*

To curb the expected exponential growth in HFC emissions due to the phase-out of ozone-depleting substances, a tax on import and production of HFCs was introduced in 2003 (the tax also includes PFCs, but the use of these gases is insignificant). In 2004, this tax was supplemented with a refund scheme, which prescribes a similar refund when gas is destroyed. The tax was initially NOK 180 (appr. 19 Euro) pr. GWP-tonnes. In 2019 the tax is NOK 508 (appr. 50 Euro) per tonne CO_2-equivalent, after relatively large increases since 2014. The tax now approximately equals the CO_2 tax rate on mineral oil. Combined and over time, the tax- and refund schemes amount to a proxy tax on emissions of HFC.

The tax and reimbursement schemes have resulted in better maintenance and improved routines for discarding old equipment. It also provides a strong incentive for choosing HFCs with the lowest GWP possible and has resulted in the increased use of natural refrigerants and alternative processes (for example indirect systems) in new installations. The tax has had very significant effects on new, bigger installations, where low-GWP alternatives are often available and the tax might represent a significant share of the investment costs. On smaller mass-produced units, the development in international legislation (such as the EU F-gas regulation and the Montreal Protocol) is likely the main driving force influencing emissions and choice of refrigerant.

Estimated effect on national emissions

The tax has significantly reduced growth in emissions compared with pre-tax scenarios, which forecasted very strong growth due to substitution of CFCs and HCFCs with HFCs. Estimates by a national expert are that the tax may reduce the HFC emissions in 2020 and 2030 by 0.7 and 0.5 million tonnes of CO_2-equivalents, respectively.

The emissions of HFCs in 2017 were approximately twice as high as in 2004. However, he growth rate has decreased significantly since 2010, and the emissions of HFCs have been stable since 2016. This is likely due to the combined effect of the tax- and refund scheme and the F-gas regulation.

4.2.8.10 *F-gas regulation and the Kigali Amendment to the Montreal Protocol*

Norway implemented EU Regulation No. 842/2006 on certain fluorinated greenhouse gases in 2010, and the revised EU regulation No. 517/2014 was implemented in 2019. Norway is exempted from the EU HFC phase-down scheme (Articles 14-18). This is mainly justified by the

implementation of the Kigali Amendment to the Montreal Protocol. Norway has ratified the Kigali Amendment, and the phase-down scheme for HFCs entered into force in national legislation by 1 January 2019. In the national legislation, Norway has implemented a stricter phase-down scheme than it's obligations under the Montreal Protocol.

Estimated effect on national emissions

The Norwegian Environment Agency provided an updated assessment on the implications of planned measures in 2016, based on the work of a national expert. For 2020, the Norwegian Environment Agency estimated a reduction in emissions of 200-300 thousand tonnes CO_2-equivalents and for 2030, an effect of 0.5-0.7 million tonnes CO_2-equivalents. The averages of these ranges are reported in CTF table 3.

4.2.9 Agriculture

4.2.9.1 *Introduction*

Norwegian agriculture is covered by overall Norwegian climate targets and policies as specified in our NDC and our agreements with the EU. Overall domestic policies for agriculture are based on a white paper on agricultural policies in December 2016; Change and development - A future-oriented agricultural production (Meld. St. 11 (2016–2017)), adopted by the Parliament in spring 2017. Climate change and agriculture was thoroughly addressed in the paper. The Norwegian Parliament stated that the most important role for agriculture in the context of climate change is to reduce emissions per unit produced, increase the uptake of CO_2 and adapt the production to a changing climate.

Current policies and practices to control GHG emissions in Norwegian agriculture include a combination of regulatory, economic and informatory measures. CO2 from the use of fossil fuel in activities related to agriculture meets CO_2-taxation similar to other sectors, and the general ban on fossil fuels for heating buildings is imposed for agriculture from 2025. Emissions related to transport and energy are accounted for in other sectors. Direct emissions from agriculture are covered neither by the emissions trading system, nor subject to GHG taxation, rather they are covered by other measures as specified below.

Previous reporting of the emission inventory and reports to the UNFCCC have identified key emission sources from Norwegian agriculture. These include methane from livestock and manure, nitrous oxide from manure and fertilized soils, and losses of carbon- and nitrogen-compounds from soils, particularly organic soils. While abatement of such emissions is considered important, it is difficult to decouple the volumes of emissions from the volumes of production.

Emissions from livestock have been slightly reduced over the last decades. This results from successes with animal breeding, welfare and feeding which have enabled increases in overall production i.e. output per animal has been increased.

Measures aimed at reducing N_2O may have various costs and benefits. As N_2O-emissions are calculated as a ratio of N-input, one option is to reduce the input. However, such approach

alone may result in reduced harvests and increased production costs. Key measures include improving manure management and fertiliser use to achieve higher nitrogen use efficiencies (NUE – the ratio of nitrogen in products relative to inputs) so that less N-input is needed per unit of product. Such improvements can have various co-benefits, including reduction of run-off to water as well as ammonia emissions to meet targets, which improves the cost-benefits from abatement of greenhouse gas emissions. The sector is making efforts to improve the use of fertilisers through improved storage, spreading, timing and dosage of fertilizer – according to crops' needs. In addition, improved soil cultivation practices and use of cover crops are taken into use to reduce the risk of erosion, loss of nutrients and associated emissions. Precision agriculture is under development with increasing use of GPS technology in land management. A combination of regulatory and economic instruments are established to support such measures and emission reductions.

A joint public and private agreement to reduce food waste was completed and signed in June 2017. The goal is to half the food waste within 2030.

Across emission sources, regulations have mostly been constant over recent years, for instance for livestock management, manure management and land management. On the other hand, agri-environmental financial instruments in agriculture have been expanded. Restrictions on cultivation of peatland and on the use of fossil fuels for heating purposes indicate willingness to use a combined set of measures.

Emission figures for agriculture have high uncertainty as emissions also depends on precipitation patterns, temperature or soil properties. Various emission sources have been identified as "key category sources" that have priority for further methodology development. In 2017 a committee was set up to identify possible revisions of methodologies for calculating emissions. The committee reported back in June 2019 with advice on how calculations and reporting can be developed to better reflect real-world differences and changes that take place. Collaboration between agriculture and climate experts has improved technical understanding of the knowledge base and enables development of measures and instruments to further reduce emissions.

Policy development in co-operation with farmers and stakeholders

Policies and measures for controlling GHG fluxes in Norwegian agriculture and food systems are developed in close cooperation with stakeholders. There are agricultural negotiations between the government and farmer's unions leading to an annual "agricultural agreement" that specifies support schemes and requirements for agriculture. In the white paper on agriculture from 2016 it was concluded that climate change should be given more emphasis in the agricultural negotiations with the farmer's unions.

Based on the same co-operative approach, the Government and farmer's organisations negotiated a climate agreement for agriculture in June 2019. The deal sets targets for abatement of greenhouse gas (GHG) emissions and removals from agriculture over 2021-2030. Improvement in on-farm livestock, manure and soil management will be key to deliver the targets, alongside improvements in consumption and reduction in food losses and waste. The deal specifies that the agricultural sector will be in charge of on-farm improvements, while authorities will be responsible for improvements elsewhere, in food consumption and food systems.

The agreement does not put bindings on future policy measures or agricultural agreements, and cannot presuppose increased subsidies.

The above-mentioned agreement to reduce food waste is another example of the co-operative approach.

Measures to control emissions on-farm include transfer of know-how, technology and financial resources to support best practices. Research, extension services, breeding programs and veterinary services are key to succeed in crop and livestock management. In Norway, farmer co-operatives have a strong position in various supply chains, and are key to secure farmers with adequate support, also for containing climate change. Numerous organizations and companies in Norwegian agriculture have joined forces in a project called "climate-smart agriculture" to succeed in these fields.

Various agri-environmental measures to control emissions are listed below. These include investment schemes that are mostly operated on the local level, and support for improved practices that are mostly operated on the regional level. While these measures are considered helpful, their effect on emissions can only be quantified in retrospect.

4.2.9.2 *Regional agri-environmental programmes*

The regional agri-environmental programmes are support schemes directed at environmental challenges in different parts of the country. Each county (region) uses schemes/measures taken from a national "menu", according to the priorities of the regional environmental programme. These involve area-based payments for farming practices to achieve various agri-environmental targets, such as reducing run-off and emissions. Few measures are directed primarily to abate GHG emissions, but several of the supported measures may have co-benefits for GHG emissions and/or increased carbon sequestration. Such supported measures include no/delayed tillage (no-autumn tillage), cover crops and environmentally friendly spreading of manure.

Estimated effect on national emissions

Environmentally friendly spreading of manure corresponds to category 1 techniques as identified in the guidance document for the LRTAP-convention (ECE/EB.AIR/120). Such techniques save ammonia emissions and indirectly also N_2O-emissions from deposition of ammonia. Such savings may also reduce the need for mineral fertilizers and resulting N_2O emissions from this source, however, the latter effect only arise if farmers reduce the dosage of fertilizer according to improved input efficiency.

In Norwegian reports to the LRTAP-convention, we note that uptake of category 1 techniques have risen over recent years, reaching approximately 20 % of the overall volumes of manure in 2018. This helped abate 1000 tonnes of ammonia compared to the reference, broadcast, technique, calculated from Norwegian $Frac_{GASM}$-factors[l]. Based on the default IPCC factor (EF_4), this helped save approximately 15 tonnes of N_2O. Assuming that farmers saved 1 unit of nitrogen fertilizer per 3 units of ammonia emissions, savings of nitrogen fertilizer amounted to 300 tonnes of N, yielding an additional saving of 5 tonnes of N_2O (based on the IPCC EF_1-

[l] Fraction of manure nitrogen that volatilises as ammonia. $Frac_{GASM}$ is combined with EF_4 to calculate indirect emission of nitrous oxide resulting from ammonia, according to equation 11.11 from IPCC (2006).

factor). Combined, these savings correspond to 6,000 tonnes CO_2-equivalents for 2020. Uptake of category 1 techniques are expected to rise over the coming years as financial support over the agri-environmental support scheme has been expanded. Savings for 2030 are therefore projected to 10,000 tonnes.

No-autumn tillage and cover crops support retention of soil organic matter and nutrients, and therefore CO_2 and N_2O emissions. For such savings to be visible in the emission inventory, farmers must also reduce the purchase and use of fertilizer pursuant to improved nutrient efficiency. Consequently, there is not sufficient knowledge to estimate the effect on emissions.

4.2.9.3 *Requirements and support for livestock on pasture*

Keeping livestock on pasture may help abate emissions from manure management compared to keeping animal in confinement. Naturally, most livestock in Norway must be kept indoors for part of the year, while there are requirements that cattle, sheep and goats should be free-range for minimum periods in summer, and additional support is paid for those who are kept outdoors longer. Through such practices, emissions from storage and spreading of manure are avoided and replaced by lower emissions from dung and urine deposited on pasture.

Estimated effect on national emissions

According to default emission factors in 2006 IPCC guidelines used in current emission calculations, deposition on pasture has modest effect on overall emissions compared to management of manure from confinements. According to the 2019 refinement of IPCC guidelines, however, deposition on pasture reduces the rate of emissions. Consequently, the ratio of pasture use has little effect for the current emission data, however, this ratio will influence what emissions level we report retrospectively in the future.

4.2.9.4 *Support scheme for Special Environmental Measures in Agriculture*

The support scheme for Special Environmental Measures in Agriculture support investments towards environmentally friendly practices. From 2017 this scheme has been expanded to support better storage of manure, to control emissions of CH_4 and N_2O.

Estimated effect on national emissions

The effect on emissions from better storage of manure depends on several characteristics and is therefore hard to measure. Investment support is given only to storage constructions that are better than requirements established in overall regulations, e.g. capacity to store manures in larger quantities and for longer periods in order to optimise the timing of application, and/or instalment of cover on storage silos in order to prevent excessive emissions. As such support was established only recently, effects on national emissions can only be expected after some years.

4.2.9.5 *Drainage of agricultural soils*

The main purpose of the scheme is to increase the quality of cultivated land by financial support to poorly drained soil, in order to increase productivity and reduce risk for erosion and water pollution. As a side-effect, better drainage may also reduce GHG emissions.

Estimated effect on national emissions

There is a tendency of higher emissions of N_2O from soils with high humidity. Drainage may therefore reduce such emissions. However, the effect also depends on e.g. fertilizer, time of fertilization, humiditiy of the soil, structure of the soil and pH values. There are currently few studies available that can help quantifying the effect on emissions, and more knowledge is therefore needed.

4.2.9.6 *Project Climate Smart Agriculture*

A project called Climate Smart Agriculture is established. The aim of the project is threefold; Making a system for data collection and documentation of practical measures, develop a system for on-farm climate decision support, and information and sharing of knowledge. The project is developed over 3 years 2017 – 2019 with funding from the Ministry of Agriculture and Food. From 2020 the project will move to implementation phase.

Estimated effect on national emissions

The project should be considered as a support system and enabling condition for other, more specific improvements.

4.2.9.7 *Climate and environment programme*

The aim of the Climate and environment programme is to contribute to climate and environmental goals within the agricultural policy through research and information measures. The programme is directed towards practical and agronomical knowledge on climate and environmental challenges, that can be quickly disseminated to the industry. Examples of projects that have been supported by this programme are Climate smart agriculture, Quality of roughage and Effects of tillage on drainage of nitrogen and phosphorus.

Estimated effect on national emissions

The project is related to development and dissemination of knowledge, while actual effect on emissions can only happen through on-farm implementation.

4.2.9.8 *Delivery of manure for production of biogas*

Treatment of manure in biogas plants can reduce CH_4 emissions from storage of manure. By using the biogas for energy purposes, use of fossil fuels for transport or heating are also reduced. To contribute to biogas treatment of an increased share of manure, the government established a pilot scheme from 2015 supporting delivery of manure to biogas plants. In 2016-2018, 60,000 – 70,000 tonnes of manure qualified for such support, approximately 1 % of the overall manure volume. According to an evaluation in 2018, the support has made manure a more attractive substrate for biogas treatment, however capacity for such treatment is still limited.

Estimated effect on national emissions

It is difficult to estimate the effect from the delivery support scheme isolated from other incentives. The effect on emissions should e.g. be seen in relation to grants for biogas projects and tax incentives for the use of biogas as compared to fossil fuels.

4.2.9.9 *Grants for biogas projects*

The government presented a national, cross-sectoral biogas strategy in autumn 2014. In the follow-up of the strategy, funding has been granted for pilot plants and research on biogas

through Innovation Norway from 2015. Additionally, through the Value Added Program for Renewable Energy in Agriculture, funding is granted for on-farm biogas projects.

Estimated effect on national emissions

The pilot scheme was evaluated in 2018 and decided closed down. Remaining grants were transferred to Innovation Norway's scheme for bio economy. The effect on national emissions is hard to estimate as the pilot scheme did not have specific requirements as to emission reductions, as the objective was rather to research and test technology and substrates used in large scale plants.

4.2.9.10 *Restrictions on cultivation of peatlands*

Land conversion from peatland to cropland has been extensive historically, and approximately 60,000 ha of croplands (7 % of the total cropland area) in Norway are identified as drained organic soils. These soils are a significant source of N_2O and CO_2, as reported under the agricultural sector and LULUCF, respectively. As described under chapter 4.2.10, restrictions for the cultivation of peatland are under establishment. Such restrictions will affect the emissions of N_2O alongside the effects for CO_2 as presented below.

Estimated effect on national emissions

Restrictions for cultivation of peatland are under development, and the exact implications for the agricultural sector are not yet clear. Emissions from land conversion from peatland to cropland are reported in the agriculture chapter for N_2O, while the LULUCF chapter (4.2.10.6) covers CO_2-emissions. For N_2O alone, the projected effect for year 2030 is estimated to 13 000 tonnes of CO_2-equivalents, based on the prevention of cultivation of 200 ha per year. For 2020 the effects can only be meager, as restrictions have yet to be enforced. For CO_2 and N_2O combined over the whole period 2021 – 2030, the effect is estimated to 450 000 tonnes of CO_2-equivalents. The effect of the restrictions are increasing over time because the emissions from each hectare of drained peatlands continue for decades after the drainage have happened. The projected effect of the restrictions is therefore estimated to be 190 000 tonnes of CO_2-equivalents per year around 2050 (based on the prevention of cultivation of 200 ha per year).

4.2.10 Land Use, Land Use Change and Forestry

4.2.10.1 *Introduction*

The IPCC has highlighted the importance of the LULUCF sector in climate policy. Forests absorb CO_2 and store large quantities of carbon, and are also an important source of renewable energy and wooden materials that can be used to replace materials with a larger carbon footprint. Other terrestrial ecosystems and organic soils are also large carbon sinks. On the other hand, human activity can cause large greenhouse gas emissions through land use and conversion of areas and ecosystems to other forms of use. To achieve a balance between anthropogenic greenhouse gas emissions and removals by sinks in the second half of this century, which is one of the aims of the Paris Agreement, it will be vital to reduce emissions and increase removals by the LULUCF sector.

Policies and Measures in the LULUCF sector

A wide range of measures, including legislation, taxation, economic support schemes, research, extension services and administrative procedures, support the implementation of forest policy and mitigation actions. The current Forestry Act was adopted by the Norwegian Parliament in 2005 and came into force in 2006. Its main objectives are to promote sustainable management of forest resources with a view to promote local and national economic development, and to secure biological diversity, consideration for the landscape, outdoor recreation and the cultural values associated with the forest. The forestry Act also contributes to the conservation of biodiversity and the sustainable use of natural resources. However, the measures implemented will also influence CO_2 sequestration. The Forestry Act requires the forest owner to regenerate areas within three years after harvesting.

In addition to ordinary support schemes for silviculture and forestry, the Government has implemented climate motivated support schemes for increased seedling density on regeneration sites, enhanced breeding of forest seedlings and fertilization of forest stands to increase the forest sink capacity in the future. In addition, a pilot-project on afforestation has been carried out. Norway has in the latest years increased support for these measures significantly.

The municipalities are obliged to take greenhouse gas emissions from the LULUCF-sector into account in their land-use planning, as stated in the Planning and Building Act. Also, the planning guidelines for "Municipal and county climate- and energy planning and climate adaptation" requires municipalities to include measures to reduce greenhouse gas emission as well as implementing measures and policies to reduce deforestation and to increase carbon sinks in forest and other land use.

It is difficult to quantify the short term (2020-2030) mitigation effects of the existing measures in the forestry sector. It is uncertain what the activity level would have been without the measures, and the mitigation effects in slow growing boreal forests must be considered in a very long timescale. For that reason short term effects are not estimated for some of the measures.

4.2.10.2 *Higher seedling densities in existing areas of forest land*

Using higher seedling densities for forest regeneration increases the growing stock and CO2 removals by forest. In 2016, a grant scheme was launched to increase the seedling density used for regeneration after harvesting. This measure forms part of ordinary planting after harvesting, and thus does not involve any afforestation.

Estimated effect on national emissions

Higher seedling densities have only a modest effect in the short term. The total potential has been calculated to increase removals by 45 000 tonnes CO_2 in 2030. In the longer term, it has greater potential, estimated at nearly 700 000 tonnes CO_2 in 2050, and the maximum increase in annual CO_2 removals of around 2 million tons of CO_2 in 2100. However, the total potential

is not yet released. Based on statistics for 2017 and 2018, about 50 per cent of the total regeneration area has been covered by this scheme. This means that the accumulated effect of CO_2-removal will be equivalently less than the former calculated potential.

4.2.10.3 *Genetical improvement, plant breeding*

Tree breeding involves making use of the genetic variation in forest trees to produce seeds that are more robust and give higher yields than non-improved seed from ordinary forest stands. High-quality seeds have been produced in seed orchards, making it possible to develop forest where tree survival rate is high, timber quality is better and growth in volume is 10–15 % larger. If more effective tree breeding techniques are used, it may be possible to increase the growth in volume by 20 % or more. Thus, tree breeding is a way of increasing CO_2 removals by forests. In addition, it is possible to ensure that forest reproductive material is resilient to future climate change.

Estimated effect on national emissions

Given these assumptions, it is estimated that the present level of annual financial support gives an estimated increase in CO_2 removals would be approximately 1000 tonnes per year in 2030, 232 000 tonnes CO_2 per year by 2050 and 1.4 million tonnes CO_2 annually per 2100. The most important tree species in Norwegian forestry is Norway spruce (≈50 % of the growing stock and 93 % of the planted seedlings) More than 90 % of the spruce trees that are planted annually originate from improved seeds.

4.2.10.4 *Fertilization of forest as a climate mitigation measure*

On forest land where growth is limited by the availability of nitrogen, using nitrogen fertiliser will increase both diameter and height growth, and boost annual CO_2 removals over a ten-year period. A grant scheme for fertilisation of forest as a climate mitigation measure was started in 2016. It is designed to meet recommended environmental criteria and avoid unacceptable effects on biodiversity and the environment otherwise. In 2017, NOK 15 million NOK was allocated to the grant scheme for fertilisation of forest.

Estimated effect on national emissions

It was estimated that fertilisation of 5 000-10 000 hectares of forest will give an additional CO_2 removals of 14 000 - 27 000 tonnes a year up to 2026. Assuming that 10 000 hectares is fertilised every year from 2018 onwards, the additional CO_2 removals will be 270 000 tonnes a year from 2027 onwards. The existing area for fertilisation has been between 5000 – 9000 ha per year, and is in the projections assumed to stabilize around 4000 hectares per year. For 2020 the estimated effect is 80 000 tonnes of CO_2 removal. The decline is partly due to environmental criteria that set a cap for fertilization in South-eastern part of Norway, where it is assumed that excessive nitrogen can run-off and cause eutrophication in Skagerak sea. If a level of 5000 ha will be pursued in the future, it gives a total removal of CO_2 for a 50 per cent of the total potential calculated.

4.2.10.5 *Afforestation*

In the period 2015-2018, the government tasked the Norwegian Environment Agency in close cooperation with the Norwegian Agriculture Agency, to carry out a pilot project for planting trees on new areas.

Estimated effect on national emissions

Former calculations indicated a potential increased annual removals of 1.8 million tonnes in 2050 within acceptable environmental limits (afforestation of 5000 ha/year in 20 years (100 000 ha total). Afforestation on new areas must be based on thorough assessments to find a balance between climate, environmental and commercial interests. The pilot project has helped identify challenges and opportunities, potential scoping of area and climate effect, as well as updated environmental criteria for planting trees as a climate solution. The government is assessing if and how to proceed with the initiative.

4.2.10.6 *Reduced emissions from peatlands and bogs*

Peatland bogs and mires are important carbon stocks. The Government is in the process of implementing restrictions on the cultivation of peatlands in order to reduce the high amount of GHG emissions associated with this practice. It is estimated that the agricultural sector cultivates approximately 200 ha of peatland bogs and mires annually as land-use conversion to agricultural land.

Estimated effect on national emissions

Restrictions for cultivation of peatland are under development, and the exact implications for the agricultural sector are not yet clear. Emissions from land conversion from peatland to cropland are reported in the agriculture chapter for N_2O (4.2.9.10), while the LULUCF chapter covers CO_2-emissions. For CO_2 alone, the projected effect for year 2030 is estimated to 60 000 tonnes, based on the prevention of cultivation of 200 ha per year. For 2020 the effects can only be meager, as restrictions have yet to be enforced. For CO_2 and N_2O combined over the whole period 2021 – 2030, the effect is estimated to 450 000 tonnes of CO_2-equivalents. The effect of the restrictions are increasing over time because the emissions from each hectare of drained peatlands continue for decades after the drainage have happened. The projected effect of the restrictions is therefore estimated to be 190 000 tonnes of CO_2-equivalents per year around 2050 (based on the prevention of cultivation of 200 ha per year).

4.2.11 **Waste**

4.2.11.1 *Introduction*

The main goal of the Norwegian waste policy is that waste is to cause the least possible harm to humans and the environment. Further, the growth in the quantity of waste generated is to be considerably lower than the rate of economic growth, and the resources found in waste are to be reutilised by means of waste recovery. Furthermore, the amount of hazardous waste is to be reduced and hazardous waste is to be dealt with in an appropriate way. The measures

to reduce greenhouse gas emissions are to a large extent concurrent with measures to increase recycling and recovery. The most important measures are:

- Regulations under the Pollution Control Act, including prohibition against depositing biodegradable waste and requirements regarding extraction of landfill gas (see below);
- Extended producer responsibility for specific waste fractions.

4.2.11.2 *Requirement to collect landfill gas*

The largest emissions in the waste sector derive from landfill gas. In 2017, the methane emissions from landfills amounted to approximately 39 104 tonnes, corresponding to 2 per cent of the total greenhouse gas emissions in Norway. Landfill gas emissions have been reduced by about 40 per cent from 2000 to 2017 and by more than 50 per cent from 1990 to 2017. The reduction is mainly due to the decrease of organic waste in landfills as depositing biological waste has been prohibited.

The Landfill Directive was incorporated into national law by the Norwegian Landfill Regulations of 21 March 2002, and states that all landfills with biodegradable waste must have a system for extracting landfill gas. The gas emissions are monitored by measuring boxes placed on the landfill surface. Also, visual inspection of the landfill surface for obvious leaks should be conducted regularly.

Extraction of landfill gas increased from about 950 tonnes CH_4 in 1990 to about 19 500 tonnes CH_4 in 2010. In 2017, extracted methane from landfills amounted to almost 7 750 tonnes CH_4. The reduction is primarily due to the prohibition of depositing organic waste. In Norway, in 2017, 8 per cent of the landfill gas production was utilized to generate electricity. 54 per cent is flared, and 38 per cent is used in heat production.

Estimated effect on national emissions

To estimate effect of the requirement to collect landfill gas it has been assumed that all collection of landfill gas occurred due to requirements. Even if the regulation was implemented in 2002, some landfills had been required in their permits to collect gas before. Therefore, effect has been estimated from 1995. To estimate the effect for the years 2020, 2030, it has been assumed that the composition and the quantity of waste to be deposited to landfill will be constant during the same period. It has also been assumed that the share of collected methane among potential emissions will be constant during the same period.

The mitigation impact has been estimated to 0.17 million tonnes in 2020 and 0.10 million tonnes in 2030. The downward trend is due to the prohibition regulation which has reduced amounts of organic waste deposited and thus potential emissions.

4.2.11.3 *Prohibition of depositing waste*

As a result of these regulations the annual amount of deposited biodegradable waste was reduced by 99.5 per cent from 1990 to 2015, although the amount of waste generated increased by 68 per cent. From 2002 landfilling of easy degradable organic waste was prohibited. This prohibition was replaced by the wider prohibition of depositing from 2009 that applies to all biodegradable waste. CH_4 production from landfills continues for several decades after

the waste is deposited. Therefore, emissions will continue for many years, but the prohibition of depositing waste has reduced CH_4 emissions over time, and will continue to, as the amount of biodegradable waste is reduced.

Estimated effect on national emissions

To estimate effect of the prohibition of deposition wet organic waste, it has been assumed a constant share of deposited amounts among easy degradable organic waste from 2002 to 2030. A constant share of deposited amounts of waste among other biodegradable waste has been assumed from 2009 to 2030 so as to estimate the effect of the prohibition of all biodegradable waste.

So as to calculate total produced amounts of organic and other biodegradable waste, the population growth has been used.

Between 2002 and 2009, collected landfill gas amounted to around 25 per cent of national potential methane emissions from landfills. This value has been kept constant during the period 2002-2030 so as to estimate the mitigation impact of the regulation. This impact has been estimated to almost 0.33 million tonnes in 2020 and 0.62 million tonnes in 2030.

Other measures in the waste sector

4.2.11.4 *Agreement with industry to minimise waste*

The systems of extended producer responsibility are partly based on voluntary agreements between the Government and relevant industries, partly on requirements regarding waste regulation and to some degree on tax incentives. Agreements are made primarily to ensure that waste is collected and sent to approved treatment, and partly to fulfil national or EEA-wide targets for recycling. Agreements have been made for packaging, electronic waste, food waste, tires and PCB-infected insulation of windows. Later on, all these waste types are regulated and in some cases the agreements have been made superfluous and terminated. In 2017 an agreement was made between the Government, represented by five ministeries, and the relevant industry organizations on the reduction on food waste.

4.2.11.5 *Measures to increase waste recycling*

The waste regulations regulate a number of waste fractions, and for some fractions set specific targets for recycling, for instance for end-of-life vehicles. In general, targets set in waste directives are relevant for Norway owing to the EEA agreement, and such targets are set in the waste regulations.

There is also a tax on beverage packaging. The tax is reduced by the accepted recycling rate; each percentage of recycling reducing the tax one per cent. The recycling rate is set by the Environment Agency and regulated by the waste regulation.

The pollution control act encourages municipalities to determine differentiated waste fees, as this could contribute to waste reduction and increased recycling. Many municipalities in Norway collect source separated household waste like paper and cardboard waste or biological

waste free of charge or to highly reduced fees. The costs are subsidized by the fees for the mixed waste. This gives incentives to the inhabitants of a municipality to separately collect certain fractions of household waste that can be recycled.

4.2.11.6 *Tax on final disposal of waste*

Norway introduced a tax on the final disposal of waste (including both landfills and incineration) on 1 January 1999. The tax for incineration was lifted on 1 October 2010 and for landfills in 2015. The purpose of the tax was to place a charge on the environmental costs of emissions from landfills, and thereby provide an incentive to reduce emissions, increase recycling and reduce the quantities of waste. On 1 July 2009 a prohibition of landfilling of biodegradable waste was introduced. The prohibition entails that future waste to landfills will have low climate gas potential.

Estimated effect on national emissions

It is difficult to quantify the mitigation effects on greenhouse base emissions of these other measures in the waste sector. Their objectives are primarily to increase waste recycling, and this is not necessarily reflected in the GHG inventory that would be used to calculate GHG effects. The effects are therefore reported as not estimated (NE) in CTF table 3.

CTF table 3. *Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects*

Please see CTF table 3 attached to this report.

4.3 Changes in domestic institutional arrangements

Norway has several legislative arrangements in place in order to help reduce emissions of greenhouse gases, such as the Pollution Control Act, the Greenhouse Gas Emissions Trading Act, the CO_2 Tax Act, and the Petroleum Act, as well as requirements under the Planning and Building Act.

4.3.1 The Climate Change Act

In June 2017, the Norwegian Parliament adopted the Climate Change Act, which establishes by law Norway's emission reduction targets for 2030 and 2050. The purpose of the act is to promote the long-term transformation of Norway in a climate-friendly direction.

The act will have an overarching function in addition to existing environmental legislation. The Climate Change Act introduces a system of five-year reviews of Norway's climate targets, on the same principle as the Paris Agreement. In addition, the act introduces an annual reporting mechanism. The Government shall each year submit to the Parliament updated information on status and progress in achieving the climate targets under the law, and how Norway prepares for and adapts to climate change. Information on the expected effects of the proposed budget on greenhouse gas emissions and projections of emissions and removals are also compulsory elements of the annual reporting mechanism.

4.4 Assessment of economic and social consequences of response measures

The UNFCCC biennial reporting guidelines encourage Parties to provide, to the extent possible, detailed information on the assessment of the economic and social consequences of response measures. On Norway's approach to minimize adverse impacts of mitigation actions in accordance with Articles 2.3 and 3.14 of the Kyoto Protocol see also chapter 4.1.5 in the NC7.

Norway has strived to follow a comprehensive approach to climate change mitigation from policy development started around 1990, addressing all sources as well as sinks, in order to minimize adverse effects of climate policies and measures on the economy.

In developing environmental, as well as the economic and energy policy, Norway strives to formulate the policy on the polluter pays principle and to have a market-based approach where prices reflect costs including externalities. As regards emissions of greenhouse gases, costs of externalities are reflected by levies and by participation in the European Emissions Trading Scheme (EU ETS). These instruments place a charge on emissions of greenhouse gases. The Norwegian Government contends that the best way to reduce emissions on a global scale, in line with the two degree target and striving for 1.5 degree limit, would ideally be to establish a global price on carbon. Pursuing a global price on carbon would be the most efficient way to ensure cost-effectiveness of mitigation actions between different countries and regions, and secure equal treatment of all emitters and all countries. This will help minimize adverse impacts of mitigation. For more information about levies on energy commodities and the design of the EU ETS, see Chapter 4.3.2 in the NC7.

The government presented a national strategy for green competitiveness in October 2017. The aim of the strategy is to provide more predictable framework conditions for a green transition in Norway, while maintaining economic growth and creating new jobs. In conjunction with the strategy for green competitiveness, the government in October 2017 also appointed an expert commission to analyze Norway's exposure to climate risk. The commission presented its report December 2018, with a clear recommendation to pursue ambitious and effective climate policies and undertake climate risk analysis to become more robust to effects of climate change.

Carbon capture and storage (CCS) is one of five priority areas for enhanced national climate action. Norway strives to disseminate information and lessons learned from projects in operation in the petroleum sector, new large scale projects under planning and from research, development and demonstration projects. The information and lessons learned are shared both through international fora, and through bilateral cooperation with developing and developed countries.

Norway has also initiated cooperation with developing countries related to fossil fuels: Oil for Development (OfD). This initiative is aimed at responding to requests for assistance from developing countries, in their efforts to manage petroleum resources in a way that generates economic growth and promotes the welfare of the whole population in an environmentally sound way. The rationale behind the OfD is to improve the economic resilience in petroleum producing countries through resource, revenue and environmental management. Furthermore, Norway has since 2007 supported initiatives fostering technology development and transfer, as well as capacity building efforts in developing countries, to increase access to renewable

energy, and to shift the energy mix away from fossil fuels, thus enhancing their resilience to social and economic effects of response measures taken.

Norway has issued Instructions for Official Studies and Reports (Utredningsinstruksen), laid down by Royal Decree. These Instructions deal with consequence assessments, submissions and review procedures in connection with official studies, regulations, propositions and reports to the Storting. The Instructions are intended for use by ministries and their subordinate agencies. The Instructions form part of the Government's internal provisions and deviation may only be allowed pursuant to a special resolution. The provisions make it mandatory to study and clarify financial, administrative and other significant consequences in advance.

In addition, Norway has a legal framework that deals specifically with environmental impact assessments. The purpose is to promote sustainable development for the benefit of the individual, society and future generations. The Environmental Impact Assessment framework and various guidelines and policies is revised as of 2017 and ensures that vulnerability due to climate change is included in environmental impact assessments.

4.5 Estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry activities

4.5.1 General Information

Chapter 4.2 describes the policies and measures that have reduced or will reduce Norway's national emissions. This chapter describes how Norway will achieve its commitments pertaining to the Kyoto Protocol's second commitment period (2013-2020).

4.5.2 The Kyoto Protocol's second commitment period (2013-2020)

As explained in chapter 3, the 2020-target was made operational through the legally binding commitment for 2013-2020 under the Kyoto Protocol where average emissions in 2013-2020 shall not exceed 84 % of the 1990 level. CTF Table 4 below provides relevant information within the adopted reporting format on Norway's progress made towards meeting its commitment under the Kyoto Protocol's second commitment period. Since the reporting format does not properly reflect the implementation of the commitment, the CTF table is supplemented by Table 4.2.

The annual emissions for the years 2013-2018 are shown in CTF Table 4. Information on the years of 2010-2012 is not reported here, since they are not relevant for the Kyoto Protocol's second commitment period. The contribution from LULUCF for the years 2013-2017 is in line with the information reported in CTF Table 4(a)II and the contribution in 2018 is the average for the years 2013-2017. The numbers for the use of market-based mechanisms under the Convention is explained further in relation to Table 4.2.

CTF table 4. *Reporting on progress* [a]

		Base year/period (1990)	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total (without LULUCF)	kt CO_2 eq	51,921.77*	NA	NA	NA	54,015.24	54,127.25	54,450.03	53,607.84	52,712.54	52,000.00**
Contribution from LULUCF	kt CO_2 eq	NA	NA	NA	NA	-34.90	-145.82	-120.26	-23.05	-26.08	-70.02 ***
Market-based mechanisms under the Convention (Kyoto Protocol)	number of units	NA	NA	NA	NA	10 351 000	10 340 000	10 765 000	9 963 000	9 060 000	8 316 000
	kt CO_2 eq	NA	NA	NA	NA	10 351	10 340	10 765	9 963	9 060	8 316
Other market-based mechanisms	number of units	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	kt CO_2 eq	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a–c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

***** As determined by the review report of the initial report (see https://unfccc.int/sites/default/files/resource/docs/2017/irr/nor.pdf)
******preliminary estimates (2018)

*** Average of 2013-2017 is used for 2018.

Within the format of CTF table 4, it is not possible to present information on the issuance of AAUs. This is an important aspect for Norway, and a supplementary table is therefore necessary. Table 4.2 shows information for the period 2013-2020.

Table 4.2. ***Achieving the commitment under the Kyoto Protocol's second commitment period (million tonnes CO_2-eq.)***

	2013-2020	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Emissions/projections [a]	423.40	54.0	54.1	54.5	53.6	52.7	52.0	51.5	51.0
Assigned amount units for CP2 [b]	348.91	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6
Net LULUCF (art 3.3 and 3.4) [c]	-0.56	-0.03	-0.15	-0.12	-0.02	-0.03	-0.07	-0.07	-0.07
Total acquisition [d]	73.9	10.4	10.3	10.8	10.0	9.1	8.3	7.8	7.3

[a] Reported emissions (2013-2017), preliminary estimates (2018), projections linearly interpolated for 2019 and 2020.

[b] AAUs for CP2 are not yet issued.

[c] Reported for 2013-2017, average of 2013-2017 used for 2019 and 2020. Negative figure indicates net uptake

[d] Includes actual carry-over of CERs and ERUs and planned carry-over of AAUs to party holding account, actual purchase and planned purchase.

The number of assigned amount units (AAUs) Norway can issue for the period 2013-2020 pursuant to the commitment under Article 3.1 has been determined through the review process of Norway's initial report for the second commitment period. Norway's will issue 348.9 million AAUs for the period 2013-2020, or on average 43.6 million AAUs annually. Domestic policies and measures have had considerable effect on emissions (see Figure 4.1 and Table 4.1 in Norway's NC7). As foreseen, emissions in the commitment period and projections for the remaining two years in the "with measures" scenario are higher than the issuance of AAUs to Norway. Norway will offset this gap by units acquired through participation in the European ETS and the state procurement program.

The role of LULUCF

Pursuant to the accounting approach under the Kyoto Protocol, Norway uses an activity-based approach for the LULUCF sector through 2020. Norway will account for all the activities under Article 3.3, and for forest management, cropland management and grazing land management activities under Article 3.4 at the end of the commitment period. CTF table 4(a)II is imported from the accounting table in the Common Reporting Format (CRF) table and reported as part of the CTF tables. Note that due to a bug with the CRF reporter software, the CRF accounting

table does not include a value for Forest management cap in the columns "Accounting parameters" and "Accounting quantity". This is the reason for why these values are missing from CTF table 4(a)II. The missing value is 14538.10.

CTF table 4(a)I is not relevant for Norway since an activity-based approach is used.

Since Norway has chosen to account for the entire commitment period, the reported values for 2013-2017 may change. However, the emissions from deforestation under Article 3.3 are for the time being higher than the removals from afforestation and reforestation under Article 3.3. Activities under Article 3.3 therefore represent net emissions. Activities under Article 3.4 represent net removals since the removals that can be accounted[m9] from forest management are much higher than the emissions from the activities cropland management and grazing land management. The preliminary sum of activities under Article 3.3 and 3.4 so far indicate a small net uptake. Current estimates represent a removal of about 0.6 million tonnes CO_2 for the period 2013-2020.

Market-based mechanisms under the Convention

The 30 percent reduction target for 2020 is made operational through the commitment for 2013-2020 under the Kyoto Protocol. Most of this period is now history. Compared to BR 3, outstanding arrangements for acquisition of are units reflecting the flows in the European ETS are now finalised. Some smaller updates to the figures reflecting recalculations of inventories are also given her. All in all, this information shows that assuming the entry into force of the Doha amendments, Norway will have enough units to comply with its 2013-2020 commitments and thus the 2020 target.

Table 4.2 shows that Norway's emissions for the period 2013-2020, including contributions from activities under Article 3.3 and 3.4, exceed the issuance of AAUs. Norway will therefore use the market-based mechanisms. The net contribution of units through the Kyoto mechanisms to comply with the commitment could be about 74 million tonnes for the whole 2013-2020 period, also reflecting the contribution from the LULUCF accounting. This includes actual carry-over of 2.25 million CERs and 0.74 million ERUs to Norway's party holding account units already acquired and planned acquisition through the procurement program (see Box 6 in chapter 4.3.3 in NC7). The planned carry-over of 5.98 million AAUs reflects the part of ETS installations' emissions in 2013 and 2014 for which they delivered CERs and ERUs and will cover these emissions.

The basis for the flow of Kyoto units between EU and Norway is the European registry regulation. Relevant amendments were only agreed in 2019 (cf. Regulation (EU) 2019/1123) making it possible to give fairly accurate estimates. Norway issued relatively few allowances in the EU ETS for industry in the period 2008-2012 compared to emissions from these sources. This total amount of allowances is the basis for calculating the number of Kyoto units to be transferred from Europe to Norway both in the first and second period. In the first period Norwegian industry therefore had a significant net demand of units from Europe, giving a tighter European

[m9]The volume that can be accounted from forest management under Art. 3.4 is subject to a cap of 3.5 per cent of 1990 emissions, representing about 1.82 Mt/year. The actual net removal in 2013-2020 is much higher.

scheme and a positive price impulse, but also resulting in an average annual transfer of 4.1 million Kyoto units from Europe to Norway. In the second period such transfer will increase to about 6-7 million units annually pertaining to industry's participation in the ETS. An additional transfer of 0-1 million units per year is foreseen from participation in the aviation ETS. The exact figure will depend on which types of units are used by the airlines. In total, the participation in the ETS could cover 50-60 million of the estimated gap of 74 million units between domestic emissions and Norway's assigned amount under the second commitment period of the Kyoto Protocol.

Policies and measures that will ensure compliance with the commitment for the second commitment period under the Kyoto Protocol represent, to a large extent, a continuation of an established system that already ensured compliance in the first commitment period, and which is well integrated into Norwegian climate policy. The procurement programme for Kyoto units has been authorized to acquire up to 60 million CERs under the CDM, for the period 2013-2020. For details see www.carbonneutralnorway.no.

The market under the Kyoto Protocol has for a number of years been characterized by low demand which has led to excess supply and low prices, both in the primary and secondary market. An implication of this is that a number of registered CDM projects are not issuing credits, and the number of new projects submitted for registration is low. Owing to the changes in the carbon market, for the second commitment period under the Kyoto Protocol Norway has only acquired units from projects facing a risk of discontinuing their operations, or from new, as yet unregistered projects.

Norway has also, in line with restrictions in the EU ETS, refrained from purchasing units from so-called industrial HFC projects. Furthermore, Norway has had a policy to refrain from purchasing units from coal-based energy production without carbon capture and storage. A small part of the portfolio is procured from the UN Adaptation Fund.

Norway has had a contract volume close to 60 Mt under the procurement program. However, the actual volume deliveried is expected to be significantly lower. The amount delivered as of 2019 was about 28 million units, including carry-over of 3 million. Further deliveries could amount to 21 mill CERs, making the total volume 47mill. In addition, the use of CERs and ERUs by the ETS installations in 2013 and 2014 has resulted in another 6 million units that have been swapped with AAUs.

In CTF Table 4(b), Parties are asked to report on the amounts of units surrendered that have not been previously surrendered by that or any other Party. Norway's accounting for the whole 2013-2020 period is likely to occur in 2022/2023. Consequently, no units have so far been surrendered pursuant to our commitment under the Kyoto Protocol. In CTF Table 4b Norway has chosen to present estimates for the net use of units from the Kyoto mechanisms based on inventory estimates for 2013-2018 and projections for 2019 and 2020. These figures include the LULUCF sector, where the contribution to be accounted is expected to be small and probably a net uptake (see also Table 4.4). The split between CERs and AAUs has not been carried out. The acquisitions for 2013-2020 are only expected to be of AAUs (reflecting net flows in the ETS) and CERs, while there is a small amount (0.7 millions) of ERUs carried over.

Table 4(b)

Reporting on progress[a, b, c]

Units of market based mechanisms			*Year*	
			2017	*2018*
Kyoto Protocol units[d]	*Kyoto Protocol units*	*(number of units)*	9 060 000	8 316 000
		(kt CO_2 eq)	9 060	8 316
	AAUs	*(number of units)*	NE	NE
		(kt CO2 eq)	NE	NE
	ERUs	*(number of units)*	NE	NE
		(kt CO2 eq)	NE	NE
	CERs	*(number of units)*	NE	NE
		(kt CO2 eq)	NE	NE
	tCERs	*(number of units)*	NE	NE
		(kt CO2 eq)	NE	NE
	lCERs	*(number of units)*	NE	NE
		(kt CO2 eq)	NE	NE
Other units [d]	*Units from market-based mechanisms under the Convention*	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
	Units from other market-based mechanisms	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
Total		*(number of units)*	9 060 000	8 316 000
		(kt CO_2 eq)	9 060	8 316

Abbreviations: AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, lCERs = long-term certified emission reductions, tCERs = temporary certified emission reductions.

Note: 2017 is the latest reporting year for which a NIR is submitted, however preliminary figures for 2018 are published.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For each reported year, information reported on progress made towards the emission reduction target shall include, in addition to the information noted in paragraphs 9(a-c) of the reporting guidelines, on the use of units from market-based mechanisms.

[c] Parties may include this information, as appropriate and if relevant to their target.

[d] Units surrendered by that Party for that year that have not been previously surrendered by that or any other Party.

5 Projections

5.1 Introduction

This chapter presents projections of greenhouse gas emissions in Norway for the years 2020 and 2030.[n] In compliance with the UNFCCC reporting guidelines for National Communications and Biennial Report, it is a "with measures" projection, based on policies and measures implemented as of midyear 2018. Since the seventh national communication (NC7) and third Biennial report (BR3) were reported, the Norwegian emission inventory has been recalculated due to a revision of the Energy Balance. The recalculation makes it challenging to compare the projections in this report with those presented in NC7/BR3. There are no changes in the methods employed for making the projections, except for LULUCF, see chapter 5.4.

Chapter 5.2 presents the baseline scenario, including comparisons with BR3. Uncertainty is discussed in chapter 5.3 and the methods and models used are presented in chapter 5.4. Key assumptions are described in box 5.1, box 5.2 and box 5.3. In addition to the changes in the inventory, these explain the changes in projections compared to those presented in BR3, see 5.5.

5.2 Baseline scenario

Norway's greenhouse gas emissions depend on the actions of a few hundred thousand businesses and several million people. Projections seek to capture these underlying developments and tendencies on the basis of, inter alia, economic, technological and population factors. Key assumptions underpinning the projections are discussed in Box 5.1. In the projections, the current climate policy is continued, both in Norway and abroad. This implies that the scope and rates of the CO_2 tax and other taxes are maintained at 2018-level and that the observed EU ETS prices for future delivery at that time are applied. The 2018-level of funding to technology development, for example via Enova, is maintained. The climate policies have also been strengthened, see Box 5.2.

Hence, the projections illustrate how Norwegian greenhouse gas emissions may develop under a continuation of current policy measures. The estimates as to how current policy, in Norway and the rest of the world, will influence future emissions are subject to considerable uncertainty, and such uncertainty increases the further into the future the projections are extended. Not only are economic outlooks and future population developments uncertain, but the same applies to access to low- and zero-emission technology and the costs of adopting such technology. The effects of policy are particularly sensitive to access to low- and zero-emission technology and the costs of adopting such technology. Most of these technological developments take place outside Norway.

The projections are neither a description of the Government's goals, nor do they capture the effects of new policies or new policy measures that could be launched in future. Adopted goals

[n] Presented in the National Budget 2019 (Meld. St. 1 (2018-2019)). https://www.regjeringen.no/contentassets/b09f08d81c134eea92830aba435850db/no/pdfs/stm201820190001000dddpdfs.pdf

Adjusted in the National Budget 2020 (Meld. St. 1 (2019-2020)) to reflect revisions in the Emission Inventory and taking on board the latest sales numbers for EVs.

without accompanying policy proposals, and policy initiatives that have yet to be operationalised in the form of regulations, tax resolutions or agreements, etc., are not incorporated into the projections.

Table 6(a): Information on updated greenhouse gas projections

		GHG emissions and removals								GHG emission projections - Scenarios	
										With measures	
GHG emissions projections	Unit	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
Sector											
Energy	kt CO_2 eq	19 734	19 734	22 025	24 323	25 458	27 218	25 973	25 938	25 128	22 713
Transport	kt CO_2 eq	10 041	10 041	10 946	12 104	13 258	14 307	14 275	12 474	11 946	9 285
Industry/industrial processes	kt CO_2 eq	14 498	14 498	11 603	12 097	10 623	8 183	8 470	8 632	8 335	7 776
Agriculture	kt CO_2 eq	4 694	4 694	4 581	4 486	4 453	4 249	4 422	4 469	4 514	4 474
Forestry/LULUCF	kt CO_2 eq	-9 969	-9 969	-13 824	-24 409	-25 143	-26 458	-23 213	-24 991	-21 723	-20 304
Waste management/waste	kt CO_2 eq	2 243	2 243	2 124	1 822	1 575	1 510	1 310	1 199	1 060	762
Other Sectors											
Gases											
CO_2 emissions including net CO_2 from LULUCF	kt CO_2 eq	41 242	41 242	37 454	30 423	30 224	29 009	31 237	27 722	29 384	24 610
CO_2 emissions excluding net CO_2 from LULUCF	kt CO_2 eq	51 210	51 210	51 278	54 832	55 367	55 467	54 450	52 713	50 984	45 010
CH_4 emissions including CH_4 from LULUCF	kt CO_2 eq	5 946	5 946	6 029	5 848	5 632	5 532	5 342	5 175	NE	NE
CH_4 emissions excluding CH_4 from LULUCF	kt CO_2 eq	5 801	5 801	5 883	5 698	5 480	5 380	5 191	5 024	4 942	4 380
N_2O emissions including N_2O from LULUCF	kt CO_2 eq	4 344	4 344	3 979	4 116	4 373	2 806	2 827	2 723	NE	NE
N_2O emissions excluding N_2O from LULUCF	kt CO_2 eq	4 093	4 093	3 706	3 826	4 070	2 486	2 506	2 394	2 430	2 398
HFCs	kt CO_2 eq	0	0	92	383	614	1 065	1 233	1 403	1 153	626
PFCs	kt CO_2 eq	3 895	3 895	2 314	1 518	955	238	146	131	161	176
SF_6	kt CO_2 eq	2 099	2 099	580	891	296	69	70	59	72	89
NF_3	kt CO_2 eq										
Other gases											
Total with LULUCF [f]	kt CO_2 eq	41 242	41 242	37 454	30 423	30 224	29 009	31 237	27 722	29 384	24 610
Total without LULUCF	kt CO_2 eq	51 210	51 210	51 278	54 832	55 367	55 467	54 450	52 713	50 984	45 010

Sources: Statistics Norway, Norwegian Environment Agency, NIBIO and Ministry of Finance.

Box 5.1 Assumptions underpinning the projections

About every other year, the Ministry of Finance prepares projections of emissions to air, drawing on input from a number of other institutions. The projections reported in NC7/BR3 were presented in the 2017 white paper on long-term perspectives for the Norwegian economy.

The projections are based on the Norwegian greenhouse gas inventory and the National Account of Statistics Norway, which constitute the descriptive underpinnings of the economic model SNOW (see chapter 5.3). More detailed calculation models supplement the SNOW model calculations.

The projections are based on a number of assumptions, including, inter alia, a continuation of current climate policy. Other key assumptions may be summarised as follows:

- The long-term macroeconomic analyses underpinning the 2017 white paper on long-term perspectives for the Norwegian economy (presented in NC7/BR3) have been updated with new population projections. Long-term crude oil and natural gas price assumptions are the same as in the 2017 white paper on long-term perspectives for the Norwegian economy.
- Implemented and adopted policies and measures by summer 2018 are maintained, including the scope and rates of the CO2 tax.
- The EU ETS price is assumed to increase from an average of NOK 150 for 2018 to about NOK 230 per tonne of CO2 in 2030, at 2018 prices.
- The projections of emissions from oil and gas production have been prepared by the Norwegian Petroleum Directorate and are based on reporting from oil companies. The scope of the petroleum industry is defined in accordance with the Petroleum Tax Act. In addition, operations at the onshore installations relating to, inter alia, onward transport of gas are included, thus bringing the projections into line with the emissions inventory.a The majority of CO2 emissions relate to energy production at the installations. Emissions from the construction and installation phase, maritime support services and helicopter transport are included under other industries.
- Road traffic emissions. The Norwegian Environment Agency has developed a projection model based on Statistics Norway's model for calculating national road traffic emissions to air. It is assumed that the share of electric cars will increase to 75 per cent of new car sales in 2030. Plug-in hybrids are also assumed to account for an increasing share of new car sales, which share is put at 25 per cent in 2020 and 30 per cent in 2025. This share is thereafter assumed to decline, as electric cars capture more of the market. These assumptions imply that new diesel and petrol cars (including non-plug-in hybrid cars) will not be sold in 2030. Traffic activity is assumed to trace population developments. Emissions per kilometre driven by cars based on fossil energy carriers are assumed to decline by just over 1 per cent per year. Biofuel blending is set at 16 per cent in real terms from 2020 in accordance with the requirement.
- Electricity consumption in energy-intensive industries is estimated to increase somewhat, in line with the power market analyses of the Norwegian Water Resources and Energy Directorate (NVE). The consumption of households and other industries is estimated to remain at about the current level.

- The Norwegian Environment Agency prepares, on the basis of activity data from NIBIO, agricultural emissions projections. Some efficiency improvement is assumed, thus reducing emissions per produced unit.
- The projections of net carbon sequestration in forests and other land areas was updated in the National Budget for 2020. Here it was estimated that sequestration would decline from the current level of about 25 million tonnes of CO2 equivalents per year to just over 20 million tonnes of CO2 equivalents in 2030. This development is premised, inter alia, on the assumption that current forestation levels are maintained and that logging is expanded from about 10 million m3 at present to just over 12.5 million m3 in 2030.

Tabell P.1 Greenhouse gas emissions in Norway by EU-ETS and non-ETS. Million tonnes CO_2 equivalents

	1990	2005	2010	2017	2020	2030
GHG emissions in Norway	51.2	55.4	55.5	52.7	51.0	45.0
EU-ETS emissions		27.7	26.6	26.5	26.2	24.5
– Oil and gas extraction		12.9	12.9	13.7	14.2	12.9
– Manufacturing industries and mining		13.7	11.0	10.9	10.7	10.2
– Other sources[1]		1.1	2.8	1.9	1.3	1.4
Non-ETS emissions		27.6	28.9	26.3	24.8	20.5
– Transport[2]		15.5	16.7	14.7	14.1	11.2
Of this. Road traffic		9.3	9.8	8.8	8.2	6.1
– Agriculture		4.4	4.2	4.5	4.5	4.5
– Other sources[3]		7.7	8.0	7.1	6.1	4.8
LULUCF	-10.0	-25.1	-26.5	-25.0	-21.7	-20.3
Emissions excluding LULUCF	41.2	30.3	29.0	27.7	29.4	24.6
Mainland Norway	43.0	41.1	41.3	38.1	35.7	31.2

[1] Includes ETS emissions from energy supply and aviation.
[2] Includes non-ETS emissions from road transport, navigation, fishing, non-ETS aviation, motor equipment etc.
[3] Includes non-ETS emissions from manufacturing industries, oil and gas extraction and energy supply, and emissions form heating and other sources.
Sources: Statistics Norway, Norwegian Environment Agency, NIBIO and Ministry of Finance.

Greenhouse gas emissions are estimated to decline by 1.2 per cent a year from 2017 to 2030, see Table 6(a) and Table P.1. Emissions will in such case be close to 8 million tonnes of CO_2 equivalents lower in 2030 than in 2017. The predominant part of this decline is expected to occur in non-EU ETS emissions, which emissions are estimated to decline by almost 6 million tonnes from 2017 to 2030; see Table P.1. The emissions trajectory must be considered in the context of, inter alia, the phase-out of oil-fired heating towards 2020, the closure of the gas power plant at Mongstad and a slight reduction in emissions from petroleum activities after

2020. The effect of an estimated reduction in transport emissions as the result of the uptake of more zero-emission vehicles only becomes truly significant after 2020.

Box 5.2 Stronger climate policy

Projections of environmentally harmful emissions to air were last presented in the 2017 white paper on long-term perspectives for the Norwegian economy (presented in NC7/BR3), and were based on the level of policy measures as at the beginning of 2017. Climate policy has been tightened since then. Some key changes presented in the Nation Budget 2019 are:

- The general rate of CO2 tax on mineral products (petrol, mineral oil, natural gas and LPG) has been increased from NOK 450 per tonne of CO2 in 2017 to NOK 500 per tonne of CO2 in 2018. The tax on HFC and PFC has been increased correspondingly. In addition, a number of exemptions from, and reduced rates of, CO2 tax on mineral products were abolished in 2018.
- The restructuring of motor vehicle registration tax, with higher tax on emissions and lower tax on weight, continued in the 2018 budget.
- Zero-emission cars are exempted from motor vehicle registration tax and value added tax. From 1 January 2018, such cars are exempted from motor insurance tax (formerly the low rate of annual road tax) and re-registration tax. The Political Platform from 2018 announced that the exemptions from motor vehicle registration tax and value added tax will be maintained for the remainder of the current term of the Storting (2021).
- The road traffic biofuel quota obligation was increased from 8.0 percent in 2017 to 10 percent in 2018. Advanced biofuel is double counted towards the general target. The quota obligation has further been increased to 12 percent (2.25 percent advanced) in 2019 and 20 percent (4 percentadvanced) from 1 January 2020. In real terms the obligation is 16 percent from 2020 (12 percent conventional biofuels and 4 percent advanced biofuels counted twice).
- Expanded railway appropriations and grants for major public transport projects increase incentives for using alternative means of transport. It is difficult to estimate the emissions effect of these measures, but they form part of the basis for assessing traffic activity developments.
- Enova has received considerably funds. A new governance agreement for the period 2017–2020 attaches more weight to climate and technological development. Supported initiatives include, inter alia, zero- and low-emission solutions for shipping and charging/fuelling stations for zero-emission cars.

Projections of net sequestration of greenhouse gases in forests and other land areas were updated in the National Budget 2020. According to these estimates, sequestration is expected to decline in coming years. Sequestration of greenhouse gases in forest and land areas is nonetheless expected to correspond about 45 per cent of emissions from other sectors over the coming decades; see Table P.1.

In aggregate, emissions of other greenhouse gases than CO_2 are estimated to decline from about 9 million tonnes of CO_2 equivalents in 2017 to just under 8 million tonnes of CO_2 equivalents in 2030; see CTF table 6a. The reduction in methane (CH_4) emissions is related to, inter

alia, declining landfill emissions. Agricultural methane emissions are estimated to be at about the same level in 2030 as in 2016. A repeal in the subsidies to chees exports is in the longer run counteracted by an expected increase in production to keep up with population growth. Nitrous oxide emissions (N_2O) are estimated to remain fairly constant in coming years, whilst HFC gas emissions are estimated to decline after 2020 as the result of the introduction of the revised EU F-gas Regulation.

Details of the estimates

The estimate for greenhouse gas emissions in 2030 has been revised downwards by 3 ¼ million tonnes of CO_2 equivalents compared to the previous projection (2017 white paper on long-term perspectives for the Norwegian economy, presented in NC7/BR3). Most of this reduction relates to lower non-EU ETS emissions, especially from road traffic. In addition to increased use of biofuels, the assumptions of faster development of zero-emission solutions in the transport sector serve to bring about a steeper reduction in the projections. EU ETS emissions have also been revised slightly downwards. Higher allowance prices provide stronger incentives for making production more efficient and for adopting new technology.

Road transport emissions are expected to decline from 8.8 million tonnes CO_2 equivalents in 2017 to 6.1 million tonnes in 2030. The decline is primarily caused by the assumption that the phase-in of low- and zero-emission cars will accelerate further in coming years. The use of biofuels was already in 2017 at the level of the quota obligation for 2020, of 16 per cent (20 per cent when double-counting advanced biofuel). This level has been maintained throughout the projection period. Compared to the 2017 white paper on long-term perspectives for the Norwegian economy, biofuels has been revised upwards by close to 10 percentage points.

In 2017, electric vehicles (EVs) accounted for about 23 per cent of new passenger car sales, and in 2018 sales increased to somewhat above 30 per cent. In 2019, when the projections for the National Budget 2019 were revised, sales of EVs had been close to 45 per cent that year. The projections assume that this share will increase to 75 per cent in 2030, compared to 50 per cent in the 2017 white paper on long-term perspectives for the Norwegian economy. Moreover, it is assumed, as in the 2017 white paper on long-term perspectives for the Norwegian economy, that the share of new van sales accounted for by electric vans in 2030 will be half of that for passenger cars. The estimates are based, inter alia, on observations that the uptake of EVs goes much faster than previously assumed. Slightly stronger technological development is also assumed for heavy goods vehicles, but this happens later and more slowly than for light vehicles. There are currently few zero-emission solutions and those that are available involve very high costs. Uncertainty about the outlook is high.

Emissions from domestic shipping and fisheries have declined significantly in recent years. The decline in emissions is likely to be linked to lower activity for offshore supply vessels, a changeover to less emission-intensive fuel and the adoption of new technology. It may also be the result of a higher percentage of vessels having bunkered fuel abroad. The projections assume that the observed decline is permanent and that further technological development and the enhancement of policy measures over the last few years will cause emissions to keep declining after 2020. In addition to Enova devoting considerable resources to supporting the introduction of zero- and low-emission technology in the maritime sector, a number of contracts that require zero- or low-emission solutions have been concluded, and it has been assumed,

inter alia, that about one third of Norway's ferries will have batteries on board by the end of 2021.

Emissions from the use of fossil oils in the heating of businesses and households have declined by 84 per cent since 1990. The prohibition against the use of mineral oil in the heating of buildings means that households will already in 2020 have no emissions from the use of oil. There will, however, still be emissions from the use of gas, as well as from wood burning. The prohibition will also accelerate the decline in the use of oil for heating in service industries. It has for projection purposes been assumed that some emissions will remain, as the result of the prohibition allowing for exemptions in, inter alia, areas where this is justified by the power situation. Emissions are estimated at ¼ million tonnes of CO_2 equivalents in 2030.
Emissions from non-EU ETS energy supply stem from the burning of fossil carbon in waste and the use of fossil energy carriers in minor energy plants. These emissions are in the projections estimated to remain at about the current level of 1 million tonnes. As before, landfill emissions are estimated to continue to decline as the result of the prohibition against the depositing of wet organic waste. Agricultural emissions are estimated to remain fairly stable in coming years.

Table P.2 summarises the historic and projected emissions of fuel sold to ships and aircraft engaged in international transport. These emissions are reported separately and are not included in previous totals. The historical emissions are based on the Energy balance from Statistics Norway. This has been revised and one of the changes is that some consumption of international bunker oils is reallocated between domestic consumption and international bunkers. The projections from international marine and aviation is mainly a prolongation of the historical trend. The CO_2 emissions from use of international bunker in aviation are, using expert judgement, projected to increase between 2020 and 2030 by 1.6 per cent per annum. That is half of the average annual growth during the period 1990-2017. Emissions from fuel sold to ships are projected to decrease by 1.5 per cent per annum (less than one third of the annual decrease 1990-2017) during the projection period.

Compared with the previous national communication, the emissions have been adjusted downward because of the reduction in consumption of marine bunkers especially since 2013. This reduction has to some degree been counteracted by increased consumption of jet fuel.

Table P.2 CO_2 emissions from international bunker. Million tonnes

	1990	2005	2015	2016	20017	2020	2030
International Bunkers	2.9	3.5	2.4	2.1	2.2	2.3	2.5
Aviation	0.6	0.9	1.7	1.6	1.7	1.8	2.1
Marine	2.3	2.6	0.7	0.5	0.5	0.5	0.4

Sources: Statistics Norway, Norwegian Environment Agency and Ministry of Finance.

Box 5.3 Key macroeconomic assumptions

Projections of emissions use Statistics Norway's general equilibrium model SNOW.
The starting point of the projections is the long-term macroeconomic analyses underpinning the 2017 white paper on long-term perspectives for the Norwegian economy (presented in NC7/BR3), updated with new population projections from June 2018. A summary in English of the initial report can be found here:

https://www.regjeringen.no/contentassets/aefd9d12738d43078cbc647448bbeca1/en-gb/pdfs/stm201620170029000engpdfs.pdf

CTF table 5 lists key macroeconomic projections underpinning the Norwegian emission projections. In the baseline scenario average annual GDP growth is estimated at 2.4 per cent in 2017-2020 and at 1.5 per cent in 2020-2030. Growth in the mainland economy, i.e. total GDP excluding petroleum activities and ocean transport, is estimated at 2.6 per cent in 2017-2020 and 2.0 per cent in 2020-2030.

Table 5: Summary of key variables and assumptions used in the projections analysis

		Historical								Projected		
Key underlying assumptions	Unit	1990	1995	2000	2005	2010	2015	2016	2017	2018	2020	2025	2030
Gross domestic product	billion NOK. Fixed 2016-prices	1,684.00		2,418.00				3,119.00	3,182.00		3,416.00		3,955.00
Of which mainland Norway	billion NOK. Fixed 2016-prices	1,338.00		1,839.00				2,713.00	2,767.00		2,991.00		3,648.00
Of which petroleum activities and ocean transport	Billion NOK. Fixed 2016-prices	281.00		518.00				407.00	413.00		425.00		359.00
Consumption	billion NOK. Fixed 2016-prices	628.00		876.00				1,412.00	1,444.00		1,568.00		2,064.00
Gross fixed capital formation	billion NOK. Fixed 2016-prices	333.00		483.00				790.00	819.00		880.00		907.00
Of which mainland Norway	billion NOK. Fixed 2016-prices	241.00		359.00				613.00	656.00		686.00		739.00
Of which petroluem activities and ocean transport	billion NOK. Fixed 2016-prices	556.00		470.00				179.00	169.00		194.00		159.00
Population	thousands	4,250.00		4,503.00				5,258.00	5,296.00		5,403.00		5,771.00
Number of persons employed	thousands	2,058.00		2,320.00				2,761.00	2,791.00		2,897.00		3,020.00
Oil price	2016-NOK per barrel	273.00		350.00				658.00	437.00		514.00		500.00
Gas price	2016-NOK per barrel	1.00		1.40				2.40	1.90		1.60		1.80

Sources: Statistics Norway and Ministry of Finance.

The high population growth in the period 2007-2014 of about 1.2 per cent annually has the past couple of years come somewhat down. From 2017 to 2030 the population is estimated to increase by 0.7 per cent annually on average. All in all the population is estimated to increase by around 9 per cent during the projection period.

The wholesale price of electricity is assumed to increase from NOK 0.27 per KWh in 2017 to NOK 0.33 per KWh in 2030 measured in 2016 prices. It is projected that the surplus of supply of electricity (exports) will increase from 4 TWh in 2016 to 20 TWh in 2030, as production will outpace demand. In the forecast, electricity consumption is projected to grow by 24 TWh from 2017 to 2030. The forecast is based on continued improvements in average energy efficiency, but i.e. population growth, establishment of data centres and increasing electrification of the car fleet and the petroleum sector will increase the use of electricity. The production of electricity is projected to increase from 149 TWh in 2016 to 153 TWh in 2020 and 171 TWh in 2030. Investment in new renewable production is up to 2020 subsidised by the electricity certificate market and most of the increase in production is assumed to be wind or unregulated water.

In the baseline scenario, the EU ETS price is assumed to increase to NOK 160 by 2020, measured in 2016-prices. In 2030 the price will increase to NOK 230 measured in 2016-prices.

5.3 Uncertainty

The projections illustrates how Norwegian greenhouse gas emission can evolve when current climate policy is being continued. The picture is uncertain, among others because the development of new climate friendly technology will influence on what a continuation of current policy means for future emissions. Such uncertainty is greater the longer into the future the projections extend. Moreover, the uncertainty is not only related to developments in, and access to, low- and zero-emission technology and the costs of implementing such technology but also to the economic outlook and future population developments.

Between 1990 and 2017, the population growth in Norway has been about 25 per cent. A considerable part of this increase comes from immigration, mainly from EU-countries. Calculations done by Statistics Norway show that CO_2 emissions could have been around 6 per cent lower in 2030 if the population growth had been more in line with the EU-average of about 2 per cent since 2005.[o] In the same analysis, Statistics Norway estimates that a supply shock that causes oil and gas prices to fall by 24 per cent could cause Norwegian CO_2 emissions to increase by 8 per cent in 2030. Lower prices on fossil fuels causes emissions in the mainland economy to increase more than the fall in emissions from lower production of oil and gas. A potential international set back that causes Norwegian export prices, including on oil and gas, to decline by 25 per cent is estimated to reduce CO_2 emissions by 14 per cent in 2030.

5.4 Methods and models

The Norwegian GHG inventory has been prepared in accordance with the revised UNFCCC reporting guidelines on annual inventories (decision 24/CP.19). This includes using the Global Warming Potential (GWP) for greenhouse gas emissions from the IPCC's fourth assessment report. The projections are consistent with historical data.

[o] Greaker, M. og O. Rosnes (2015): Robuste norske klimamålsetninger. Samfunnsøkonomen nr. 1-2015, pp. 67–

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The emission projections for Norway are based on various sources and methods. The projections for energy-related emissions are largely based on simulations with the macroeconomic model SNOW supplemented by available micro studies. Projections of CO_2, CH_4 and NMVOC- - emissions from the petroleum sector are based on information collected by the Norwegian Petroleum Directorate. Projections of emissions of greenhouse gases than CO_2 are mainly based on sector- and plant-specific information, collected by the Norwegian Environmental Agency from the industries concerned.

There are no changes in the methods and models employed for making the projections compared to NC7/BR3.

The SNOW-model

SNOW-model is a computable general equilibrium (CGE) model. The model gives a detailed description of the structures of economic policy, production and consumption in the Norwegian economy. Agents are represented as optimising individuals who interact with each other in national and international markets. Factor prices and prices of deliveries to the domestic markets are all determined by market equilibria. Consumption and savings result from the decisions of the representative household, which maximizes welfare, given income from labour, capital and natural resources.

The model is a recursive dynamic, integrated economy and emissions model that can project energy-related and process emissions based on macroeconomic assumptions. The model gives a detailed description of the production and consumption structures in the Norwegian economy. The model specifies 46 industries (42 private production sectors and 4 government sectors), classified to capture important substitution possibilities with environmental implications. The model includes 20 consumption goods with detailed description of use of energy and transport. Moreover, detailed description of governmental taxes and transfers such as environmental policy, trade policy, subsidies, tax rates, and real government spending is also included.

Producer behaviour is characterised by perfect competition. The main production factors are material inputs, labour, three types of real capital, five types of energy goods (incl. biomass) and various types of polluting and non-polluting transport services. For most commodities, a certain degree of substitution between production factors is assumed, depending on their relative prices and the exogenous assumptions about factor productivity developments. Labour and capital are perfectly mobile between sectors. In each sector, real capital formation is determined so that expected return on capital equals an exogenously given return on capital.
We model a small, open economy, which considers the world market prices and interest rate as exogenous. Domestic and foreign goods are assumed to be imperfect substitutes (Armington assumption). Together with a given balance of payments, the real exchange rate will be determined consistent with domestic consumption.

The model provides a relatively detailed description of the markets for energy and transport. A detailed emission module is incorporated into the SNOW model, turning it into an effective tool for assessing environmental consequences of changes in economic activity. Both emissions related to energy use and emissions from industrial processes are modelled. Energy-related emissions are linked in fixed proportions to the use of fossil fuels, with emission coefficients

differentiated by the specific carbon content of the fuels. A recent addition is a detailed modelling of electric vehicles, which allows us to study the policies targeting emissions from transport. Various environmental and climate policy instruments are included, e.g., emission quotas, taxes and subsidies.

For reference scenario, a dynamic recursive variation of the model is applied with endogenous labour supply (via labour-leisure choice) and exogenous path for government spending.

The intended field of application of the model is climate policy, tax reforms and sustainable public finance. The main input data categories and data sources are National accounts and official statistics on emissions. Outputs of the model are prices and quantities for all goods (monetary values, based on national accounts), GHG emissions, emissions of other pollutants, energy consumption, tax revenues and government spending. Gases covered by the model is domestic emissions of twelve pollutants (six GHG and six air pollutants) disaggregated by source and sector. The base year is 2013 and the model can be run to 2100. Population projections are from Statistics Norway. The model structure is top-down with bottom-up features. There are nested CES functions in production and consumption.

Projections of emissions of greenhouse gases other than CO_2 are mainly based on sector- and plant-specific information, assessed by the Norwegian Environment Agency.

SNOW is a general model that simultaneously accounts for behavioural responses to a variety of policy instruments and other drivers. The model's relatively rich variety of policy variables will give synergies between policies and measures (PaMs) when projecting emissions. However, the model only operates with, for example, average marginal tax rates and does not capture the richness of all policy instruments (e.g. differentiation in vehicle registration tax);
One of the strengths of using an integrated macroeconomic and emission model like SNOW is that the model provides consistency between long-term economic forecasts and emission projections. The usual caveats of computable general equilibrium top-down approaches apply. One shortcoming of SNOW is its poor specification of new technologies (abatement options) in industries, but this is under development. Another shortcoming is the need for the outputs to be supplemented by the results from more disaggregated models and expert judgment.

GHG emissions from the petroleum sector
The projections of emissions from oil and gas production have been prepared by the Norwegian Petroleum Directorate and are based on reporting from oil companies. Emissions from the petroleum sector in Norway are well documented. The industry's own organisation, the Norwegian Oil and Gas Association, has established a national database for reporting all releases from the industry, called EPIM Environment Hub (EEH). All operators on the Norwegian continental shelf report data on emissions to air and discharges to the sea directly in EEH. Oil companies operating on the Norwegian shelf must annually submit data and forecasts for their respective operated fields, discoveries, transport- and land facilities. The reporting includes corporate financial data, projects, resource volumes and forecasts for production, costs and environmental discharges/emissions. The Norwegian Petroleum Directorate (NPD) quality-assures and organises the data reported by the companies. The NPD also prepares its own estimates and classifies the resources based on its own assumptions. Based on the information from the companies and NDP's own assumption, the NPD updates the resource accounts for the Norwegian shelf and prepares forecasts for production, costs and emissions.

Emissions of CO_2 mainly derive from offshore generation of electricity, gas pipeline compressors, and from flaring for safety reasons. In addition, mobile facilities linked to a permanent facility in production generate some emissions.

In the projection it is assumed that the emissions are a function of the infrastructure in place and not the production level. Many of the new installations is expected to use existing infrastructure for processing and pipeline transport. Once in production the power demand at an installation is almost constant, and so are the CO_2 emissions. The emission projections thus take into account that emissions are a consequence of the time the installation is producing and to a much lesser extent the production on the installation. Only new installations with new gas-fired power generation will result in higher emissions and correspondingly lower emissions when an installation is closed down.

GHG emissions from road traffic

Emissions of CH_4, N_2O, CO_2 from road traffic are projected in an Excel spreadsheet model. The model is based on data from the model used by Norway to estimate historical emissions from road traffic (Handbook of Emissions Factors (HBEFA) v3.3 using activity data for 1990-2017). Emissions are projected using time series estimates for the following parameters: population growth, km driven per person for different vehicle classes, emission factors, biofuel blending, and a factor that adjust for the discrepancy between fuel sales and bottom-up estimates of fuel consumption.

For heavy vehicles (buses and HGV), the trend in the emission factor is specified directly at an aggregated level. For light duty vehicles, the trend in the emission factor is specified by technology (gasoline, diesel, plug-in hybrids, and zero emission vehicles such as electric cars). The fraction in the vehicle stock of different technologies is estimated using simple stock models for passenger cars and other light duty vehicles.

Projection data:

- Activity, population - Statistics Norway.
- Activity, km driven per person for different vehicle classes - expert estimates based on historical trends and background data in the National Transport Plan
- Emission factors: trend by vehicle class (or by technology for light duty vehicles) - expert estimates
- Biofuels: adopted quota obligations
- Adjustment for the discrepancy between fuel sales and bottom-up estimates of fuel consumption - expert estimates

Agriculture sector

The projections are based on the same estimation methodologies of CH_4, N_2O and NH_3 from agriculture as for calculation historical emissions. Descriptions of the side models used to project emissions for enteric CH_4 from cattle and sheep, CH_4 and N_2O from manure management and the NH_3 model are given annually in chapter five of the Norwegian National Inventory Report (NIR) and Annex IX to the NIR. Calculations are in Excel.

The projection of CH_4, N_2O and NH_3 emissions from agriculture are based on projected development in animal stock, share of concentrate in fodder, milk yield, mineral fertiliser use and

assumption about the development in cultivation of peat land. The emission trends are dependent on the expected development in number of inhabitants and expected food consumption trend, and scenarios for agriculture polices nationally.

Activity assumptions are given by the Ministry of Agriculture and Food for animal population development and increase in animal manure substitutes for synthetic fertiliser (1 kg manure-N: 0.45 kg fertilizer-N).

In addition, expert estimates are used for area cultivated organic soils, development depending on cultivation of new areas, share of concentrates and milk yield (trend from Norwegian Institute of Bioeconomy Research).

Solid waste disposal

The emissions model for estimating methane from Solid Waste Disposal Sites (SWDS) uses the model in the IPCC 2006 Guidelines. From 2009 deposition of wet organic waste on landfills is prohibited. The effect of this measure and all other policy measures concerning the waste sector are taken into account in the baseline scenario. The effect of licensing requirements for collection and combustion of methane from landfills is also taken into account in the projections. This implies that in the projection, only minor amounts of paper and sewage sludge are deposited, and this corresponds with Statistics Norway's waste account. In the projection, about 15 per cent of produced methane is recovered. This equal to the actual recovery in 2016. Descriptions of the model for calculating CH_4 from landfills are given annually in chapter 7 of the Norwegian NIR.

Emissions of N2O, PFCs and SF6 from Industrial processes and product use

- Projections of N2O emissions from nitric acid production are based on information about the N2O reducing technology as of 2017 and expanded production in a new production line. In the projections, the emissions from the existing production lines are assumed to have an efficiency rate of 0.2 percent per annum from 2017. This efficiency rate is lower than in the years 2010-2017. The assumed emissions of N2O per tonne nitric acid produced in the newest production line is based on information from the plant. N2O emissions from production of mineral fertilizers are also Included in the projections. The emissions derive from phosphate used in production of mineral fertilizers.
- The emission projections of perfluorocarbons (CF4 and C2F6) from aluminium production reflect increased production at two sites. It is assumed that the emissions per tonne aluminium produced are as reported by the plants for 2017.
- Norway reports SF6 emissions from the CRF categories 2E1, 2G1 and 2G2. The trends for these sources are different, but the total emissions are assumed to increase by 13 per cent from 2016 to 2020 and by 12 per cent from 2020 to 2030.
- HFC emissions: Emission projections of HFCs are based on the HFC emission inventory and current regulations.

Projections of the LULUCF sectors

Method and assumptions

New projections of removals and emissions from the LULUCF sector were published by the Norwegian Institute of Bioeconomy Research (NIBIO) in December 2019. The projections cover removals and emissions of all greenhouse gases in the LULUCF sector from 2018 to

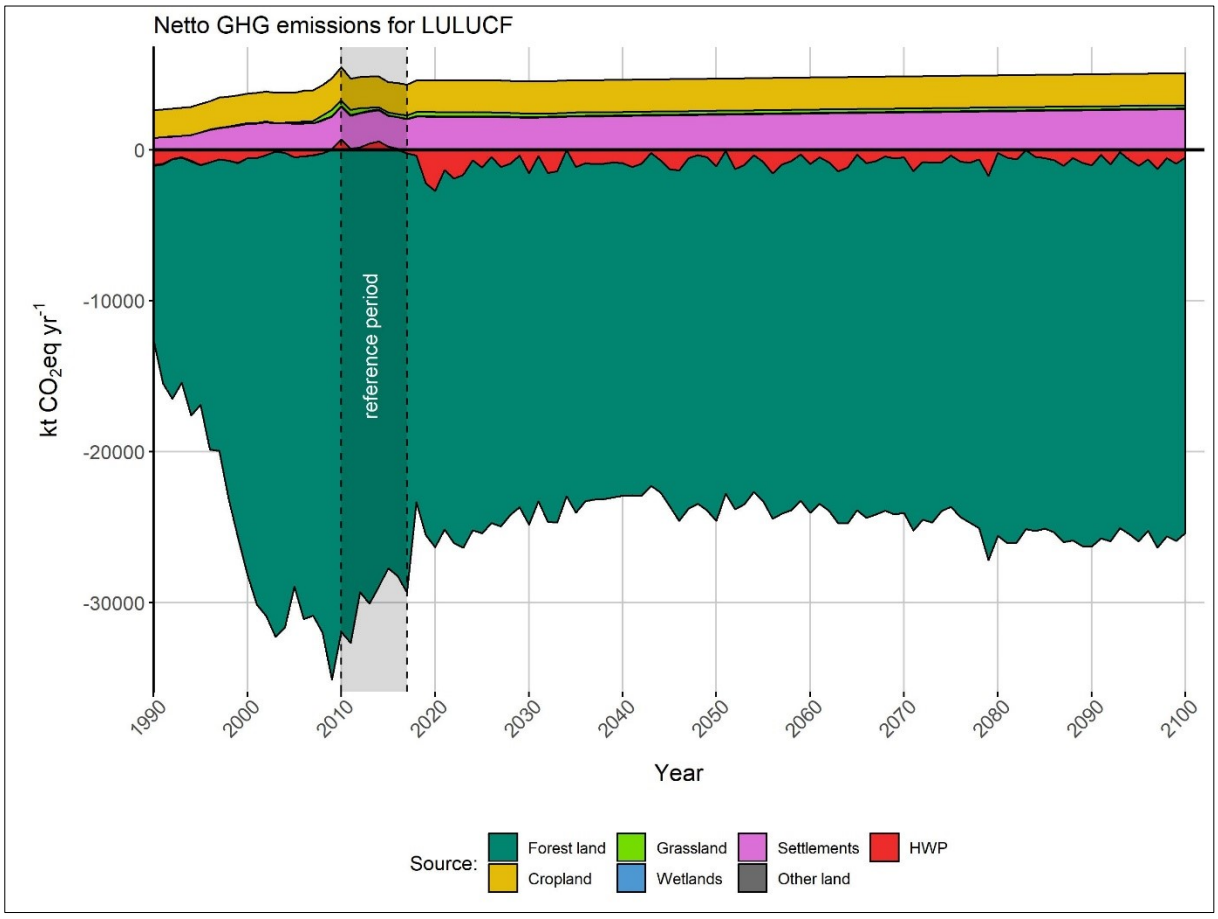
2100 based on the Climate Convention, the Kyoto protocol and the LULUCF regulation under the EU climate and energy 2030 framework, respectively. The projections include all land categories, and take the following existing policy measures into account: Increased seedling density, enhanced breeding of forest seedlings, fertilization of forest and protection of 10 percent of the forest area.

The Norwegian Institute of Bioeconomy Research (NIBIO) based the projections on the best available and most updated data and models. The reference period was from 2010- 2017. The report is based on the SiTree model, updated numbers from the The National Forest Inventory (NFI) database and the RCP 4.5 climate scenario.

The SiTree model is an individual growth simulator, and imputation methods to project the future growth, mortality, ingrowth, and natural regeneration. The emissions and removals of total soil organic C (dead wood, litter, and soil pools) from forest land on mineral soil are estimated using the decomposition model Yasso07 (NIBIO 2019).

Projections

Figure 3 shows net removals and emissions of greenhouse gases from 1990 to 2017 (historic data) and projections until 2100 for all categories in accordance with the reporting to the UNFCCC.



TOTAL NET EMISSIONS FROM ALL CATEGORIES, INCLUDING CO2, N2O AND CH4, EXPRESSED AS CO2-EQVIVALENTS FOR THE PERIOD 1990 – 2100. THE FIGURE SHOWS EMISSIONS FROM AREAS IN TRANSITION AND AREAS REMAINING IN THEIR CATEGORY (I.E. WAS THE SAME CATEGORY IN 1990, OR CHANGED CATEGORY MORE THAN 20 YEARS AGO). .SOURCE: NORWEGIAN INSTITUTE OF BIOECONOMY RESEARCH.

The total net removals of the LULUCF-sector for the historic period 1990 – 2017 and projections for 2020 and 2030 is given in table 4.

Table 4: Net removals in the LULUCF sector (historic and projections). Source: Norwegian Institute of Bioeconomy Research

	1990	2005	2010	2017	2020	2030
LULUCF	-10,0	-25,1	-25,6	-25	-21,7	-20,3

The projections show that the total sink is expected to be reduced in the period 2021-2030. The projections indicate that the carbon sink capacity of the current forest stock has reached a peak. This is primarily due to low harvest intensity over the recent years and a skewed age class structure of the Norwegian forest with 43 per cent mature stands. The annual increment and removals will inevitably decline towards 2030 and 2050 due to ageing forests and higher harvesting rates. Nevertheless, since the annual timber harvest is approximately 50 per cent of the annual increment, the carbon stocks in the Norwegian forests are still increasing. The projections indicate that the forests' capacity to act as a sink will increase again after 2050 towards 2100 as a result of the implementation of new forest management measures, a more normal age class structure but also better growing conditions due to global warming.

5.5 Main differences in projections between current and previous report

Since BR3 Statistics Norway has revised the entire time series for emissions to air due to changes in the Energy Balance. As a result of the update and restructuring of the Energy Balance for Norway, the calculated greenhouse gas emissions for the whole period back to 1990 was changed in 2018. New information on the use of fossil fuels for heating and transport led to significant changes in emissions from these sources. The revision has resulted in changes for the entire period, and the level of emissions has increased most years. The increase is due to relocation of consumption of marine gas oils from international shipping (not regarded as Norwegian territory) to domestic coastal traffic. In addition, some gasoline consumption and diesel moved between non-quota sectors and consumption of fuel oil from the ETS sector to the non-ETS sector.

In addition, a new calculation method has been used for ammonia, nitrous oxide and nitrogen oxides from agriculture, which has led to major changes in the sources of animal manure and agriculture, among other things.

The revisions in the Energy Balance led to an increase in emissions by 0.5 million tonnes CO_2 equivalents in 2015; see Table P.3. Even though the historic emissions now is estimated to be higher than in the BR3, emissions are projected be 0,8 million tonnes CO_2 equivalents in lower in 2020 and 3,3 million tonnes lower in 2030 than in the BR3. As discussed in 5.2 the main reason is faster reduction in transport emission due to increased share of EVs.

Table P.3 Changes in GHG emissions compared with BR3 by sector. Million tonnes CO_2 equivalents

	1990	1995	2000	2005	2010	2015	2020	2030
Energy	-0,2	0,4	0,0	-0,2	-0,4	-0,4	-0,3	-1,0
Transport	-0,2	-0,2	0,3	0,6	0,8	1,0	-0,7	-2,1
Industry/industrial processes	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-0,2
Agriculture	-0,1	-0,1	-0,1	-0,1	-0,1	-0,1	0,1	0,0
LULUCF	0,5	-0,2	-0,9	-0,6	-0,6	1,1	1,8	1,0
Waste management/waste	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Total with LULUCF	0,0	-0,1	-0,7	-0,3	-0,4	1,6	0,9	-2,3
Total without LULUCF	-0,5	0,1	0,2	0,3	0,2	0,5	-0,8	-3,3

6 Provisions of financial, technological and capacity-building support to developing countries

7 Other reporting matters

7.1 Process of self-assessment

The UNFCCC biennial reporting guidelines encourages Parties to report to the extent possible, on the domestic arrangements established for the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments or the level of emission reduction that is required by science.

Norway has had a quantitative emission reduction commitment for the Kyoto Protocol's first commitment period and has taken a quantitative emission reduction commitment for the Kyoto Protocol's second commitment period. Through its annual submissions of its GHG inventory and the review of these inventories, Norway has a sound knowledge of its emissions and removals. Chapter 4 and 5 of this report shows Norway's policies and measures implemented to reduce emissions and enhance removals, and their effects. Moreover, chapter 4.5 explains how the Kyoto mechanisms were used to fulfil the commitment for the first commitment period (2008-2012) and how Norway plans to fulfil its commitment for the second commitment period (2013-2020). Norway has through its submission of the SEF tables reported the number of units transferred to its retirement account each year.

7.2 National rules for taking local action against domestic non-compliance

The UNFCCC biennial reporting guidelines encourages Parties to report, to the extent possible, on the progress made in the establishment of national rules for taking local action against domestic non-compliance with emission reduction targets. In Norway’s environmental legislation, there are provisions for enforcement of different obligations and decisions made in accordance with the law. For more information about the Pollution Control Act, the Greenhouse Gas Emissions Trading Act and the Climate Change Act, see chapter 4.

7.3 Other matters

The UNFCCC biennial reporting guidelines encourages Parties to report any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its biennial report. Norway has made its 2020 target operational through the target for 2013-2020 under the Kyoto Protocol. The demonstration of compliance with these targets internationally assumes ia. issuance and transfers of AAUs pursuant to the cooperation with the EU on a common emissions trading system, similar to what was done for the first commitment period. The Doha amendment, which Norway ratified 12 June 2014, has still not entered into force when this BR 3 is issued. Thus, issuance and transfer of AAUs, as well as carry over of AAUs, has so far not been possible. Norway does not have any other information to report on this matter in its BR3.