Norwegian Ministry
of Climate and Environment

Report

Status report as of December 2022, resubmitted in March 2023

Norway's Eighth National Communication

Under the Framework Convention on Climate Change

Status report as of December 2022, resubmitted in March 2023

Norway's Eighth National Communication

Under the Framework Convention on Climate Change

Table of Contents

1 EXECUTIVE SUMMARY

This report is Norway's eighth national communication on national circumstances, policies and measures related to climate change under the Framework Convention on Climate Change (UNFCCC). The previous national communications were submitted in 1994, 1997, 2002, 2006, 2010, 2014 and 2018 respectively. The latest National Inventory Report (NIR) for greenhouse gases was submitted in April 2022. Norway ratified the UNFCCC on 9 July 1993, the Kyoto Protocol on 30 May 2002 and became a Party when the Protocol entered into force on 16 February 2005, ratified the Doha amendment in June 2014 and the Paris Agreement on 20 June 2016.

1.1 National circumstances

Norway is a constitutional monarchy with a democratic parliamentary system of governance. The current Government (the Støre Government) took power in October 2021. It is a minority coalition between the Labour Party and the Centre Party. The Storting (Norwegian parliament) determines Norway's overall climate policy and the government implements and administers the policies and measures.

Norway is part of the European Union's internal market through the Agreement on the European Economic Area (EEA Agreement) since 1994. The objective of the EEA Agreement is to strengthen trade and economic relations between the EEA/EFTA States and the EU Member States, based on level playing field throughout the EEA. The Agreement gives the EFTA countries opportunities to influence EU policy making also in areas of relevance to the internal market, including environmental policies.

With a total area of almost 324 000 km^2 and only 5.5 million inhabitants, Norway has the lowest population density in Europe after Iceland and Russia. The large majority of the Norwegian population is settled along the coast and the fjords, and an increasing percentage, at present about 80 per cent of the population, lives in urban settlements.

Norway is a small, open economy. In 2021, exports constituted about 46 per cent of GDP. Together with foreign shipping, the production of crude oil and natural gas account for about a fourth of GDP in Norway, but only a small proportion of employment. Around 35 per cent are employed in the public sector.

Emission intensity fell by 2.2 per cent annually from 1990 to 2021. An even more marked decline has occurred in the mainland economy, where emissions per produced unit have dropped by 3.0 per cent annually. Greenhouse gas emissions relative to GDP normally decline as scarce resources are utilized more efficiently. Use of taxes or quotas on emissions, resulting in higher energy costs, reinforce this trend. Norway introduced a CO_2 tax as early as 1991. This tax has subsequently been supplemented by the participation of Norwegian installations in the EU's emissions trading system. About 85 per cent of all greenhouse gas emissions in Norway are subject to economic instruments.

The use of economic instruments has contributed to the significant decline in emission intensity.

The mainland of Norway is 1 752 km from north to south, spanning about 13 degrees of latitude. The mainland coastline is more than 2 500 km long, excluding fjords and bays. In the east, Norway shares borders with Sweden, Finland and Russia. In addition, the Arctic Archipelago of Svalbard is under Norwegian jurisdiction. Emissions from Norwegian activities in Svalbard are included in the Norwegian emission inventories. The long and narrow shape of Norway is accompanied by wide variations in climate, geology and topography. This gives large variation in conditions for land use. Only about 30 per cent of the land area is lowland below 300 meters, and this is where most people live and where agricultural production is most intensive. As much as 20 per cent of the land area is mountainous areas more than 900 meters above sea level. Agricultural areas account for only 3 per cent of the mainland, while about 37 per cent is covered by forest. The remaining area consists of other cultivated and developed land, scrub, and heath along the coast, mountain forest and marginal forest, and sparsely vegetated mountains and mountain plateaus.

Because of the influence of the North Atlantic Ocean, Norway has a much warmer climate than its latitudinal position would indicate. Therefore, most of Norway has a maritime climate with relatively mild winters and cool summers. On an annual basis, the highest normal (1991–2020) annual air temperatures, (up to 8.6°C) are found along the south-western coast (see Figure 2.2). Outside the mountain regions, the lowest annual mean temperatures (down to -1,9°C) are found on the Finnmark Plateau. During winter, the coast from Lindesnes to Lofoten has normal monthly mean temperatures above 0°C. The absolute lowest and highest temperatures measured at official weather stations on the mainland are -51.4°C and +35.6°C, respectively.

Norway is in a unique position as regards renewable energy. Nearly all of Norway's electricity production is based on renewable energy sources, and the proportion of energy use accounted for by electricity is considerably higher than in most other countries. Historically, access to reasonably priced hydropower has shaped the energy use in Norway. Norway has a large energy-intensive manufacturing sector, and electricity is more widely used to heat buildings and water than in most other countries. Because renewable energy is the main source of energy usage, greenhouse gas emissions associated with stationary energy use are low in Mainland-Norway.

Electricity is the dominant energy carrier, followed by petroleum products. Electricity dominates energy use in manufacturing, the household sector and service industries, while petroleum products account for a large proportion of energy use in sectors that make heavy use of transportation and machinery. District heating and natural gas account for only a small share of energy use, but this has been increasing in recent years.

Norway's decentralised settlement gives rise to a relatively high demand for transport. In addition, the Norwegian economy is largely based on the extraction of raw materials and exports of goods, which means that there is a large volume of goods transport. The demand for rapid transport and more frequent deliveries of goods has also been increasing. The proportion of passenger transport by car and the proportion of goods transport by road and air have increased since 1990. About one third of the total Norwegian greenhouse gas emissions originated from transport in 2020. Road traffic was responsible for most of these emissions (17 per cent of total emissions in Norway in 2020), while domestic civil aviation, domestic navigation, railways and other means of transport were responsible for the rest. In the period from 1990 to 2020, greenhouse gas emissions from road transport increased by around 13 per cent, while emissions from domestic aviation, domestic navigation, railways and other means of transport increased by 37 per cent.

The emissions from the Norwegian road transport sector were approximately 12.8 per cent above 1990-levels in 2020. Road traffic emissions have decreased since 2015. The decrease is caused by a decrease in the use of fossil fuels. The use of diesel has decreased by 16 per cent and the use of gasoline has decreased by 26 per cent from 2015 to 2020. Fossil fuels have been replaced by biofuels, and the use of biofuels is one of the drivers behind the decrease in road transport emissions. The use of biofuels has increased by 171 per cent between 2015 and 2020.

The use of zero-emission vehicles is another important explanation behind the decreased road transport emissions in Norway. Statistics show that total mileage with diesel/gasoline vehicles has decreased by 6 per cent from 2005 to 2020, while the total electric vehicle (EV) mileage has increased by 435 per cent. Total EV mileage accounted for 10 per cent of the total mileage in 2020 and 12 per cent of the total passenger car mileage.

A considerable part of Norwegian manufacturing industries is based on natural resources. The historic availability of low-cost hydro power created a basis for the establishment of metal and fertilizer production. Some chemical production is based on the petroleum resources. Production of pulp and paper derived from the forest resources has also been considerable, and the fisheries have also given a base for industry. Norwegian industry therefore has a high share of production of raw materials and semi-manufactured goods including iron and steel, non-ferrous metals, chemicals, fertilisers, pulp and paper, mineral industries, food processing industries, building and construction industry.

The waste sector accounted for 2.8 per cent of the national GHG emissions in 2020. Most of the emissions from the waste sector originate from solid waste disposal on land. Economic growth, or growth in production and consumption, is the key driver behind the growing waste volume. Even though the total amount of waste generated has increased, GHG emissions from the waste sector have generally decreased since 1990. This is due to the increase in material recycling and the ban issued in 2009 on disposing biodegradable waste to landfill. The central government authorities set the general framework, while municipalities and industry are responsible for waste collection and treatment.

There were a little less than 4.3 million buildings in Norway in 2021. The number of buildings in 2021 was 9 per cent higher than in 2010 and 24 per cent higher than in 2000. There were a little less than 1.6 million residential buildings in 2021. Of the about 2.7 million non-residential buildings in 2021, 72 per cent were classified as holiday house, garage linked to dwelling etc. Other important types of non-residential buildings are agricultural and fishery buildings (19 per cent) and industrial buildings (4 per cent). About 4.4 million, or a little more than 82 per cent of the residents in Norway lived in urban settlements in 2021. The urban population has increased by 50 per cent since 1990, 31 per cent since 2000 and 14 per cent since 2011.

Approximately 3 per cent of Norway's land area is cultivated soil. The most suitable lands, approximately 1 per cent, is mostly allocated to arable crops, while grassland and ruminant livestock are allocated to regions less suitable for arable crops. While cultivated soil is a scarce resource in

Norway, in addition there is extensive land that is suitable for pasture and used extensively by reindeer husbandry and other ruminant livestock.

Forest and wooded land cover about 12 million hectares and constitute approximately 38 per cent of the land area in Norway. The most widespread species are Norway spruce (47 per cent), Scots pine (33 per cent) and birch (18 per cent). Approximately 88 per cent – that is 120 000 properties – of the forest area is privately owned. Most of the forest holdings are farm and family forests.

Fishing has always been an important basis for settlement and employment along the Norwegian coast. The Norwegian fishing and aquaculture industries are among Norway's most important export industries today, currently supplying seafood to consumers in more than 130 countries worldwide.

1.2 Greenhouse gas inventory information

Norway's national greenhouse gas inventory covers emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and hydrofluorocarbons (HFCs) from 1990 to 2020. Norway prepares its National Inventory Reports (NIR) in accordance with the UNFCCC Reporting Guidelines, and generally, the estimation methods follow the Guidelines for National Greenhouse Gas Inventories published by the Intergovernmental Panel on Climate Change (IPCC). The UNFCCC reviews all parties' NIRs and emission inventories every year. The latest inventory with the NIR and Common Reporting Format (CRF) covering the years 1990–2020 was submitted to the UNFCCC Secretariat on April 8th, 2022.

The total emissions of greenhouse gases, measured as CO_2 equivalents, were about 49.3 million tonnes in 2020, and a preliminary total for 2021 from Statistics Norway is 49.1 million tonnes. Between 1996 and 2011, emissions exceeded 54 million tonnes CO_2 equivalents in all years except in 2009, which was a special year as the economy was set back by the financial crisis. Emissions peaked at 56.6 million tonnes in 2007. Since 2009, emissions have stayed below 55 million tonnes CO_2 equivalents. Since 2015, total emissions have gone down, mainly caused by decreased emissions in the energy sector, especially within the transport and oil and gas sector. Much of this reduction is due to a 18.5 per cent reduction in road transport emissions from 2015 to 2022. The reduction in road transport emissions can be explained by more efficient vehicles, more electric vehicles, and increased use of biofuels.

Norway also monitors emissions of black carbon and organic carbon as well given that these particles have an effect on the climate system as well as on public health. The UNFCCC does not regulate black carbon and it is not included it in Norway's inventory reported to the UNFCCC. For more details, see box 3.1.

1.3 Policies and measures

Norway's climate policy is based on the objective of the 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.

Climate change and emissions of greenhouse gases have featured on the Norwegian policy agenda since the late 1980s. Today, Norway has a comprehensive set of measures covering almost all emissions of greenhouse gases as well as removals. Norway overachieved the commitment for 2008–2012 under the Kyoto Protocol by about

13 per cent and implements its commitments for 2013–2020, having ratified the Doha amendment 12 June 2014.

On 14 June 2016, the Storting (Norwegian parliament) gave its consent to Norway's ratification of the Paris Agreement, and on 20 June the same year, Norway ratified the agreement. Norway has through its National Determined Contribution (NDC) under the Paris Agreement committed to a conditional target of at least 55 per cent emission reduction by 2030 compared to 1990. Norway's intention is to fulfil this target jointly with the EU.

In June 2017, the Storting adopted a Climate Change Act (Lov om klimamål) which establishes by law Norway's emission reduction target for 2030 and 2050. 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, based 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.

The Støre Government presented a climate status and plan in a separate attachment to Prop. 1 S (2022–2023) in October 2022. The climate status and plan will be updated annually and summarises the government's climate policy, see box 4.2. The climate status and plan has not yet been debated by the Norwegian Parliament.

The polluter pays principle is a cornerstone of the Norwegian policy framework on climate change. Policies should be 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 taxes on emissions of greenhouse gasses and the EU emission trading system) form the basis for decentralised, cost-effective and informed actions, where the polluter pays. As a main rule, areas subject to general policy instruments, should not be subject to additional regulation. For non-ETS emissions, taxes on greenhouse gases is the main mitigation measure. If the tax is not considered to be an adequate or appropriate instrument, other instruments that reduce emissions will be considered, including direct regulation under the Pollution Control Act and voluntary agreements. Norway also employs biofuel sales mandates as an important policy instrument for reducing ESR emissions.

Over the last ten years, the scope of Norwegian carbon pricing has steadily increased. Close to 85 per cent of domestic greenhouse gas emissions are from 2022 either covered by the emissions trading scheme or taxes on greenhouse emissions. The level of carbon pricing is also among the highest in the world, with over 80 per cent of emissions being priced at or above approximately 80 USD in 2022. There is also a broad political consensus on increasing the taxes on ESR emissions to above USD 200 in 2030, and to continue the participation in the EU-ETS.

The overall national climate policy is decided by the Storting, and the government implements and administers the most important policies and measures, such as economic instruments and direct regulations. Most policies and measures in the area of climate policy are developed through interministerial processes before the political proposals are tabled. The Ministry of Climate and Environment has the overarching cross-sectoral responsibility for co-ordination and implementation of the Norwegian climate policy. It also operates the Norwegian carbon credit procurement program. The Ministry of Finance is responsible for the tax schemes. The other ministries are responsible for policies in their respective sectors.

Cross-sectoral policies and measures

Close to 85 per cent of Norway's domestic emissions is subject to mandatory emissions trading or a tax on greenhouse gases, or both. CO_2 taxes were introduced in 1991 as a step towards a cost-effective policy to limit emissions of greenhouse gases. In 2022, the standard tax rate on ESR emissions is 766 NOK per tonne CO_2 and is levied on most uses of mineral oils, petrol and diesel, natural gas, LPG and HFC/PFC. The price on greenhouse gas emissions varies 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 taxes in addition to the EU ETS, and the total price on emissions is about NOK 1 500 in 2022. 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.

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 EU ETS at that stage. In addition to the sectors included in the EU 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 EU ETS. From 2013, phase III (2013–2020), the coverage of the EU 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 EU ETS. From 2021, phase IV (2021–2030), there is no change in the coverage of sectors and gases compared to phase III for stationary installations. Emissions covered by the EU ETS in this phase amounts to about 50 per cent of the Norwegian emissions.

There are a number of other cross-sectoral policies and measures. 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 Planning and Building Act sets the framework for the planning and use of land areas and building requirements. Enova is a state-owned enterprise, owned by the Ministry of Climate and Environment.

In 2016, a financial support scheme was introduced to promote emissions reduction projects in Norwegian municipalities and counties. 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.

Petroleum activities

A CO_2 offshore tax regime was introduced in 1991. The tax regime includes emissions from burning of natural gas and oil and venting in the production phase on the Norwegian Continental Shelf. From 2008 offshore activities were included in the EU Emissions Trading Scheme (EU ETS). More than 90 per cent of the emissions from the sector are covered by the EU ETS. In addition, most of the emissions from the sector is subject to the offshore CO_2 tax.

The CO_2 tax on petroleum activities has been the most important instrument for reducing emissions in the petroleum sector to date, and the impact has been significant. The CO_2 tax and regulations under the Pollution Control Act have resulted in improvements in technology and emission-reducing measures such as the CO_2 storage projects at Sleipner (including Gudrun) and Snøhvit, and the replacement of gas turbines with electricity from the onshore power grid. Since the power production system in Norway is based on hydro power (96 per cent in 2016), providing power supply from the mainland to offshore installations results in significantly lower national emissions compared with using offshore gas turbines.

Carbon capture and storage

CCS comprises capture, transport and permanent geological storage of CO_2 emissions from fossil-fuel combustion, industrial production and waste incineration. According to the Intergovernmental Panel on Climate Change (IPCC), CCS is a key measure for reducing global greenhouse gas emissions. Technology development in an international perspective and ways of reducing costs are key to the deployment of CCS at a global scale.

Norway has demonstrated experience with safe and secure CCS. Since 1996, CO_2 from natural gas production on the Norwegian Continental shelf has been captured and reinjected into sub-seabed formations in the Sleipner and Snøhvit petroleum fields.

A full-scale CCS demonstration project, Longship, for capture, transport and storage of CO_2 is under development in Norway. The Longship project is a central part of the Norwegian government's policy for CO_2-management, and of Norway's contribution to developing necessary climate technologies. The project consists of two Norwegian CO_2 capture facilities, Hafslund Oslo Celsio (waste incineration) and Norcem (cement), and a CO_2 transport and storage project, The Northern Lights (Equinor, Shell and Total). The permanent storage will take place on the Norwegian continental shelf. Northern Lights is engaging with industrial emitters around the North Sea to enlarge the project in a possible next phase.

Energy and transformation industries

About 98 per cent of electricity generation in Norway is based on renewables. Hydropower constitutes about 89 per cent of the electricity generation. In addition, wind power contributes with approximately 9 per cent of the energy generation (normal year average). Norway's thermal power plants account for about 1.5 per cent of total production capacity. The legal framework encompasses statutes and regulations concerning public ownership of hydropower resources, licenses for the construction and operation of installations and regulations of the power market. The legislation is intended to ensure effective management of resources, and to ensure that various user and environmental interests are heard and considered. A tax on electricity consumption was introduced in 1951. At present an excise duty is levied on electricity supplied in Norway. The excise duty on electricity is mainly a fiscal tax. Since the majority of the stationary energy consumption in Norway is based on electricity generated from hydropower, emissions from energy consumption are very low in Norway compared to most other countries. Energy efficiency measures and new renewable capacity will therefore have limited effect on emissions in Norway.

The EU renewable energy directive (2009/28/EC) is incorporated into the EEA Agreement. The Norwegian target for renewable energy share is 67.5 per cent by 2020. Norway reported a 77.4 per cent of renewable energy in 2020. A common Norwegian-Swedish market for electricity certificates was established 1 January 2012. The electricity certificate system is a market-based support scheme with the objective of increased renewable electricity production.

The excise duty on mineral oils, comprising mostly fuel oils, was introduced in 2000. Norway also has other energy-related taxes. Fuel oils, kerosene and natural gas are subject to CO_2 tax. In June 2017, the Government put forward a regulation banning use of mineral oil for heating of buildings from 2020. By the end of 2021, a 53.3 TWh new annual production has been built under the joint Norwegian-Swedish electricity certification market. Norway has contributed with 19.1 TWh. At the end of 2021, the system was closed for new projects, but the electricity certification market will continue until 2035.

Enova is a state-owned enterprise, owned by the Ministry of Climate and Environment. Enova is managed by the ministry based on four-year rolling agreements. The Government has given Enova a clearer climate profile for the current four-year period, so that its purpose is to contribute to Norway's emission reduction commitment and contribute to Norway's transition to a low-emission society. Enova contributes to the development of technologies necessary towards 2030 and the low emission society in 2050. Enova provides funding and advice for climate and energy projects, and supports both companies and individual households, as well as local and regional governments. Funding for projects is drawn from the Climate and Energy Fund, which was provided NOK 4.1 billion in 2022. Enova's activities focus on late-phase technology development and early-stage market introduction. Grants for late-phase technology development help to speed up the pace and scale of pilot and demonstration projects and full-scale testing, so that new technologies and solutions reach the market more quickly. 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.

Transport

The transport sector accounts for about 1/3 of Norwegian greenhouse gas emissions, and around 2/3 of the ESR emissions. There are several measures in place that affect 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. In addition, the vehicle tax policy contributes to shifting vehicle demand towards low and zero emission vehicles. Norway also has a quota obligation for biofuels for road traffic, see chapter 4.3.7.2.4. In addition, there are several other measures, such as Enova's grant schemes, requirements in public procurement processes etc.

Industry

This sector covers primarily emissions from the manufacturing industry, including emissions from 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 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.

Agriculture

Current policies and practices to control GHG emissions in Norwegian agriculture include a combination of regulatory, economic and informatory measures. CO_2 from the use of fossil fuel in activities related to agriculture meets CO_2-taxation similar to other sectors. The government has proposed a mandatory biofuels turnover for non-road machinery from 2023 and this will also include agricultural machinery, whereas 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.

Forestry

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 entered 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.

Waste

The main goal of the Norwegian waste policy is that waste is to cause the least possible harm to humans and the environment. The quantity of waste generated is to be considerably lower than the rate of economic growth, whilst rates for the preparing for reuse and recycling should rise. 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: i) regulations under the Pollution Control Act, including the ban on depositing biodegradable waste in landfills and requirements regarding extraction of landfill gas (see below) and ii) extended producer responsibility for specific waste fractions. In general, targets set in EU waste directives, such as EU-targets for preparing for reuse and recycling of municipal waste, also apply for Norway owing to the EEA agreement.

1.4 Projections and the total effect of policies and measures

In the baseline scenario, total greenhouse gas emissions excluding LULUCF are projected to decline from the 2021 level to 38.6 Mt in 2030 and to continue this trend to 33.8 Mt in 2035. This is a “with measures” projection, based on policies and measures implemented as of midyear 2022. Emission reductions are foreseen both for emissions included in the EU ETS and for the ESR emissions.

New projections of removals and emissions from the LULUCF sector were published in October 2022. The projections cover removals and emissions of all greenhouse gases in the LULUCF sector from 2021 to 2100. 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 a skewed age class structure of the Norwegian forest with 43 per cent mature stands.

There are considerable methodological difficulties in calculating the effect of policies and measures ex post, including establishing a hypothetical baseline and obtaining relevant data, and with multiple measures and policies covering the same emission sources. Nevertheless, effects are estimated for a number of policies and measures, including the most significant ones. According to the estimates, the GHG emissions in 2020 and the projected emissions in 2030 would be about 26 and 37 million tonnes CO_2 equivalents higher respectively if policies and measures had not been implemented.

1.5 Vulnerability assessment, climate change impacts and adaptation measures

The Norwegian economy, environment and society are vulnerable to climate change. The Government has conducted several actions, in compliance with the requirements of UNFCCC, in order to prepare for climate change.

In 2010, the Official Norwegian Report NOU 2010: 10 Adapting to a changing climate was published. In this report, a committee appointed by the Government assessed Norway’s vulnerability to the effects of climate change and the need to adapt. The NOU incorporates many of the aspects described in the Intergovernmental Panel on Climate Change (IPCC) Technical Guidelines for Assessing Climate Change Impacts and Adaptations and the United Nations Environment Programme (UNEP) Handbook on Methods for Climate Change Impacts Assessment and Adaptation Strategies. Following publication of the NOU, a white paper on climate change adaptation, Meld. St. 33 (2012–2013) Climate change adaptation in Norway, was prepared and adopted by the Norwegian Parliament. The white paper outlines actions to be taken at various governmental levels and within sectors in order to adapt to a changing climate. In 2022, the Government announced that it will start working on a new strategy for climate change adaptation, from which a new white paper will result.

Since the release of Norway’s 7th National Communication in 2018, Norway has passed several milestones in its work related to climate change adaptation, and important progress has been made on local to national administrative levels and across different sectors. An NOU concerning climate risk and the Norwegian economy has been published, and central government planning guidelines on how to integrate climate change adaptation into municipal planning activities has been developed. Capacity building has been strengthened through networks, cooperation and other activities related to climate change adaptation. Climate change adaptation is also integrated into strategies and action plans within and across relevant sectors, such as in the recently adopted white paper Meld. St. 9 (2020–2021). Moreover, the Norwegian Parliament adopted a Climate Change Act in 2017, which includes reporting requirements related to adaptation to climate change. The Office of the Auditor General (OAG) of Norway recently assessed the work of the government authorities in adapting infrastructure and built-up areas to a changing climate, revealing that the Norwegian government authorities do not have the necessary overview of the risks of natural disasters in a future climate.

1.6 Research and systematic observation

The Norwegian government's white paper Meld. St. 5 (2022–2023) Long-term plan for research and higher education 2023–2032 outlines the Government policy for research and higher education. The white paper identifies climate change as the defining challenge in the world today. The Government will scale up appropriations to research and higher education within six long-term priority areas: i) oceans and coastal areas, ii) climate, the environment and energy, iii) health enabling and industrial technologies, iv) social security and preparedness and v) trust and community.

International cooperation is a prerequisite for carrying out high-level research. Norway is part of the global knowledge development trend and participates extensively in international cooperation on research and education with countries throughout the world. Norway is participating in Horizon Europe, EUs Research and Innovation programme (2021–2027) and is well-integrated in the European collaboration on research and higher education. Norway has taken part in this competitive arena for more than 20 years. The Government states in the white paper that it will continue its work to stimulate institution-based, long-term international collaboration.

The most recent white paper on climate policy Meld. St. 13 (2020–2021) Norway's climate action plan for 2021–2030, emphasizes the development of knowledge through research and innovation to combat climate change. The Government has, in line with the EU, a target that public funding of research and innovation should amount to 1 per cent of the gross domestic product (GDP). Since 2016, this target has been achieved, and in 2020 the amount was 1,15 per cent.

1.7 Financial resources and transfer of technology

The impacts of climate change are increasingly visible and felt around the world, especially in developing countries who are the most severely affected and the least equipped to respond to its consequences. The poorest and most vulnerable communities are experiencing the effects of climate change through extreme weather events such as floods, drought, hurricanes and sea level rise. Climate change has the potential to reverse significant development gains made in developing countries. Norway recognises the critical need for support to developing countries with respect to both climate mitigation and adaptation. In the period 2019–2020 Norway has continued to provide a wide range of financial, technological and capacity-building support to developing country Parties in order to build their capacity to reduce carbon emissions and to support adaptation to take action against the negative effects of climate change.

The Norwegian public climate finance amounted to USD 734 million (NOK 6 459 million) in 2019 and USD 706 million (NOK 6 646 million) in 2020. The majority of Norwegian climate finance is earmarked support, including bilateral contributions and earmarked contributions through multilateral institutions. In addition to the public climate financing, these interventions mobilised private climate relevant investments in developing countries. The private finance mobilised amounted to USD 16 million (NOK 145 million) in 2019 and USD 33 million (NOK 313 million) in 2020.

Norway's International Climate and Forest Initiative (NICFI) supports global efforts that reduce greenhouse gas emissions from deforestation and forest degradation in developing countries (REDD+). Forest and land use emissions are estimated to account for about 10 per cent of global net anthropogenic greenhouse gas emissions. It represents an even bigger part of the near-term potential solution by simultaneously halting forest loss and restoring forest lands. Forest and land use emissions are a necessary part of the solution of the ambitious target of the Paris-agreement of limiting the global warming to below 2 degrees Celsius. This is also among the most cost-effective ways to mitigate climate change and contributes to most of the sustainable development goals.

From 2008 through 2020 Norway had disbursed 31 billion NOK through Norway's International Climate and Forest Initiative and is committed to continue allocating NOK 3 billion a year. These funds are used to pay for verified emission reductions in partner countries, to finance efforts to build up global and national REDD frameworks, build satellite technology to monitor global forests in real time, and to support civil society and indigenous peoples around the world.

1.8 Education, training and public awareness

The text of the Convention on Climate Change refers directly to education, training and public awareness, and these issues have been important elements of the Norwegian climate policy since the 1990s. Several activities have been initiated to give the general public a better understanding of climate change and its effects. This in turn should result in support for policy measures to deal with climate change and also encourage public participation in climate-related measures; in accordance with national policy for the green shift.

The Ministry of Education and Research is working closely across departments and ministries on the implementation of the Sustainable Development Goals at the national and global level. Each year, the ministry reports on progress for the SDGs to the Norwegian parliament, in the budget proposal. The Ministry of Education and Research is responsible for the national coordination of SDG 4: Quality Education and is cooperating closely with the Ministry of Foreign Affairs on the follow-up of SDG 4 internationally. Norway is an active supporter of UNESCOs leading role in the global coordination of SDG 4. In an effort towards strengthening global academic and student mobility, Norway was the first country to ratify the Global Convention on the Recognition of Qualifications Concerning Higher Education in 2020.

Norway aims to achieve a high degree of transparency in environmental policymaking and implementation of regulations. Norwegian environmental authorities have a long tradition of including civil society in environmental policymaking. Norway provides annual financial support to a number of NGOs listed in the Government's annual budget. The Ministry of Climate and Environment also provides financial support for Norwegian NGOs to participate in different international meetings. Norway also aims to involve NGOs in the preparations for such meetings, and to enable them to contribute actively during the meetings.

2 NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

2.1 Government structure

Norway is a constitutional monarchy with a democratic parliamentary system of governance. The current Government (the Støre Government) took power in October 2021. It is a minority coalition between the Labour Party and the Centre Party. The Storting (Norwegian parliament) determines Norway's overall climate policy and the government implements and administers the policies and measures.

Although it is not a member of the EU, Norway has, since 1994, been part of the European Union's internal market through the Agreement on the European Economic Area (EEA Agreement). The objective of the EEA Agreement is to strengthen trade and economic relations between the EEA/EFTA States and the EU Member States, based on level playing field throughout the EEA. The agreement gives the EFTA countries opportunities to influence EU policy making also in areas of relevance to the internal market, including environmental policies. A practical implication of the EEA Agreement is that Norway adopts the same legislation as EU where relevant. Details on legislation relevant to climate change are given in chapter 4.

2.2 Population profile

With a total area of almost 324 000 km^2 and only 5.5 million inhabitants, Norway has the lowest population density in Europe after Iceland and Russia. The large majority of the Norwegian population is settled along the coast and the fjords, and an increasing percentage, at present about 80 per cent of the population, lives in urban settlements. Most of the urban settlements are small and have under 20 000 inhabitants. Only six areas – Oslo, Bergen, Stavanger/Sandnes, Trondheim, Fredrikstad/Sarpsborg and Drammen – have more than 100 000 residents. More than a third of Norway's population lives in the six largest city areas. Population has grown about 31 per cent from 4.2 million in 1990 to almost 5.5 million in 2022.

2.3 Economic profile

Norway is a small, open economy. In 2021, exports constituted about 46 per cent of GDP. Together with foreign shipping, the production of crude oil and natural gas account for about a fourth of GDP in Norway, but only a small proportion of employment, see Table 2.1. Around 35 per cent are employed in the public sector.

Table 2.1 GDP and employment by sector in 2021

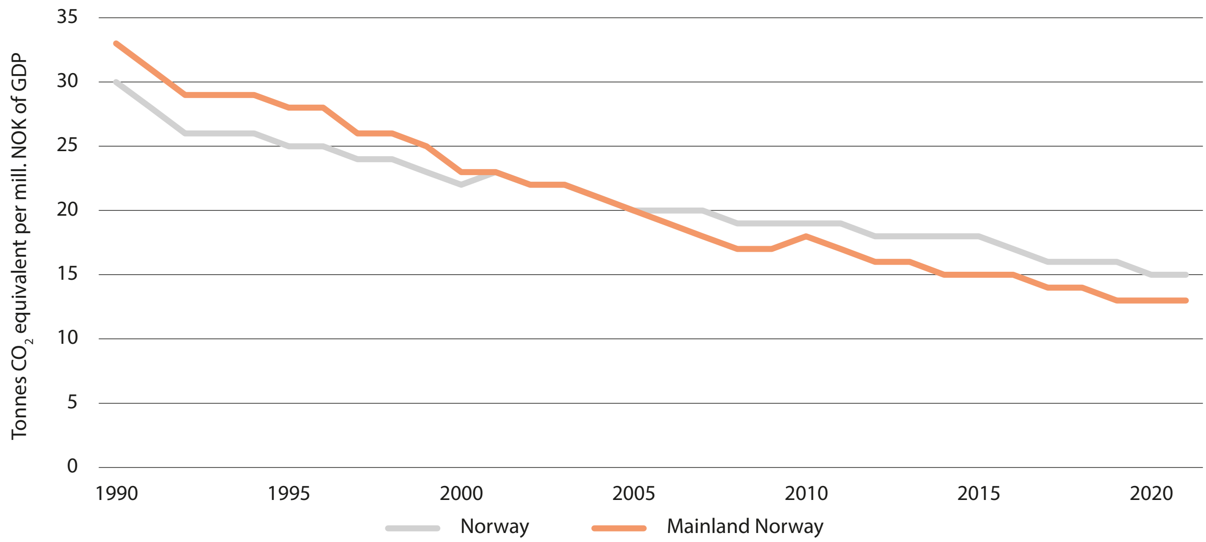
	Value Added at basic prices (mill. NOK)	Share of total	Employment (1000 persons)	Share of total
Total GDP	3 713 278	1.00	2 826.7	1.00
Total GDP, mainland[1]	*2 838 790*	*0.76*	*2 784.8*	*0.99*
Agriculture and forestry	24 623	0.01	46.5	0.02
Fishing and aquaculture	42 208	0.01	20.2	0.01
Mining and quarrying	7 646	0.00	4.5	0.00
Oil and gas extraction including services	869 625	0.23	57.7	0.02
Manufacturing	227 577	0.06	216.1	0.08
Electricity, gas and steam	117 148	0.03	16.6	0.01
Water supply, sewerage, waste	25 187	0.01	17.7	0.01
Construction	224 702	0.06	247.5	0.09
Wholesale and retail trade, repair of motor vehicles	287 566	0.08	357.8	0.13
Transport via pipelines	17 973	0.00	0.2	0.00
Ocean transport	24 449	0.01	17.4	0.01
Transport activities excl. ocean transport	75 061	0.02	111.5	0.04
Postal and courier activities	9 220	0.00	16.5	0.01
Accommodation and food service activities	38 692	0.01	85.6	0.03
Information and communication	156 737	0.04	105.0	0.04
Financial and insurance activities	158 144	0.04	48.6	0.02
Real estate activities	107 066	0.03	30.2	0.01
Imputed rents of owner-occupied dwellings	158 534	0.04	0.0	0.00
Professional, scientific and technical activities	178 291	0.05	150.2	0.05
Administrative and support service activities	80 912	0.02	131.2	0.05
Public administration and defence	241 422	0.07	203.1	0.07
Education	184 873	0.05	229.8	0.08
Health and social work	393 256	0.11	604.1	0.21
Arts, entertainment and other service activities	62 366	0.02	108.5	0.04

[1] Oil and gas extraction, transport via pipelines and ocean transport are subtracted from Total.

Source: Statistics Norway.

Few countries have benefitted more from cross-border trade and investments than Norway. Globalization facilitates access to financing, capital and labour inputs, export markets, technological transfers, and increases competition. The result is a more efficient use of available resources, which has contributed to strong global growth during the past decades. Norway has also, for a long time, benefitted from rising export prices and falling import prices. Accordingly, Norway's terms of trade have improved, and real disposable income has grown fast and resulted in high revenues for the state and companies, and strong growth in real household earnings.

Figure 2.1 Emission intensity



Source: Statistics Norway

As in many other countries, economic policy was expansionary during the pandemic. The central bank reduced the interest rate to a historically low level of 0 per cent, while fiscal policy was used actively to compensate the unemployed, expanding furlough schemes and prevent otherwise solvent companies from filing for bankruptcy. This successfully guided Norway through the crisis, and the economy has been going at full speed since the restrictions were gradually lifted during the spring of 2021. Unemployment has fallen to a level not seen before the financial crisis, and many companies report that difficulties recruiting workers constrain production. Inflation has also picked up significantly, both due to high energy prices and high demand for goods and services. Recently, there have been signs that the business cycle has reached its peak, and that economic growth is slowing down. High price growth, combined with higher interest rates to combat inflation is expected to reduce economic growth next year. Growth in the non-oil economy is nevertheless projected to remain somewhat higher than the estimated trend growth of around 1.75 per cent next year.

The petroleum industry will remain important for the Norwegian economy for years to come, but the importance on the economy in the coming decades is expected to decline as remaining resources decline. A continuously stricter global climate policy and an ever faster technological development changes the overall conditions for Norwegian business. Norway's 2030 target under the Paris agreement is to reduce emissions by at least 55 per cent compared to 1990. This transition will require higher growth and new jobs in less carbon-intensive sectors. The strategy for green competitiveness sets the direction for this change.

Norway accounts for around 0.1 per cent of global greenhouse gas emissions. Norway's emissions totalled 49.1 million tonnes of CO_2 equivalents in 2021, excluding LULUCF, according to preliminary figures. Norway's emissions peaked in 2007 and have since then decreased by 7.5 million tonnes CO_2 equivalents, or 13 per cent.

Emission intensity fell by 2.2 per cent annually from 1990 to 2021 (see Figure 2.1). An even more marked decline has occurred in the mainland economy, where emissions per produced unit have dropped by 3.0 per cent annually. Greenhouse gas emissions relative to GDP normally decline as scarce resources are utilized more efficiently. Use of taxes or quotas on emissions, resulting in higher energy costs, reinforce this trend. Norway introduced a CO_2 tax as early as 1991. This tax has subsequently been supplemented by the participation of Norwegian installations in the EU's emissions trading system. About 85 per cent of all greenhouse gas emissions in Norway are subject to economic instruments. The use of economic instruments has contributed to the significant decline in emission intensity.

2.4 Geographic profile

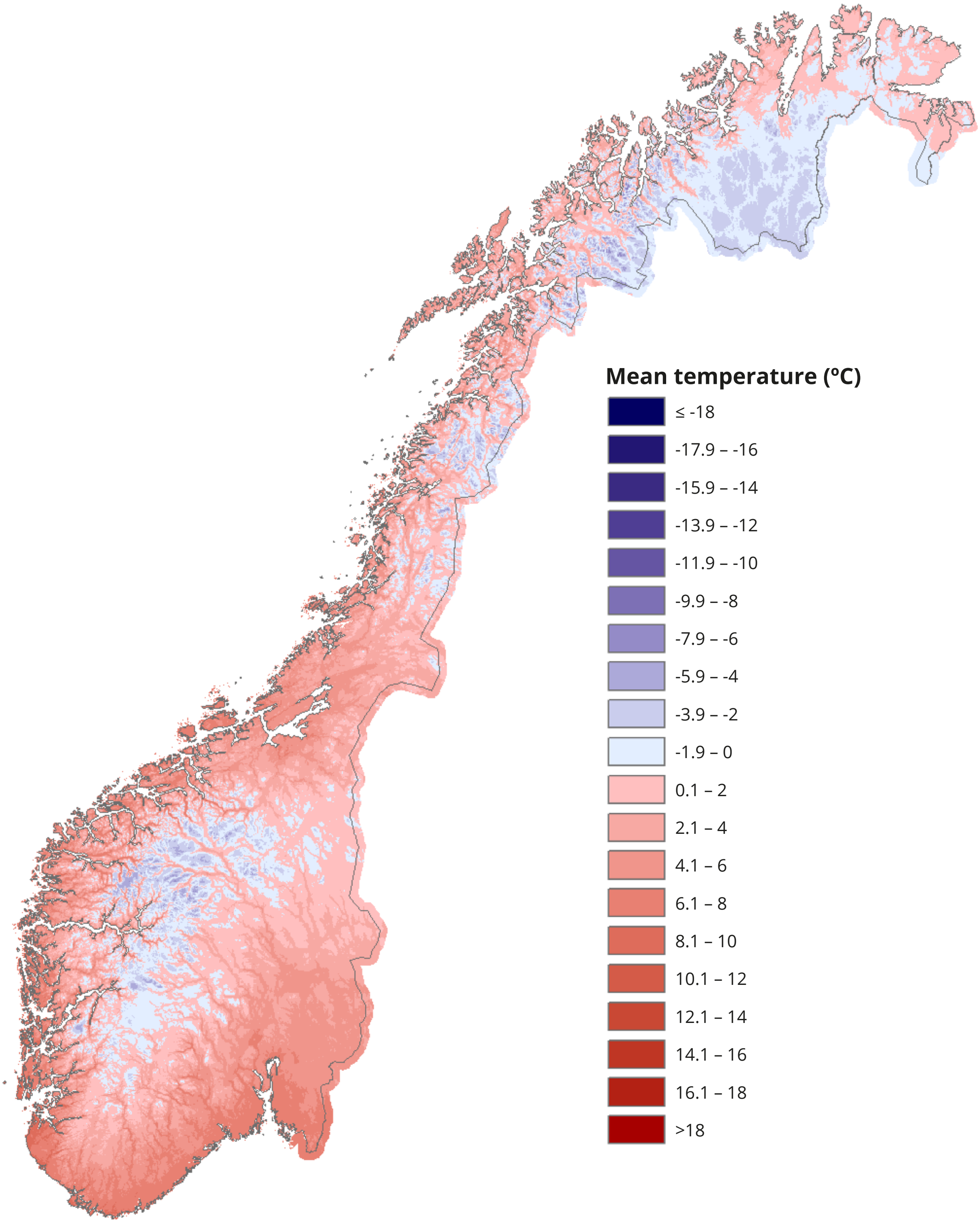
The mainland of Norway is 1 752 km from north to south, spanning about 13 degrees of latitude. The total area of the mainland is 323 781 km^2. In addition, the Norwegian continental shelf is 2 039 951 km^2. The mainland coastline is more than 2 500 km long, excluding fjords and bays. In the east, Norway shares borders with Sweden, Finland and Russia. In addition, the Arctic archipelago of Svalbard is under Norwegian jurisdiction. Emissions from Norwegian activities in Svalbard are included in the Norwegian emission inventories.

The long and narrow shape of Norway is accompanied by wide variations in climate, geology and topography. This gives large variation in conditions for land use. Only about 30 per cent of the land area is lowland below 300 meters, and this is where most people live and where agricultural production is most intensive. As much as 20 per cent of the land area is mountainous areas more than 900 meters above sea level. Agricultural areas account for only 3 per cent of the mainland, while about 37 per cent is covered by forest. The remaining area consists of other cultivated and developed land, scrub, and heath along the coast, mountain forest and marginal forest, and sparsely vegetated mountains and mountain plateaus. About 46 per cent of the land is above the tree line. Currently, 17.1 per cent of the land area is protected under the Nature Conservation Act. Nevertheless, the proportion of wilderness-like areas, defined as areas more than 5 km from major infrastructure development, has been reduced dramatically from about 48 per cent of the land area in 1900 to about 12 per cent today. Only about 5 per cent of the area of southern Norway is characterised as wilderness-like.

2.5 Climate profile

Because of the influence of the North Atlantic Ocean, Norway has a much warmer climate than its latitudinal position would indicate. Therefore, most of Norway has a maritime climate with relatively mild winters and cool summers. On an annual basis, the highest normal (1991–2020) annual air temperatures, (up to 8.6°C) are found along the south-western coast (see Figure 2.2). Outside the mountain regions, the lowest annual mean temperatures (down to -1,9°C) are found on the Finnmark Plateau. During winter, the coast from Lindesnes to Lofoten has normal monthly mean temperatures above 0°C. The absolute lowest and highest temperatures measured at official weather stations on the mainland are -51.4°C and +35.6°C, respectively.

Figure 2.2 Normal annual temperature in Norway 1991–2020.

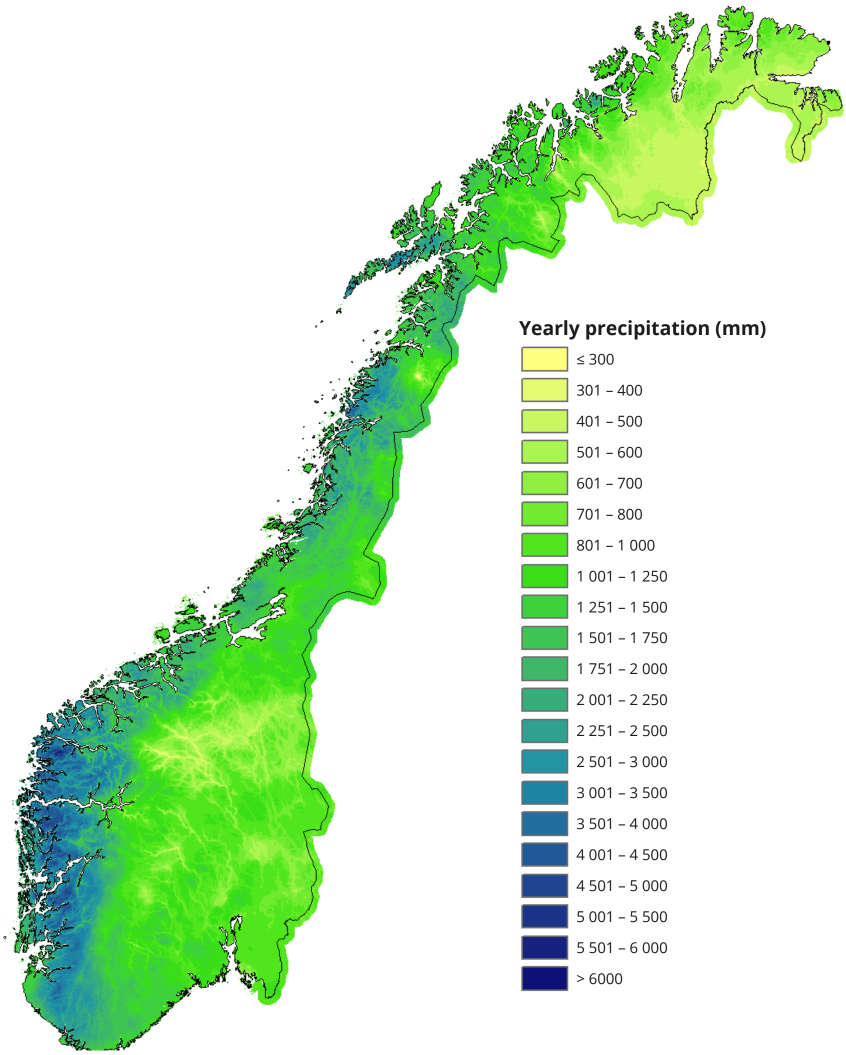


Source: Norwegian Meteorological Institute

In the cool Norwegian climate, there is a substantial need for heating of buildings. The "heating degree days" (defined as the number of degrees the daily mean temperature is below 17 °C, added up for every day of the year) for the 1991–2020 period was between 3000–4000 in the coastal lowland areas. In the northernmost parts of Norway, the value can be up to 7000.

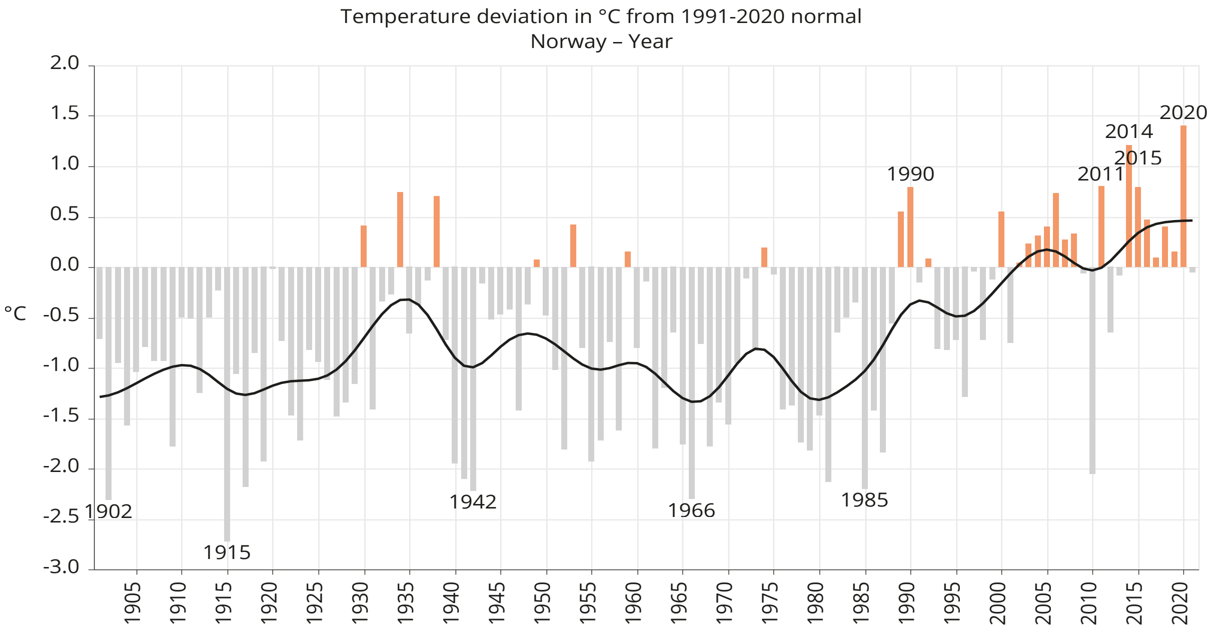
Because of prevailing westerly winds, moist air masses flow regularly in from the ocean giving abundant precipitation over most of Norway. Areas just inland of the coast of western Norway get the most precipitation (see Figure 2.3). This zone of maximum precipitation is one of the wettest in Europe, and several sites in this region have normal annual precipitation of more than 3500 mm. On the leeward side of the mountain ranges, the annual precipitation is much lower, and a few sheltered stations in the inland areas of south-eastern Norway and one station in Nordland have normal annual precipitation less than 350 mm.

Figure 2.3 Normal annual precipitation in Norway 1991–2020



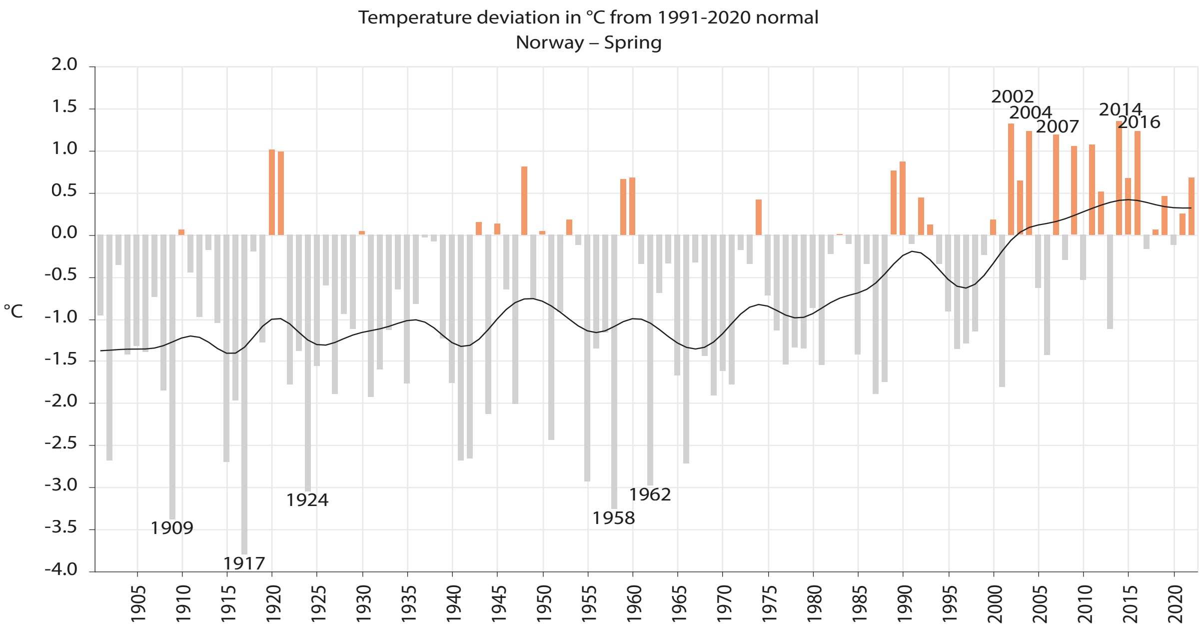
Source: Norwegian Meteorological Institute

Figure 2.4	Annual temperatures for the Norwegian mainland 1901–2021, deviation from the 1991–2020 normal.



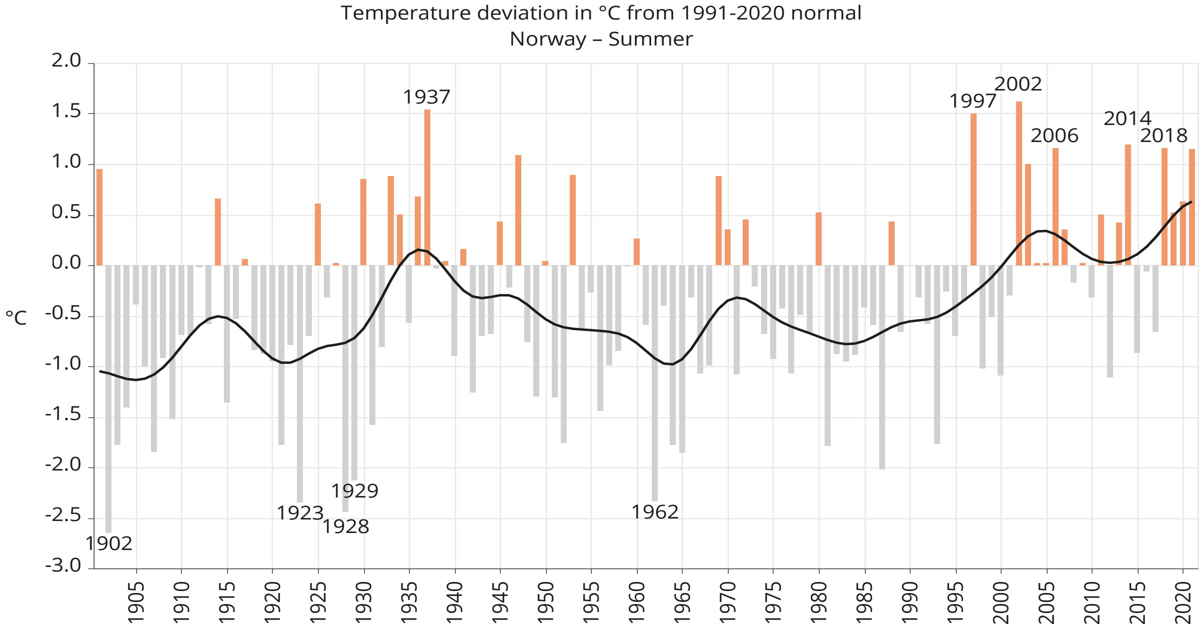
Source: Norwegian Meteorological Institute

Figure 2.5	Spring temperatures for the Norwegian mainland 1901–2021, deviation from the 1991–2020 normal.



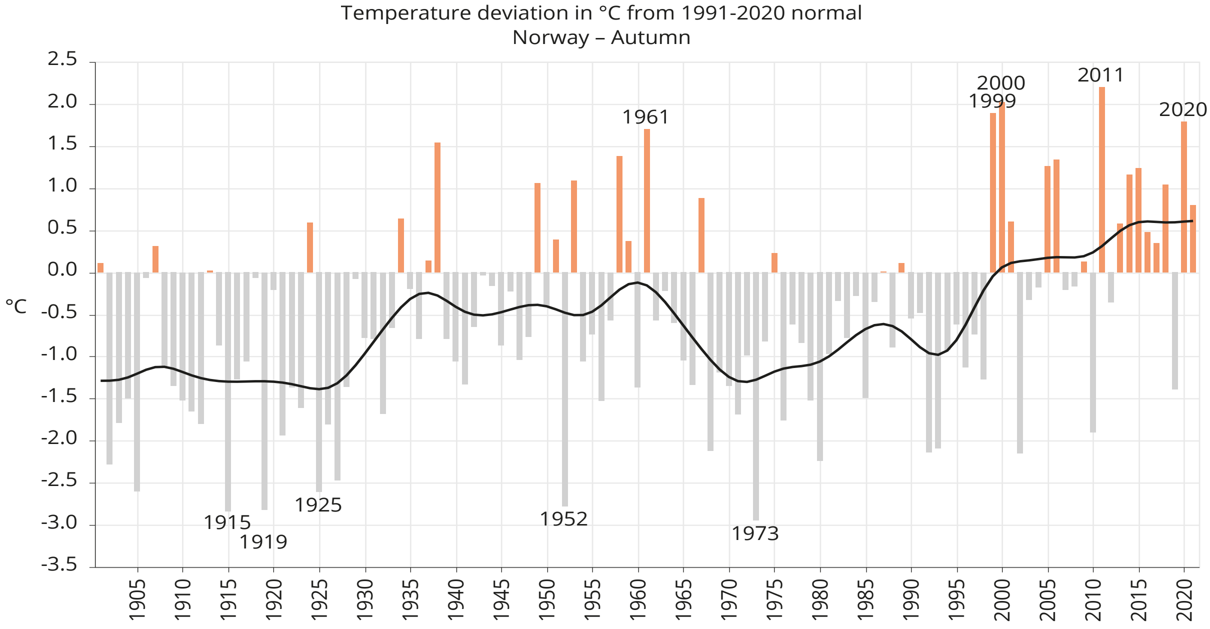
Source: Norwegian Meteorological Institute

Figure 2.6	Summer temperatures for the Norwegian mainland 1901–2021, deviation from the 1991–2020 normal.



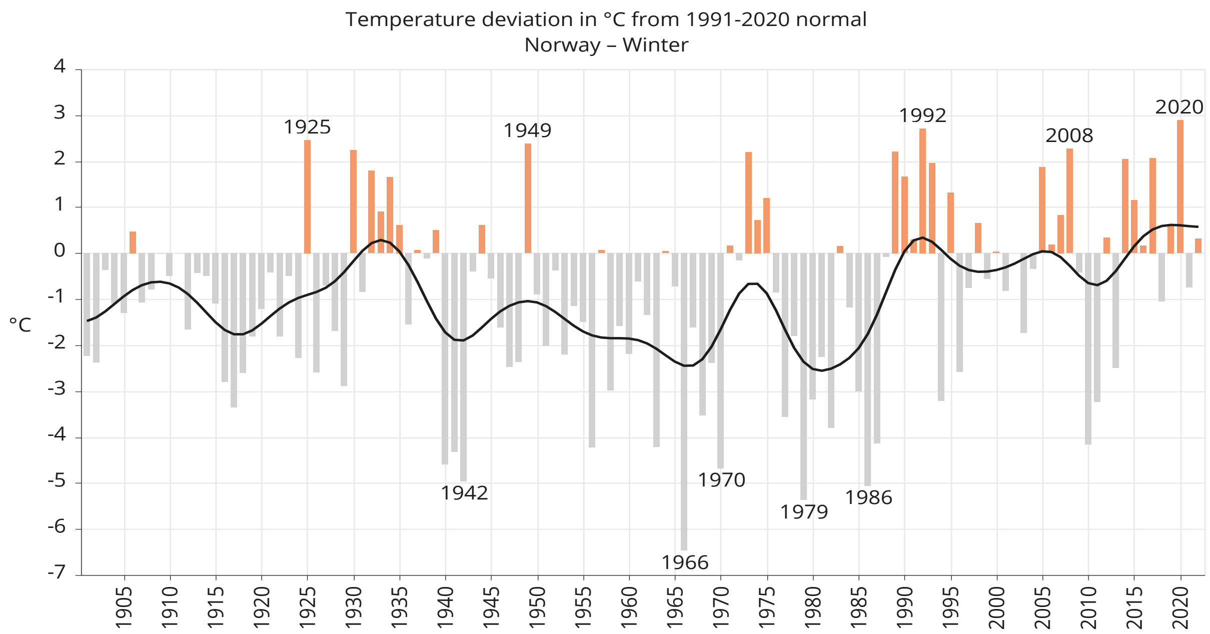
Source: Norwegian Meteorological Institute

Figure 2.7	Autumn temperatures for the Norwegian mainland 1901–2021, deviation from the 1991–2020 normal.



Source: Norwegian Meteorological Institute

Figure 2.8 **Winter temperatures for the Norwegian mainland 1901–2021, deviation from the 1991–2020 normal.**

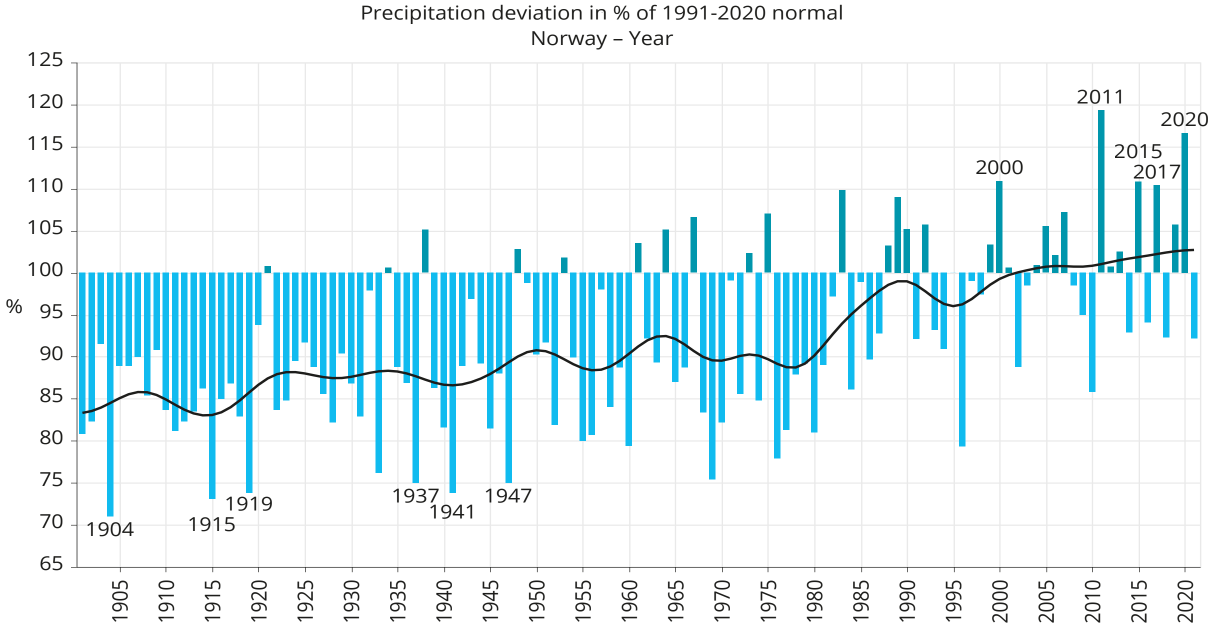


Source: Norwegian Meteorological Institute

2.5.1 Temperature trends

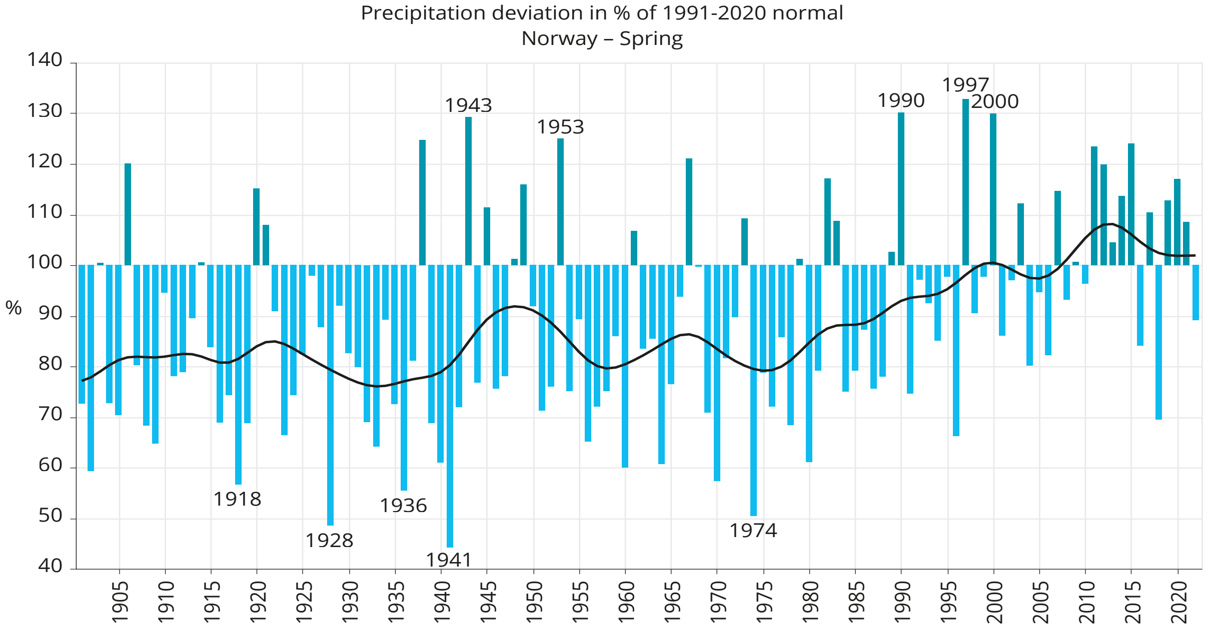
The figures (2.4 – 2.8) on annual and seasonal temperature anomalies show deviations (°C) relative to the 1991–2020 average. The smoothed black curves in Figures 2.4 to 2.8 show decadal scale variability, while the bars indicate values for the individual years.

Figure 2.9	Annual precipitation for the Norwegian mainland 1901–2021, per cent of the 1991–2020 normal.



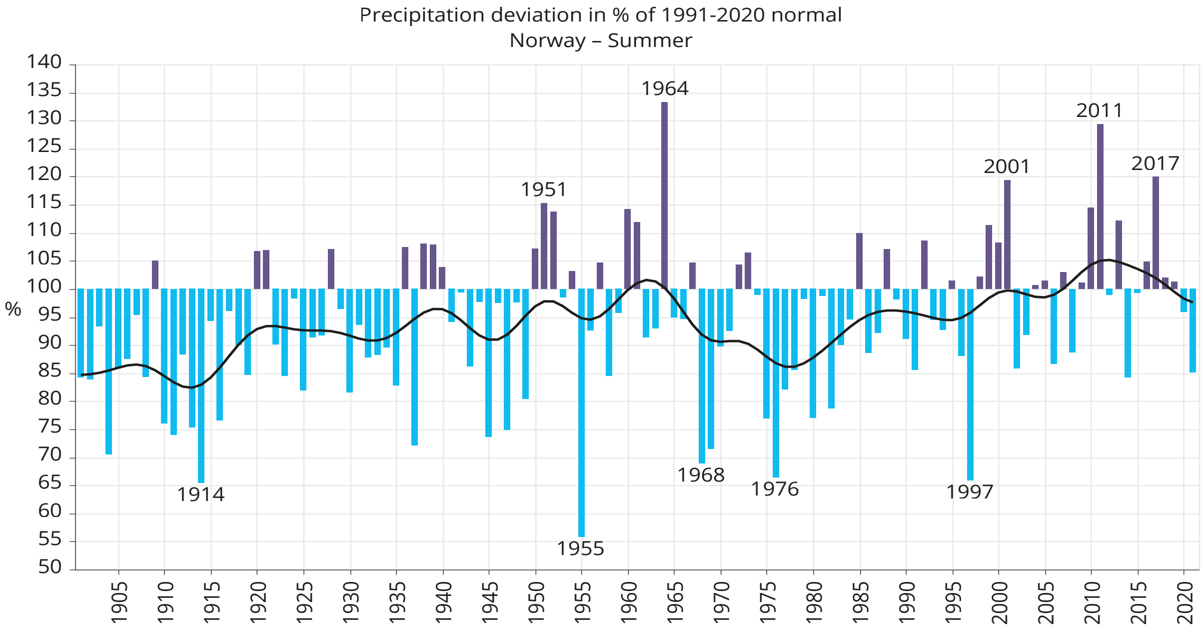
Source: Norwegian Meteorological Institute

Figure 2.10	Spring precipitation for the Norwegian mainland 1901–2021, per cent of the 1991–2020 normal.



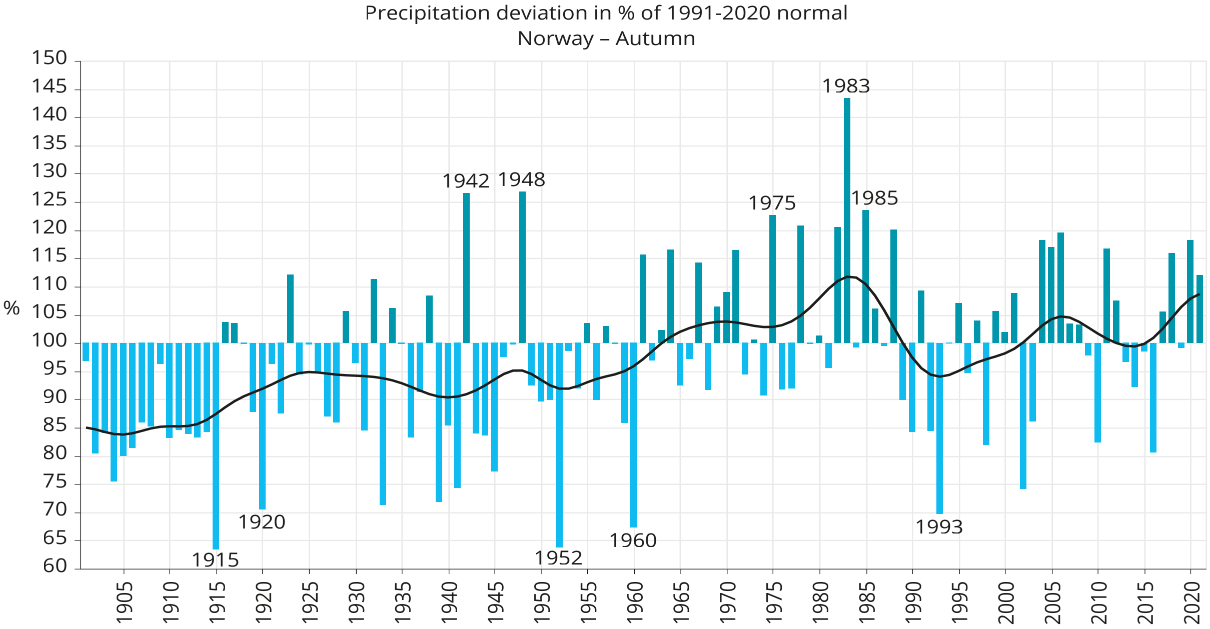
Source: Norwegian Meteorological Institute

Figure 2.11 Summer precipitation for the Norwegian mainland 1901–2021, per cent of the 1991–2020 normal.



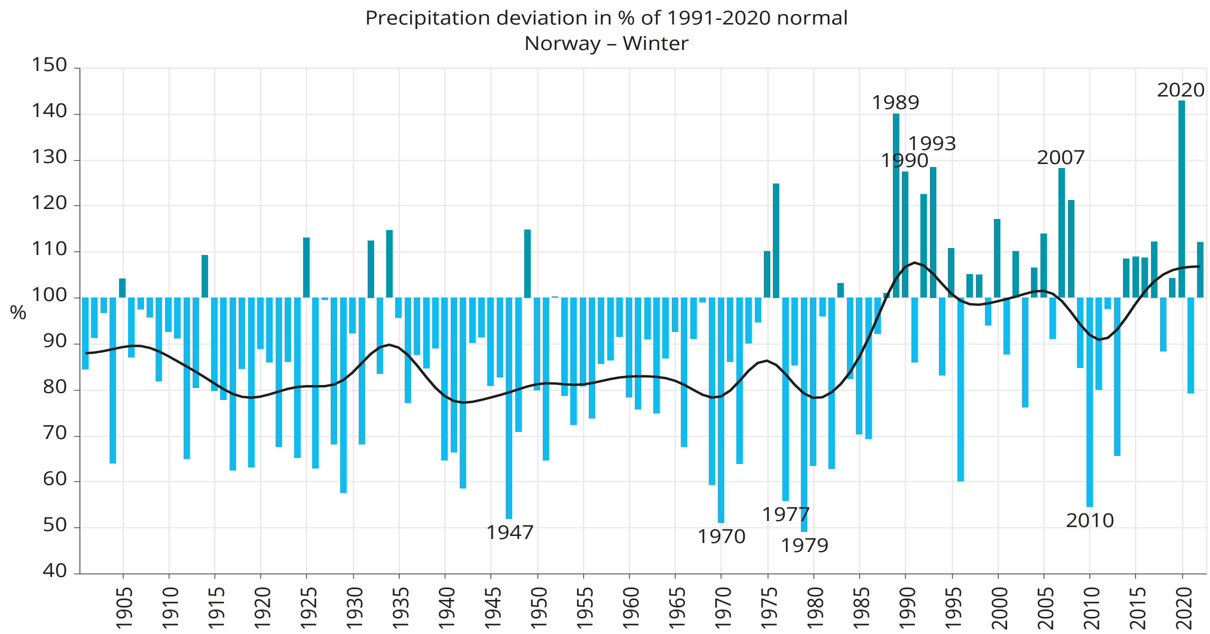
Source: Norwegian Meteorological Institute

Figure 2.12 Autumn precipitation for the Norwegian mainland 1901–2021, per cent of the 1991–2020 normal.



Source: Norwegian Meteorological Institute

Figure 2.13	Winter precipitation for the Norwegian mainland 1901–2021. In per cent of the 1991–2020 normal.



Source: Norwegian Meteorological Institute

2.5.1.1 Precipitation trends

The figures on annual and seasonal precipitation (Figures 2.9 to 2.13), show the values in per cent of the 1991–2020 average. The smoothed black curves in the figures show decadal scale variability, while the bars indicate values for the individual years.

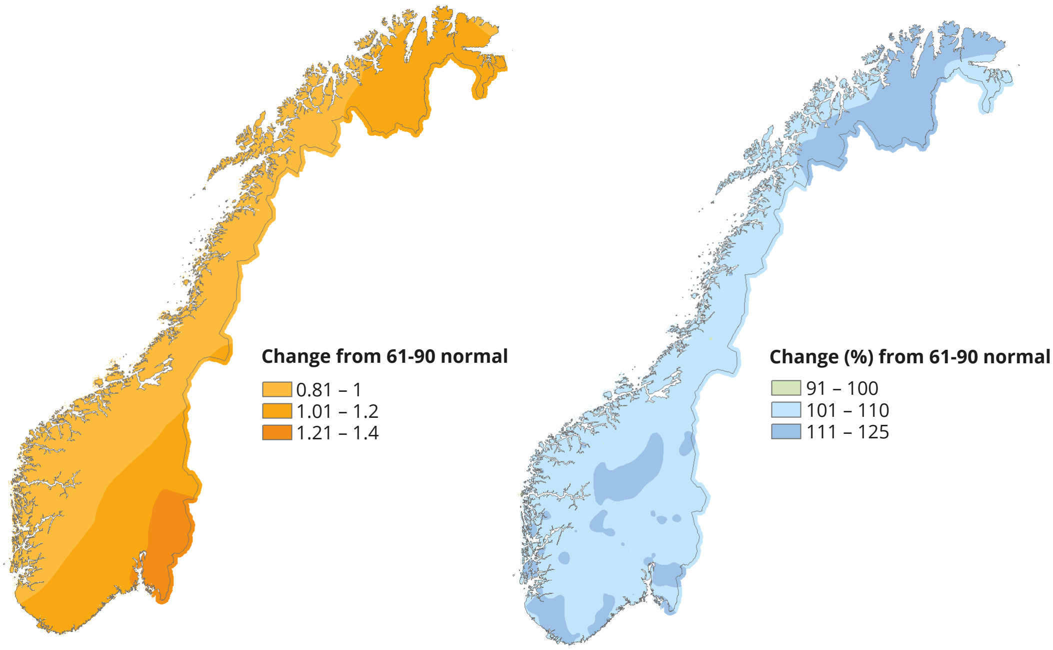
2.5.1.2 Changes since the previous normal period

Both annual as well as for each season temperatures have increased since the previous normal period of 1961–1990, particularly in the winter season. The annual precipitation has also increased in this period, particularly in the spring season. When comparing the current normal period of 1991–2020 to the previous period 1961–1990, the annual mean temperature in Norway has increased about 1.0 °C. This increase has been largest in winter and in the south-eastern and north-eastern parts of Norway. The annual precipitation increased by about 8.5 per cent from the previous normal period to the current one. The largest increase is observed during spring and the smallest during autumn.

2.5.1.3 Svalbard

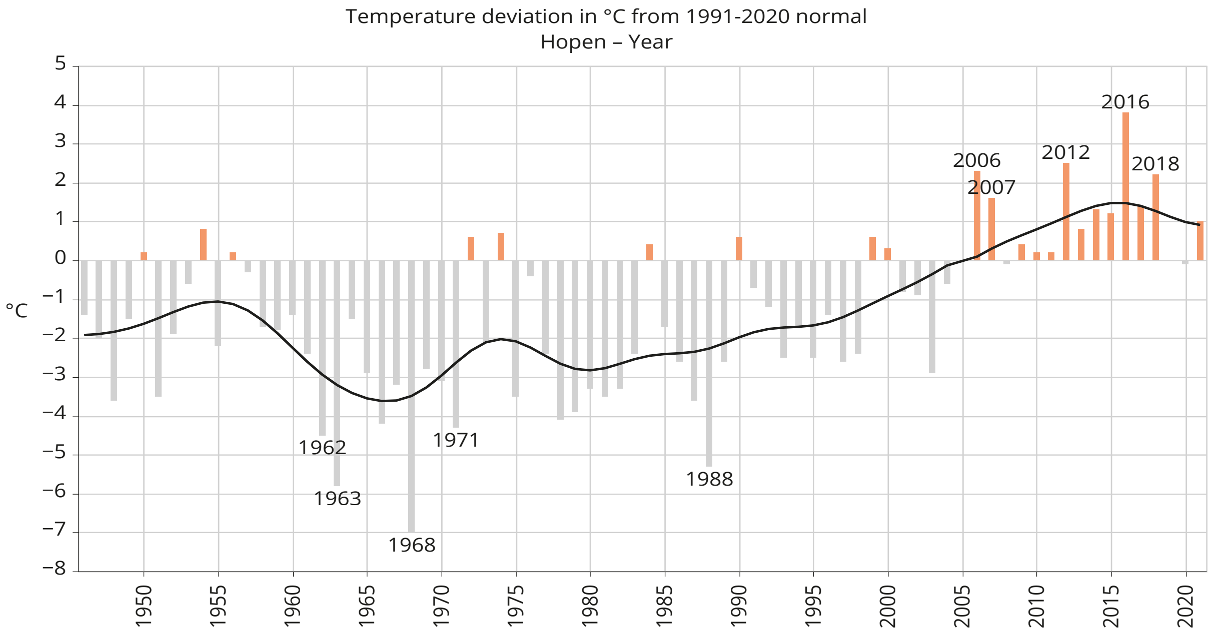
In Svalbard, observations from the two normal periods show increasing trends in temperature and precipitation. From the previous normal period to 1991–2020, the normal temperature at Svalbard Airport increased by 2.8 °C. The largest increase has been observed during the winter season, at about 4.4 °C. Observations indicate an increase in precipitation in Svalbard Airport of 15 per cent from the previous normal period. Figure 2.13 presents the temperature measurements from the nearby island Hopen, where measurements have been ongoing for an even longer time than in Svalbard Airport.

Figure 2.14	Changes in mean annual temperature and total annual precipitation between the 1961–1990 normal to the 1991–2020 normal.



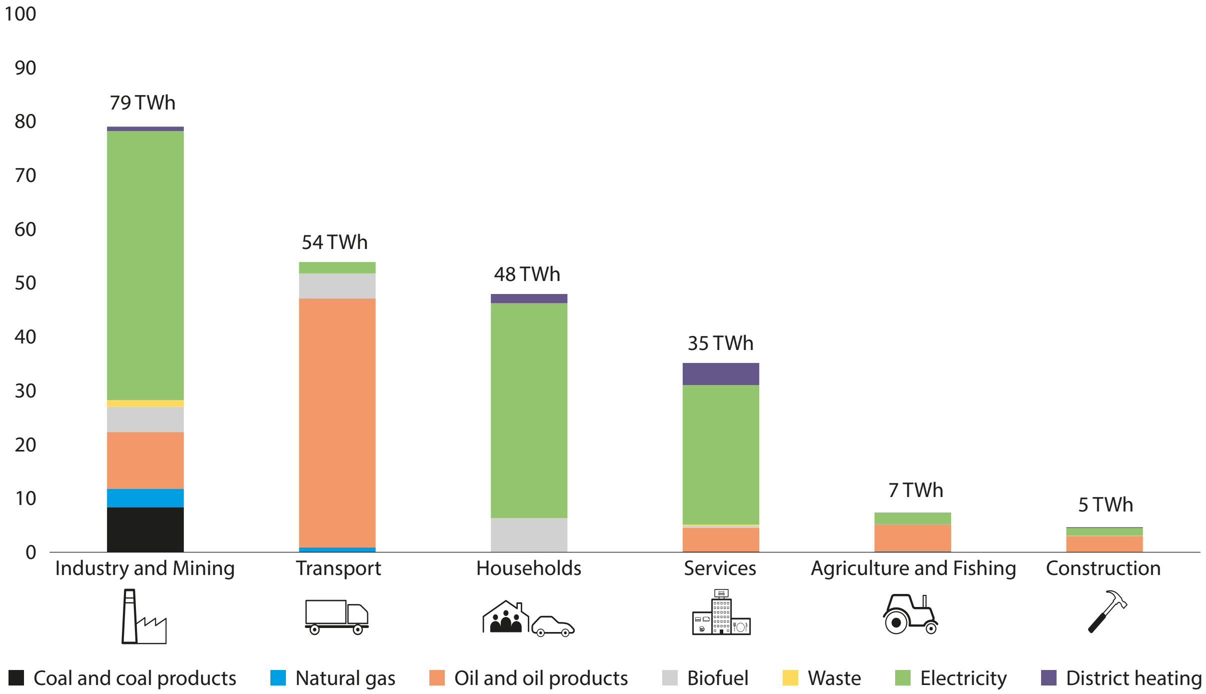
Source: Norwegian Meteorological Institute

Figure 2.15	Annual mean temperatures as measured at Hopen meteorological station, with an averaged trend.



Source: Norwegian Meteorological Institute

Figure 2.16 Energy usage in Norway split by energy carrier. Excluding non-energy use and the offshore petroleum sector.



Source: Statistics Norway

2.6 Energy

2.6.1 Energy use and electricity production

Norway is in a unique position as regards renewable energy. Nearly all of Norway's electricity production is based on renewable energy sources, and the proportion of energy use accounted for by electricity is considerably higher than in most other countries.

Historically, access to reasonably priced hydropower has shaped the energy use in Norway. Norway has a large energy-intensive manufacturing sector, and electricity is more widely used to heat buildings and water than in most other countries. Because renewable energy is the main source of energy usage, greenhouse gas emissions associated with stationary energy use are low in Mainland-Norway[1].

Emissions to air from energy use are therefore mainly concentrated in manufacturing, transportation, construction, and agriculture where the use of fossil fuels is still widespread. Emissions to air from offshore petroleum activities largely originate from the combustion of natural gas and diesel in turbines, engines and boilers, flaring of natural gas for safety reasons, venting and diffuse emissions of gas, and storage and loading of crude oil.

[1] Mainland Norway consists of all domestic production activity, except exploration of crude oil and natural gas, transport via pipelines and ocean transport

Important drivers of energy use

There are various factors that influence the energy usage in Norway. Variations in energy use from year to year are often related to fluctuations in weather conditions and in the prices of energy and energy-intensive goods and services. Longer-term trends are related to population growth and other demographic factors, and to the rate of economic growth and structural changes in the economy.

Norway's population has increased by 1.2 million since 1990 (28 per cent). Strong economic growth has resulted in a tripled GDP since 1990. Both demand for goods and services that use energy are growing steadily. However, final energy consumption has risen by only 14 per cent, demonstrating that the Norwegian economy gradually has become less energy-intensive.

Energy usage, by sector

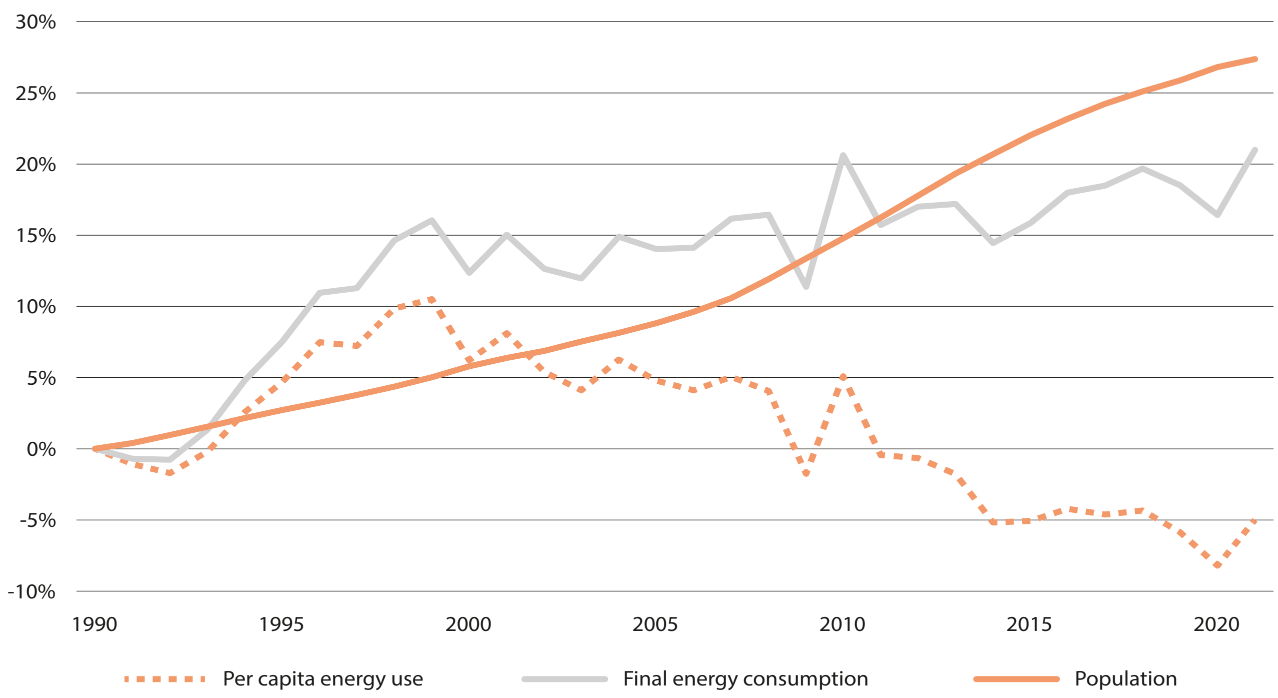
As seen in figure 2.16, energy use in absolute numbers is highest in the manufacturing and transport sectors, followed by households and services. Other sectors such as construction, agriculture, and fisheries account for only a small proportion of energy use. Energy use has increased by about 39 TWh since 1990, with most of the increase taking place before 2000. In 2021, the final energy consumption totaled 223.4 TWh, somewhat above the average since 2000. The average final energy consumption since the year 2000 is around 217 TWh.

Figure 2.16 shows that electricity is the dominant energy carrier, followed by petroleum products. Electricity dominates energy use in manufacturing, the household sector and service industries, while petroleum products account for a large proportion of energy use in sectors that make heavy use of transportation and machinery. District heating and natural gas account for only a small share of energy use, but this has been increasing in recent years. Consumption of district heating has risen, particularly in service industries and households, while there has been an increase in the use of gas in manufacturing industries and the transport sector. These energy carriers have been replacing fuel oil for heating and coal, coke and heavier petroleum products in industrial processes.

The energy intensity of the Norwegian economy has declined by 45 per cent since 1990. This indicates a decoupling of economic growth and energy use.

Per capita energy use has also declined in Norway during this period and was 4 per cent lower in 2021 than in 1990 (see figure 2.17).

Figure 2.17 Per capita energy use in Norway, shown as percentage change since 1990.



Source: Statistics Norway

Features of the Norwegian energy system

Renewable energy sources account for 98 per cent of Norwegian electricity production and the power sector has very low emissions compared to most other countries. In a normal year renewable electricity generation exceeds gross domestic consumption.

At the beginning of 2022, the installed capacity of the Norwegian power supply system was 38 744 MW with an estimated annual production of 154.8 TWh in a normal year.

Norway is now developing more renewable power production capacity than it has done for over 25 years. Wind power currently accounts for only a relatively modest share of production capacity, but accounted for 86 per cent of new power production in 2020.

Hydropower accounts for approximately 90 per cent of Norwegian power supply, and the resource base for production depends on the precipitation level in the given year. This is a distinctive feature of the Norwegian power system, compared to most power systems, where security of supply is secured by thermal power plants.

Norway has half of Europe's reservoir storage capacity, and more than 75 per cent of Norwegian production capacity is flexible. Production can be rapidly increased and decreased at low cost.

The Norwegian power system is closely integrated with the other Nordic systems, both in physical terms and through market integration. In turn, the Nordic market is integrated with the rest of Europe through cross-border interconnectors with the Netherlands, Germany, the Baltic states and Poland.

In 2021, district heating deliveries totalled 6.6 TWh, four and a half times as much as in 2000. This is equivalent to about one sixth of the total energy consumption in households per year in Norway.

District heating can be produced using many different types of fuel. In 2021, almost 45 per cent of district heating was produced from waste and about 33 per cent from bioenergy. The use of petroleum products has declined since 2018. Mineral oil accounts for only 1 per cent of district heating production.

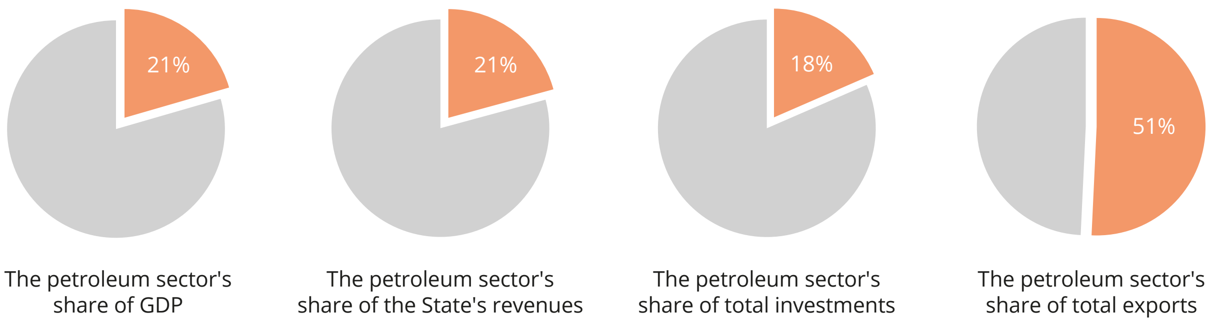
Bioenergy is an important energy source for heat production in Norway. Annual consumption of bioenergy in Norway rose from 10 TWh in 1990 to about 17.5 TWh in 2010. Since then, the consumption has varied and was about 19 TWh in 2021. Fuelwood consumption in households accounts for a large proportion of biofuel consumption, and totalled more than 6 TWh in 2021. The second largest user is the manufacturing sector, where chippings and other wood waste are used as fuel in production processes.

In 2021, total sales of gas amounted to 113 billion Sm^3. Nearly all the gas produced is exported to other countries in Europe. Most of the domestic gas consumption in Norway is related to industrial use, while the use in households is limited.

2.6.2 Petroleum sector

Petroleum activities have given substantial impetus to Norway's economic growth and has helped finance the Norwegian welfare system. The oil and gas sector is Norway's largest in terms of value added, government revenue, investments and export value. Since oil and gas production started in the early 1970s, petroleum activities have contributed more than 18 000 billion (1 800 billion USD) in current NOK to Norway's GDP. Related service and supply industries contribute to economic value creation as well. It is estimated that only half of the recoverable resources on the Norwegian continental shelf has been produced.

Figure 2.18 Macroeconomic indicators for the petroleum sector, 2021 The service and supply industry is not included



Source: National Accounts, National Budget 2023

Since production started, oil and gas have been produced from a total of 119 fields[2] on the Norwegian shelf. At the end of 2021, 94 fields were in production: 71 in the North Sea, 21 in the Norwegian Sea and two in the Barents Sea.

In 2021, Norwegian petroleum production accumulated to 231 million Sm³ o.e. By way of comparison, total production was 226.5 million Sm³ o.e. in 2020 and 264.1 million Sm³ o.e. in the record year 2004. Both oil and gas production rose in 2021. Important reasons for this are higher production regularity of Norway's oil fields and new fields coming on stream. Total production is expected to increase slightly until the mid-2020s, and then decrease over time.

Gas sales totalled 113,1 billion Sm³ (40 MJ) in 2021, an increase from the 2020 production of 110,2 billion Sm³. In light of the European energy crisis, the oil and gas producing companies and the government have taken steps to increase the gas production. An additional 9 BCM from 2021, or 8 per cent, is expected in 2022, bringing close to 100 TWh of extra energy to the European markets. In 2021, natural gas accounted for just under 50 per cent of total production by oil equivalents.

Like oil, gas is one of Norway's most important export commodities. Domestic consumption of gas is low, and nearly all the gas produced is exported. An extensive network of subsea pipelines links Norway's offshore gas fields and onshore terminals directly to recipient countries in Europe. In addition, liquefied natural gas (LNG) is shipped out from the Snøhvit field off Hammerfest on LNG carriers. Hammerfest LNG started producing again in early June 2022, after being shut down due to a fire at the LNG facility in September 2020.

About 40 per cent of Norway's estimated gas resources have been produced and sold so far. Gas production is expected to remain high for the next 10 years.

Norway is the biggest producer of oil and gas in Europe, and as net exporter contributing significantly to European energy security. In 2021, Norway exported about 113 billion Sm3 gas. As the Hammerfest LNG plant was closed through-

[2] A field is one or more petroleum deposits, which together are comprised by an approved plan for development and operation (PDO) or for which exemption from the PDO requirement has been granted.

out 2021, all Norwegian gas was exported directly through pipelines to other countries in Europe. In large parts of Europe, gas is an important source of energy for heating, industrial use and for electricity generation in gas-fired power plants. Norwegian gas covers now up to 30 per cent of EU's and UK's gas consumption. The total length of the Norwegian gas pipeline network is about 8 800 kilometeres. Most Norwegian gas is sold on the European market is delivered to Germany, the UK, Belgium and France. Norwegian natural gas may support the phasing-out of coal in energy consumption in many of these countries, and may be an important co-player with renewables in the efforts to reduce emissions. Gas can be stored and serve as a flexible energy source for heat and electricity production, balancing supply and demand.

2.7 Transportation

Norway's decentralised settlement gives rise to a relatively high demand for transport. In addition, the Norwegian economy is largely based on the extraction of raw materials and exports of goods, which means that there is a large volume of goods transport. The demand for rapid transport and more frequent deliveries of goods has also been increasing. The proportion of passenger transport by car and the proportion of goods transport by road and air have increased since 1990. About one third of the total Norwegian greenhouse gas emissions originated from transport in 2020. Road traffic was responsible for most of these emissions (17 per cent of total emissions in Norway in 2020), while domestic civil aviation, domestic navigation, railways and other means of transport were responsible for the rest. In the period from 1990 to 2020, greenhouse gas emissions from road transport increased by around 13 per cent, while emissions from domestic aviation, domestic navigation, railways and other means of transport increased by 37 per cent.

The emissions from the Norwegian road transport sector were approximately 12.8 per cent above 1990-levels in 2020. Road traffic emissions have decreased since 2015. The decrease is caused by a decrease in the use of fossil fuels. The use of diesel has decreased by 16 per cent and the use of gasoline has decreased by 26 per cent from 2015 to 2020. Due to the introduction of national sales mandates, fossil fuels have been replaced by biofuels, and the use of biofuels is one of the drivers behind the decrease in road transport emissions. The use of biofuels has increased by 171 per cent between 2015 and 2020.

The use of zero-emission vehicles is another important explanation behind the decreased road transport emissions in Norway. Statistics show that total mileage with diesel/gasoline vehicles has decreased by 6 per cent from 2005 to 2020, while the total electric vehicle (EV) mileage has increased by 435 per cent. Total EV mileage accounted for 10 per cent of the total mileage in 2020 and 12 per cent of the total passenger car mileage.

Statistics on the emissions of greenhouse gases from passenger cars show a 19 per cent decrease from 1990 to 2020. At the same time the emissions from vans and medium and heavy duty vehicles have increased by 78 per cent. Passenger cars accounted for 10 per cent of the total greenhouse gas emissions in Norway in 1990, while in 2020 the passenger cars accounted for 8 per cent. Heavy duty vehicles have become a larger source of emissions and have increased from 3 per cent of the total emissions in 1990 to 6 per cent in 2020.

Total mileage in Norwegian road transport has increased by 16 per cent from 2005 to 2020. The mileage has increased for passenger cars, as well as for vans, small lorries and heavy duty vehicles. The mileage for buses has decreased in the same period. For passenger cars, it is the EV mileage that drives the increase in total mileage, while the mileage with diesel/petrol passenger cars has decreased annually since 2016.

EVs had a 53 per cent market share for new passenger cars in 2020. The EV market share increased by 13 per centage points from 2019 to 2020 and follows a steady increase over the last years.

From 2020 to 2021 the preliminary figures on emissions from the Norwegian road transport increased by 3,8 per cent. The increase can be explained by reopening after the retreat of COVID-19. Still, the total mileage with diesel vehicles decreased and the EV market share for passenger cars increased to 63 per cent. The increased emissions can be explained by an increase in HDV mileage, where the EV mileage still is insignificant as a factor in the total emissions. The forecasts for Norway show an expected decrease in the road transport emissions. The EV market shares are likely to continue to increase and will contribute more heavily in the statistics on road transport emissions towards 2030. Biofuels are expected to play a less significant role for passenger cars, because of the tranisition to EVs. Biofuels may be allocated to other parts of the transport sector, where zero emission alternatives are less ready for market.

Emissions from farming and construction machines and other motorized equipment have increased by 78 per cent since 1990. Road and railway construction are important sources of emissions. For these vehicles, a transition into zero-emission vehicles is not expected in the short term. The emission trend follows the level of activity. Norway is conducting testing and demonstration activities in order to speed up the transition.

Since more than 80 per cent of railway traffic in Norway is electric, transportation by railways account for a marginal share of the total emissions. Thus, direct emissions from the railway sector results mainly from transportation of passenger and freight on the diesel driven tracks, during the construction of new railway infrastructure, and while operating and maintaining existing railway infrastructure.

Emissions from railways (including passenger and freight transport) have remained more or less constant at 50 000 tonnes CO_2-equivalents in the last few years, accounting for about 0.1–0.3 per cent of the total emissions from the transport sector.

COVID-19 as well as the associated governmental interventions designed to curb and mitigate the virus resulted in an unparalleled transformation of mobility needs and travel behavior. For example, a survey[3] of travel behaviors of commuters in Eastern Norway finds that people are expected to travel less often by train after the pandemic. According to the survey, people in Eastern Norway expect to reduce the number of train journeys by between 14 and 24 per cent compared to before the pandemic.

The main causes behind these changes are attributed to an increased use of the opportunity to work from home, and discomfort with crowding and/or traffic congestion. On average, travelers expect to work from home at least one day a week. Travelers aversion to crowds may contribute to work-related commuting spreading out more evenly throughout the day, reducing the peaks at rush hour. While flexible working life is expected to continue in the medium-long term, there is uncertainty about sensitivity to crowding and congestion. The changes in travel pattern after the pandemic could affect how train services will be organized in future.

[3] Koronapandemiens påvirkning på togreiser *Kartlegging av endring i togreiser, preferanser og potensialet for etterspørselsstyring, Jernbanedirektoratet 2022* *Koronapandemiens påvirkning på togreiser (jernbanedirektoratet.no)*

Due to the COVID-19 pandemic, there has been a dramatic decline in domestic passenger transport (measured in passenger km) from 2019 to 2020. The overall decline was around 14 per cent, but the decline has been especially large for rail, air and sea transport, where passenger km fell by more than 50 per cent from 2020 to 2021. The decline in road transport was around 8 per cent in the same period.

Passenger traffic by railways nearly halved from 80.4 million passengers in 2019, to 42.5 million passengers in 2020[4]. During the first quarter of 2022, the number of passengers has doubled when compared to the same period during the preceding year, while still amounting to only half of the number of passengers in the corresponding period in 2019. For domestic goods transport, there was an increase in tonnes-km from 2019 to 2020. For goods transport exclusive cabotage, the increase was 5.5 per cent, while for goods transport inclusive cabotage, the increase was 1.6 per cent.

Transportation of goods by railways has witnessed an increase during and after the pandemic. Freight transport, which had remained more or less constant during the pre-pandemic years (2017–19), increased by 8 per cent in 2020 and 12 per cent in 2021. There is a rising demand for freight transportation by railways.

Domestic civil aviation was greatly affected by the travel restrictions enforced due to COVID-19. Traffic decreased at most by 92 per cent (8–14 April 2020) compared to 2019 levels. Domestic air traffic was however maintained to a greater extent than international air traffic. This is due to the state procurement of a “minimum provision” on flight routes that prior to the pandemic were operated on commercial terms, as well as additional procurement on ordinary public service obligation routes (PSO routes). As a result of the pandemic greenhouse gas emissions from domestic civil aviation (including helicopters) reduced to about 1,6 per cent of total national emissions in 2020, from to 2.3 per cent in 2019 (1.19 of a total of 51.65 million tonnes of CO_2 equivalents) in 2019.

The war in Ukraine and the energy-crisis that followed suit is also affecting domestic aviation in Norway. Primarily this is seen in the sharp price increase on jet fuel, and uncertain supply chains and capacity shortages that contribute to scarcity of important production materials. It does not, however, seem to have affected the domestic traffic levels significantly so far.

2.8 Industry

A considerable part of Norwegian manufacturing industries is based on natural resources. The historic availability of low-cost hydro power created a basis for the establishment of metal and fertilizer production. Some chemical production is based on the petroleum resources. Production of pulp and paper derived from the forest resources has also been considerable, and the fisheries have also given a base for industry. Norwegian industry therefore has a high share of production of raw materials and semi-manufactured goods including iron and steel, non-ferrous metals, chemicals, fertilisers, pulp and paper, mineral industries, food processing industries, building and construction industry.

Process emissions from industry were at about 18 per cent of the national totals in 2020. Process emissions have come down 45 per cent from 1990. Emissions from energy use of fossil fuels on this sector were about 5 per cent of the national totals.

2.9 Waste

The waste sector, with emissions of 1.4 million tonnes of CO_2 equivalents in 2020, accounted for 2.8 per cent of the national GHG emissions. Most

[4] Jernbanestatistikk 2022

of the emissions from the waste sector originate from solid waste disposal on land (62 per cent).

Economic growth, or growth in production and consumption, is the key driver behind the growing waste volume. Even though the total amount of waste generated has increased, GHG emissions from the waste sector have generally decreased since 1990. This is due to the increase in material recycling and the ban issued in 2009 on disposing biodegradable waste to landfill. The central government authorities set the general framework, while municipalities and industry are responsible for waste collection and treatment.

In general, targets set in EU waste directives, such as EU targets for preparing for reuse and recycling of municipal waste, also apply for Norway owing to the EEA agreement.

2.10 Building stock and urban structure

According to Statistics Norway, there were a little less than 4.3 million buildings in Norway in 2021. The number of buildings in 2021 was 9 per cent higher than in 2010 and 24 per cent higher than in 2000. There were a little less than 1.6 million residential buildings in 2021 and the types of residential buildings are shown in table 2.2.

Table 2.2 Residential buildings by type of building

	2018	2019	2020	2021
Detached house	1 167 548	1 171 237	1 174 481	1 177 792
House with 2 dwellings	166 582	168 868	171 080	173 168
Row house, linked house and house with 3 dwellings or more	166 722	169 662	172 198	174 445
Multi-dwelling building	39 853	40 717	41 578	42 346
Residence for communities	5 194	5 260	5 325	5 421
Total	1 545 899	1 555 744	1 564 662	1 573 172

Source: Statistics Norway (Statbank table 03175)

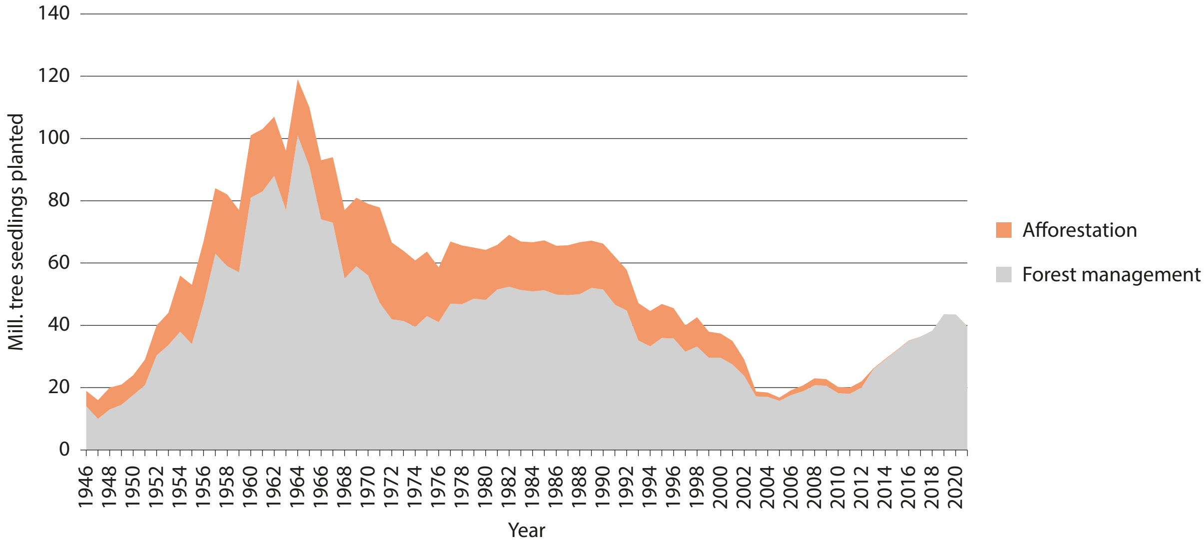
Of the about 2.7 million non-residential buildings in 2021, 72 per cent were classified as holiday house, garage linked to dwelling etc. Other important types of non-residential buildings are agricultural and fishery buildings (19 per cent) and industrial buildings (4 per cent).

About 4.4 million, or a little more than 82 per cent of the residents in Norway lived in urban settlements in 2021. The urban population has increased by 50 per cent since 1990, 31 per cent since 2000 and 14 per cent since 2011. The area of urban settlements in 2021 was about 2 200 km2 and has steadily increased since 2013. A new method for defining urban settlements was implemented in 2013 and due to this, figures before and after 2013 are not directly comparable.

2.11 Agriculture

Stretched along the western side of the Scandinavian Peninsula, approximately one fourth of the surface area of Norway lies north of the Arctic Circle. The long coastline has an Atlantic, humid climate, while the inland climate is continental. Approximately 3 per cent of Norway's land area is cultivated soil. The most suitable lands, approximately 1 per cent, is mostly allocated to arable crops, while grassland and ruminant livestock are allocated to regions less suitable for arable crops. While cultivated soil is a scarce resource in Norway, in addition we have extensive land that is suitable for pasture, and used extensively by reindeer husbandry and other ruminant livestock.

Figure 2.19 Historical levels of tree planting in the Norwegian forestry.



Source: Ministry of Agriculture and Food

Agriculture is estimated to account for about 8.4 per cent of Norway's emissions of greenhouse gases. This particularly includes methane and nitrous oxide from animal husbandry and fertilisation. In addition, nitrous oxide emissions from cultivation of peatland are allocated to agriculture, while CO_2 emissions from the same source are allocated to LULUCF. Use of fossil fuels for agricultural activities are allocated to other sectors, e.g. transport. The agricultural emissions have been reduced by approximately 5 per cent since 1990.

2.12 Forest

Forest and wooded land cover about 12 million hectares and constitute approximately 38 per cent of the land area in Norway. The most widespread species are Norway spruce (47 per cent), Scots pine (33 per cent) and birch (18 per cent). Approximately 88 per cent – that is 120 000 properties – of the forest area is privately owned. The majority of the forest holdings are farm and family forests.

The historical levels of tree planting in the Norwegian forestry are shown in figure 2.19. Norway spruce (picea abies) and Scots pine account for more than 95 per cent of the seedlings. Broadleaves and foreign tree species are only planted to a small extent.

2.13 Other circumstances

Fishing has always been an important basis for settlement and employment along the Norwegian coast. The Norwegian fishing and aquaculture industries are among Norway's most important export industries today, currently supplying seafood to consumers in more than 130 countries worldwide. This makes Norway the second largest exporter of seafood globally. According to the United Nations Food and Agriculture Organization (FAO), the consumption of seafood worldwide is expected to increase substantially over the next 20 to 30 years.

In addition to climate change, fisheries and aquaculture are affected by various types of pollution. With an increase in the level of CO_2 in the atmosphere, the ocean absorbs an increasing level of CO_2, causing ocean acidification. Ocean acidification is a source of concern for marine ecosystems and fisheries. Important focus areas for fisheries are improving fuel efficiency and finding alternatives to fossil fuel for engine power. Significant reductions have been achieved by replacing refrigerants that have high global warming potential, used in onboard cooling systems, by climate neutral ones.

Technological developments and improved fishing methods, equipment and vessels have made possible a restructuring of the fishing-fleet, which today catches much larger quantities per fisherman, per vessel and per trip than a few decades ago. This has reduced the general fuel-consumption of the fleet. For fish farming, optimizing feed use and feed composition play an important part in reducing the climate impact of salmon aquaculture products. Also, in the fish farming industry, electricity is increasingly used as power for service vessels and farms instead of fossil fuel.

3 GREENHOUSE GAS INVENTORY INFORMATION, INCLUDING INFORMATION ON NATIONAL SYSTEMS AND NATIONAL REGISTRIES

3.1 Summary tables

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 NIR and Common Reporting Format (CRF) covering the years 1990–2020 was submitted to the UNFCCC Secretariat on April 8th, 2022. Annex 1 contains the summary tables for Norway for the years 1990–2020 and the tables are drawn from the annual submission under the Climate Convention and the Kyoto Protocol. The summary tables are also reported as CTF table 1 together with Norway's fifth Biennial Report,

The NIR covers emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorcarbons (PFCs), sulphur hexafluoride (SF_6) and hydrofluorocarbons (HFCs) from 1990 to 2020. NF_3 emissions do not occur in Norway. Norway's inventory includes indirect emissions of CO_2 from non-combustion sources originating from the fossil part of CH_4 and NMVOC. See chapter 9 of the NIR for more details.

3.2 Descriptive summary

3.2.1 Overview

Table 3.1 presents emission figures for all greenhouse gases, expressed in absolute emission figures and total CO_2 equivalents using GWP-100 values from the IPCC's fourth Assessment report. Between 1990 and 2020 the total greenhouse gas emissions decreased by 2.2 million tonnes, or by 4.2 per cent. Preliminary figures for 2021 show a total of 48.9 Mt. Between 1996 and 2011, emissions exceeded 54 million tonnes CO_2 equivalents in all years except in 2009, which was a special year as the economy was set back by the financial crisis. Emissions peaked at 56.6 million tonnes in 2007. Since 2009, emissions have stayed below 55 million tonnes CO_2 equivalents. The net greenhouse gas emissions including all sources and sinks amounted to 28.9 million tonnes in 2020. The total contribution from different sources from 1990 to 2020 is illustrated in Figure 3.1. Figure 3.2 illustrates the development of emissions of greenhouse gases from various sources (excluding LULUCF) relative to the emission level in 1990. The increases in emissions of greenhouse gases from 1990 were caused by increased activity in the energy sector. The increase was slowed by the reduced emissions from waste handling and industrial processes. Since 2015, total emissions have gone down, mainly caused by decreased emissions in the energy sector, especially within the transport and oil and gas sector. Much of this reduction is due to a 18.5 per cent reduction in road transport emissions from 2015 to 2020. The reduction in road transport emissions can be explained by more efficient vehicles, more electric vehicles, and increased use of biofuels.

In 2020, the net greenhouse gas removals in the LULUCF sector was 20.3 million tonnes CO_2 equivalents, which corresponds to about 41 per cent of the national greenhouse gas emissions (from all other sectors than LULUCF) that year. The average annual net sequestration from the LULUCF sector was about 18.0 million tonnes of CO_2 equivalents for the period 1990–2020. The calculated changes in carbon depend upon several factors such as growing conditions, harvest levels, management practices 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. For more information on the annual variation in CO_2 removals on forested land, please see chapter 6.1.1 of the Norwegian National Inventory Report 2020.

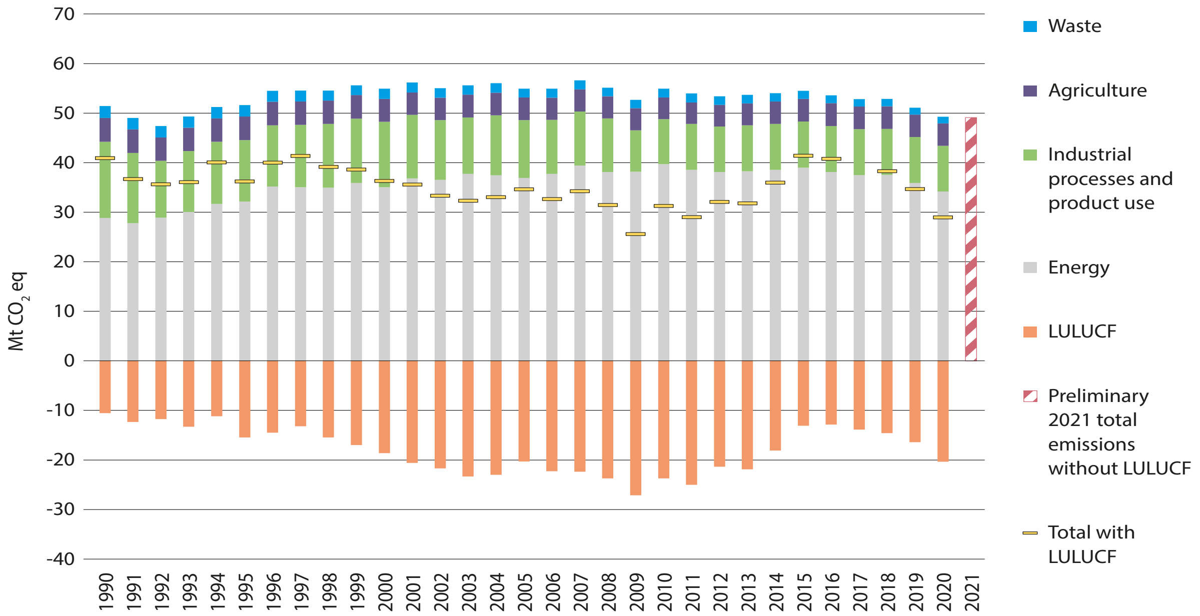
Total emissions increased in the 1990s, but have, since the turn of the century, been more or less stable, and declined in recent years (9.6 per cent since 2015), cf. Figure 3.1. While emissions of CO_2 from most sources have increased, emissions of other greenhouse gases have decreased (cf. Figure 3.3). 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 overall growth in CO_2 has been partly offset by reductions in other gases and sectors. In 2020, emissions decreased by 3.5 per cent, and were 4.2 per cent lower than in 1990. Emissions in 2020 are illustrated by gases in Figure 3.4.

Table 3.1 **Emissions of greenhouse gases in Norway, 1990–2020. Units: CO_2 in Mtonnes (Mt) and other gases in ktonnes (kt).**

Gas	CO_2	CH_4	N_2O	PFC	SF_6	HFC
Year	Mt	kt		kt CO_2 equivalents		
1990	35.1	249.4	13.8	3 894.8	2 098.5	0.04
1995	38.5	256.8	12.5	2 314.0	579.8	97.8
2000	42.1	247.0	12.8	1 518.5	891.3	369.3
2005	43.3	229.6	13.6	955.3	296.9	548.7
2010	45.7	223.0	8.3	238.4	68.5	894.2
2011	44.8	218.2	8.3	262.6	53.6	965.8
2012	44.3	214.5	8.3	200.5	52.6	1 028.3
2013	44.6	211.2	8.2	181.0	55.4	1 118.1
2014	45.0	208.9	8.3	178.9	48.8	1 081.1
2015	45.6	208.8	8.4	146.4	67.6	963.3
2016	44.8	205.3	8.2	186.2	61.2	1 005.5
2017	44.2	199.6	8.0	131.0	56.3	1 029.2
2018	44.4	196.5	7.9	148.1	53.9	996.5
2019	42.8	189.4	8.0	175.1	68.0	934.0
2020	41.2	188.5	7.8	161.4	73.7	810.0

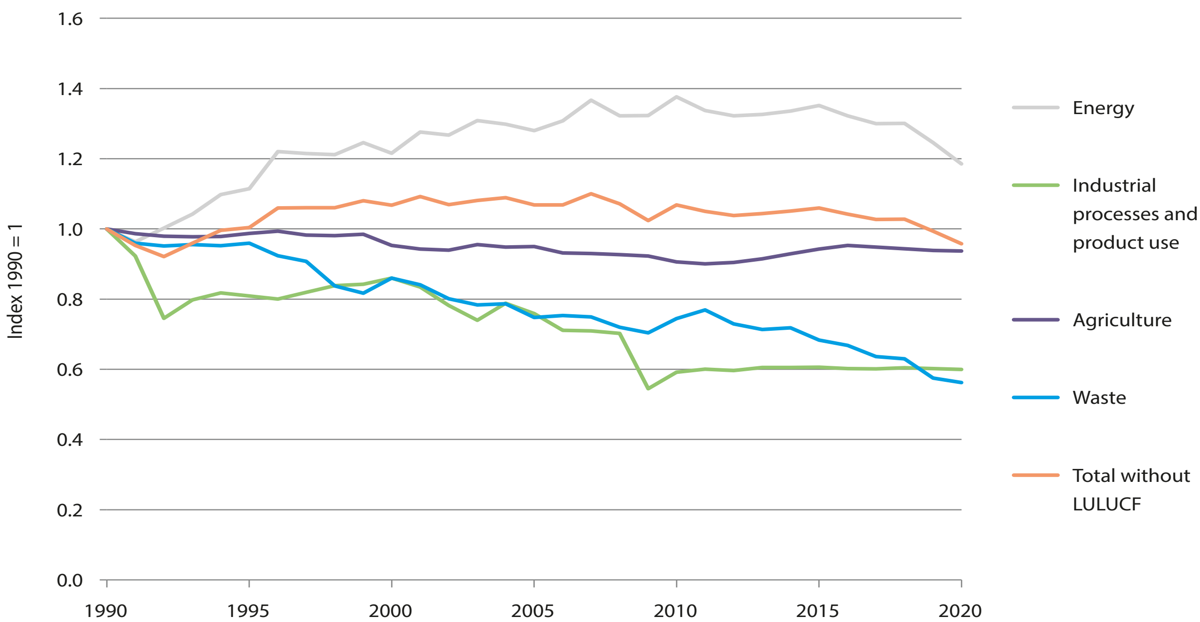
Source: Statistics Norway/ Norwegian Environment Agency

Figure 3.1 Total emissions of greenhouse gases by sources and removals from LULUCF in Norway, 1990–2020 (million tonnes CO_2 equivalents), and preliminary emissions estimates for 2021



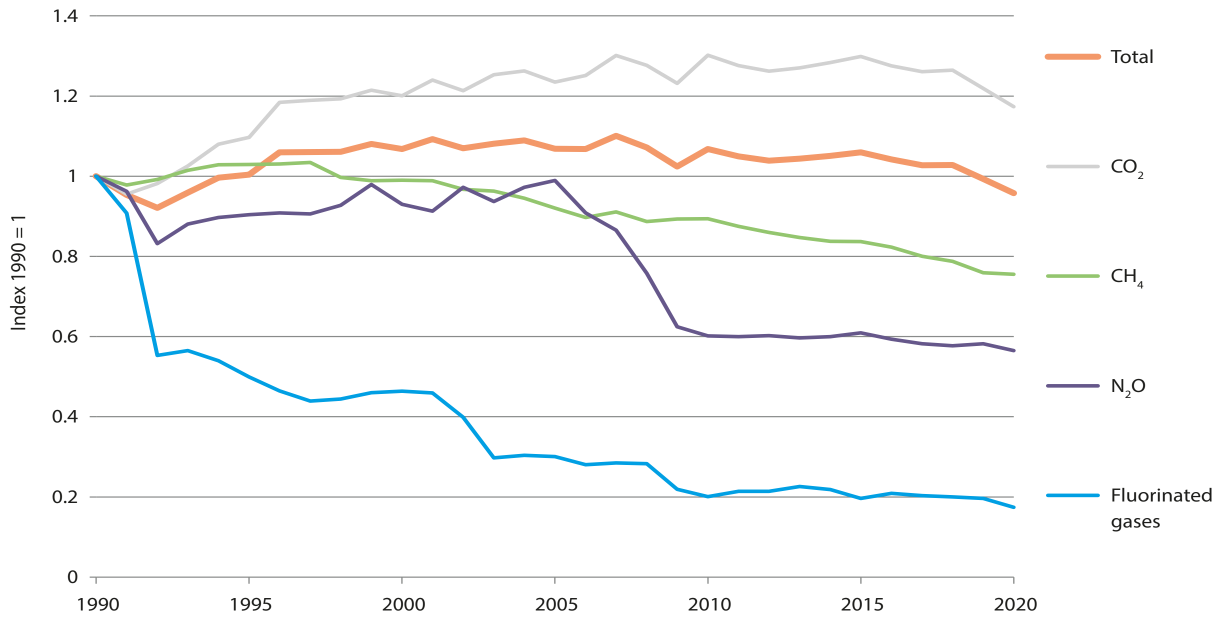
Source: Statistics Norway/Norwegian Environment Agency/Norwegian Institute of Bioeconomy Research

Figure 3.2 Changes in emissions of greenhouse gases, relative to 1990, illustrated by UNFCCC source categories, 1990–2020. Index 1990 = 1.



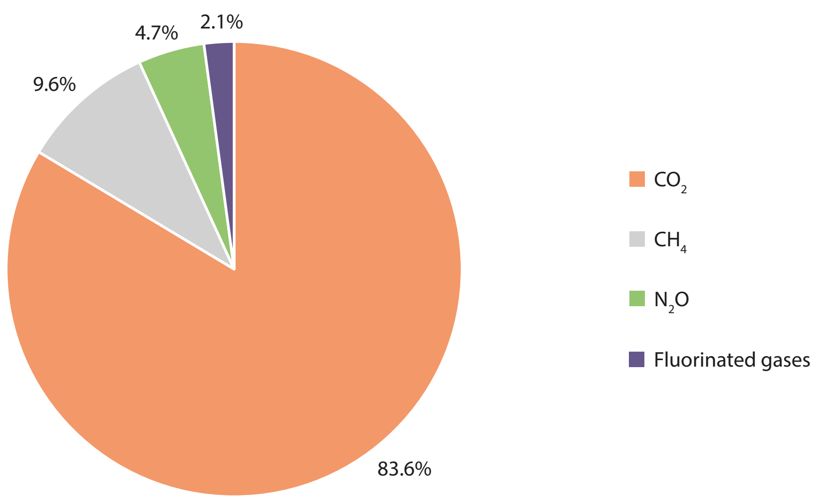
Source: Statistics Norway/Norwegian Environment Agency

Figure 3.3 Changes in emissions of greenhouse gases, relative to 1990, by gas, 1990–2020. Index 1990 = 1.



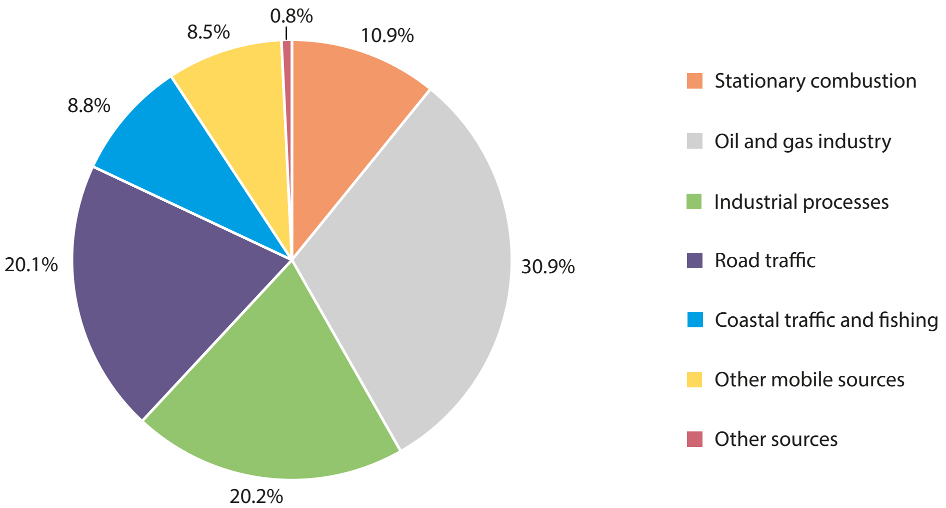
Source: Statistics Norway/Norwegian Environment Agency

Figure 3.4 Distribution of emissions of greenhouse gases in Norway by gas, 2020



Source: Statistics Norway/Norwegian Environment Agency

Figure 3.5 Distribution of CO_2 emissions in Norway by sub-categories in 2020



Source: Statistics Norway/ Norwegian Environment Agency

3.2.1.1 Emissions of carbon dioxide (CO_2)

In 2020, CO_2 emissions amounted to 41.2 million tonnes. These emissions originated mainly from the source categories energy (80 per cent) and industrial processes and products use (19 per cent). The source category energy includes sub-categories such as oil and gas extraction, transport and stationary combustion. During the period 1990–2020, the total emissions of CO_2 increased by 17 per cent, or by 6 million tonnes. This is mainly due to increases in emissions from oil and gas extraction and from transport, particularly from road traffic, civil aviation, coastal traffic and fishing. On the other hand, emissions from stationary combustion have decreased by 2.0 million tonnes CO_2 since 1990 and by 2.7 million tonnes CO_2 since 2010. The CO_2 emissions from the category industrial processes have increased by 0.6 million tonnes of CO_2 since 1990.

The Norwegian electricity production is dominated by hydroelectric power. Thus, emissions from energy industries origin almost completely from fuel combustion in oil and gas extraction and related activities.

Table 3.2	CO_2 emissions (million tonnes) from different source categories, 1990–2020

Year	Stationary combustion	Oil and gas industry	Industrial processes	Road traffic	Coastal traffic and fishing	Other mobile sources	Other sources	Total
1990	6.44	7.85	7.72	7.29	2.55	2.68	0.57	35.10
1995	6.49	9.48	8.19	7.40	3.25	3.22	0.48	38.51
2000	5.51	12.25	9.33	8.25	3.51	2.91	0.39	42.15
2005	5.30	13.40	8.55	9.43	3.15	3.18	0.33	43.34
2010	7.14	13.32	8.03	9.90	3.43	3.61	0.25	45.69
2011	6.21	13.08	8.25	9.84	3.45	3.69	0.27	44.79
2012	5.34	13.19	8.32	9.86	3.52	3.80	0.27	44.30
2013	5.45	13.16	8.35	9.91	3.53	3.89	0.28	44.59
2014	5.16	13.86	8.15	10.12	3.64	3.84	0.27	45.05
2015	5.07	14.37	8.46	10.15	3.44	3.84	0.26	45.59
2016	4.99	14.06	8.35	9.88	3.32	3.89	0.27	44.76
2017	5.22	13.83	8.60	9.00	3.45	3.86	0.28	44.24
2018	5.11	13.65	8.58	9.24	3.43	4.09	0.28	44.39
2019	4.79	13.46	8.21	8.60	3.58	3.87	0.26	42.78
2020	4.47	12.73	8.31	8.26	3.61	3.50	0.31	41.20

Source: Statistics Norway/ Norwegian Environment Agency

28.4 per cent of the total Norwegian CO_2 emissions originate from transport[5]. Of this, about 70.4 per cent originates from road transport. Since 1990, CO_2 emissions from transport have increased by 18.4 per cent. CO_2 emissions from road transportation increased by 13.0 per cent between 1990 and 2020, although emissions from personal cars decreased by 17.6 per cent.

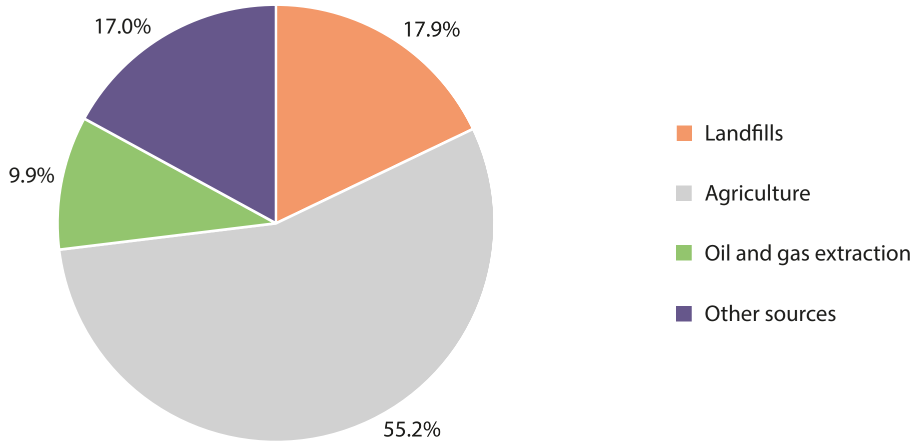
The petroleum sector emitted 12.7 million tonnes CO_2 in 2020, which was 30.9 per cent of total CO_2 emissions in Norway. The majority of CO_2 emissions from the petroleum sector stems from combustion of natural gas and diesel in turbines on offshore installations. Other CO_2 emissions originate from onshore oil and gas terminals and indirectly from NMVOC emissions (process emissions). Total CO_2 emissions from the sector have grown year by year up to 2007, primarily as a result of the increased activity level, more mature oil fields and increased gas production and sales. Emissions have been reduced by 12 per cent between 2007 and 2020.

CO_2 emissions from industrial processes were 8.3 million tonnes in 2020, an increase of 0.6 million tonnes since 1990.

In 2020, about 61.0 per cent of the CO_2 emissions from industrial processes were from metal production. CO_2 emissions from metals manufacturing derive primarily from the use of coal, coke and charcoal as a reducing agent, and are therefore primarily dependent on the volume of production. Mineral production accounted for 12.2 per cent and manufacturing of chemicals accounted for 22.5 per cent of the CO_2 emissions from industrial processes in 2020.

[5] The transport sector includes road transport, civil aviation, navigation and fishing, railway and off road vehicles and other machinery

Figure 3.6 Distribution of CH_4 emissions in Norway by sub-categories in 2020



Source: Statistics Norway/Norwegian Environment Agency

CO_2 emissions from stationary combustion derive from combustion in onshore industry, energy production and heating in buildings. These emissions constituted 10.9 per cent of the total CO_2 emissions in 2020, a decrease of 30.6 per cent compared with 1990. While emissions from electricity production and district heating have increased somewhat during the period, emissions from use of oil for heating has been reduced, resulting in the observed reduction trend in total for stationary combustion.

3.2.1.2 Emissions of methane (CH_4)

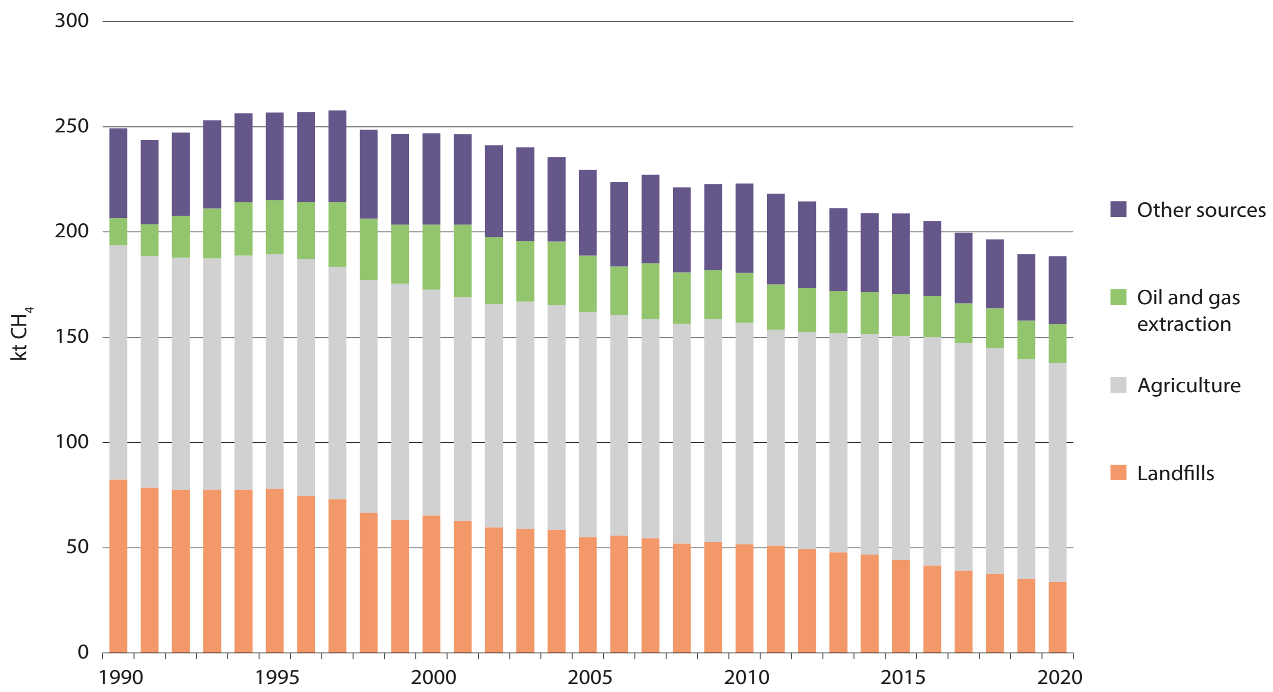
The total emissions of methane (CH_4) amounted to 188 ktonnes (4.7 million tonnes of CO_2 equivalents) in 2020. About 55 per cent of the emissions in 2020 derived from agriculture, primarily releases from enteric fermentation, and about 18 per cent from landfills (Figure 3.6). Combustion and evaporation/ leakage related to oil and gas extraction accounted for about 10 per cent of the total emissions in 2020. The category "other sources" includes emissions from petrol cars, domestic heating, coal mining and oil refineries and amounted to 17 per cent in 2020.

Agricultural emissions are relatively stable from year to year. Methane emissions from the agricultural sector amounted to 104 ktonnes in 2020 and constituted about 55 per cent of total Norwegian methane emissions. The emissions were reduced by 6.5 per cent from 1990 to 2020.

During the period 1990–2020, total CH_4 emissions decreased by 24 per cent. Figure 3.7 shows that this was primarily caused by decreased emissions from landfills (-59 per cent from 1990 to 2020), which more than compensated for the growth in emissions from the oil and gas industry. The waste volumes increased during the period 1990–2020, but this effect was more than offset by increased recycling and incineration of waste and increased burning of methane from landfills.

Methane emissions in the oil and gas industry accounted for about 19 ktonnes in 2020. These emissions are largely caused by landing and loading of crude oil offshore. Methane emissions from the oil and gas industry have increased by 43 per cent since 1990 due to higher production.

Figure 3.7 CH_4 emissions in Norway between 1990 and 2020. Unit: ktonnes

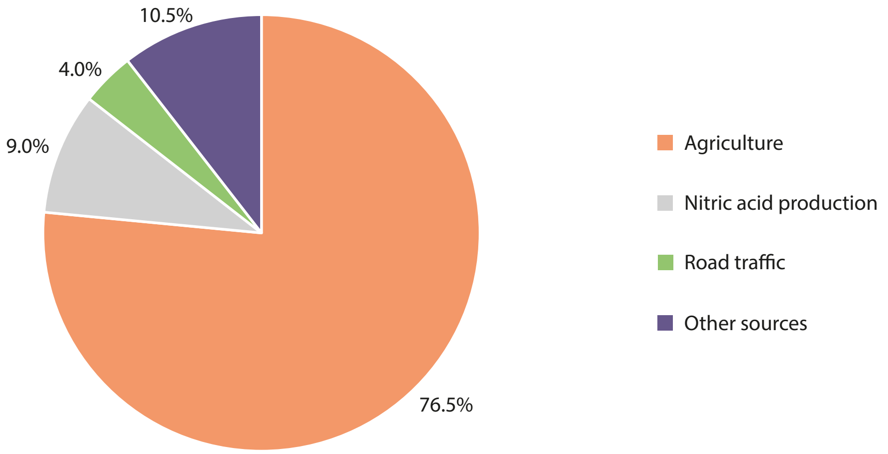


Source: Statistics Norway/ Norwegian Environment Agency

3.2.1.3 Emissions of nitrous oxide (N_2O)

The total emissions of N_2O amounted to 7.8 kilo tonnes (2.3 million tonnes of CO_2 equivalents) in 2020. Figure 3.8 shows that about 77 per cent of Norwegian emissions of N_2O are of agricultural origin, with agricultural soils as the most prominent contributor. Production of nitric acid takes place at two plants and is one step of the fertiliser production. This production accounts for about 9 per cent of the total N_2O emissions. The contribution from road traffic amounted to 4 per cent in 2020. The category "other sources", which amounted to almost 11 per cent of N_2O emissions in 2020, includes emissions from e.g. fuel combustion, manure management, biological treatment of waste and wastewater handling.

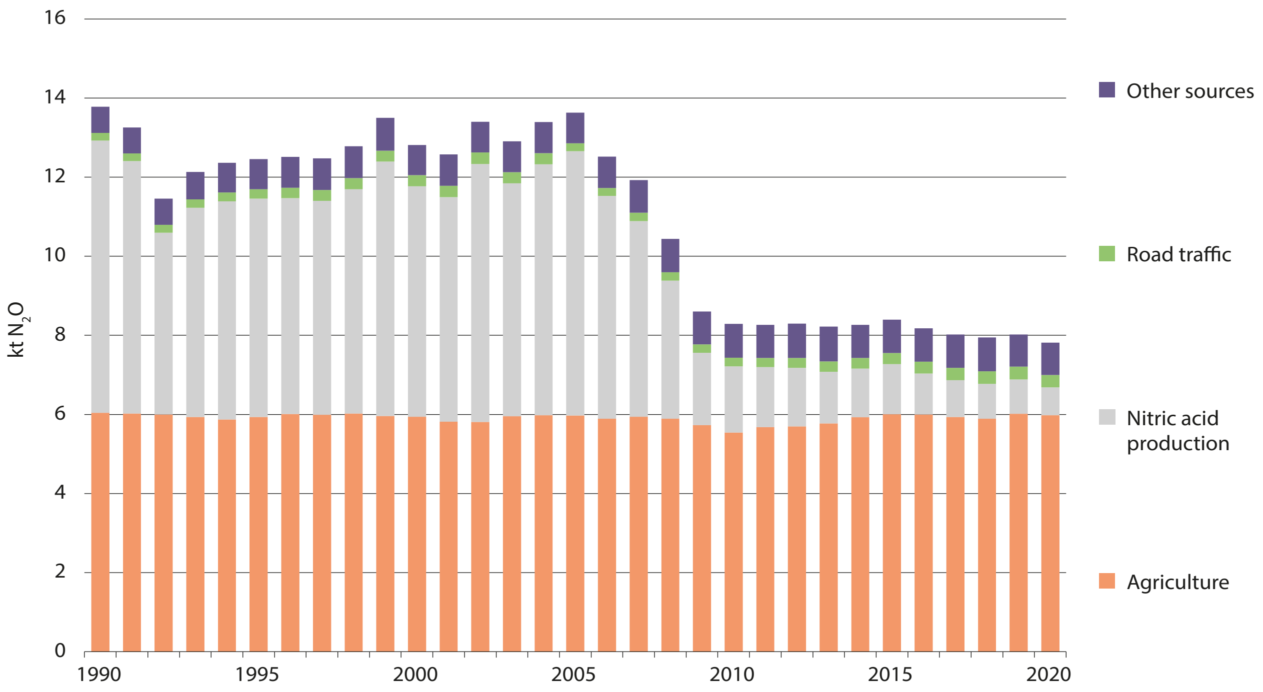
Figure 3.8 Distribution of Norwegian N_2O emissions by major sources in 2020



Source: Statistics Norway/ Norwegian Environment Agency

The emissions of N_2O were reduced by about 43 per cent from 1990 to 2020. The emissions were fairly stable through the 1990s, and the major part of this reduction took place after 2005. This was mainly caused by reductions in emissions from nitric acid production, from which emissions were reduced by about 90 per cent from 1990 to 2020. Decreased emissions at the beginning of the 1990s were caused by changes in the production processes, while there was a moderate increase in emissions during the following years owing to increased production volumes. Improvements in the production process brought the emissions down again in 2006. Emissions of N_2O from production of nitric acid decreased by about 90 per cent from 2005 to 2020.

Figure 3.9 N_2O emissions for major Norwegian sources, 1990–2020. Unit: ktonnes



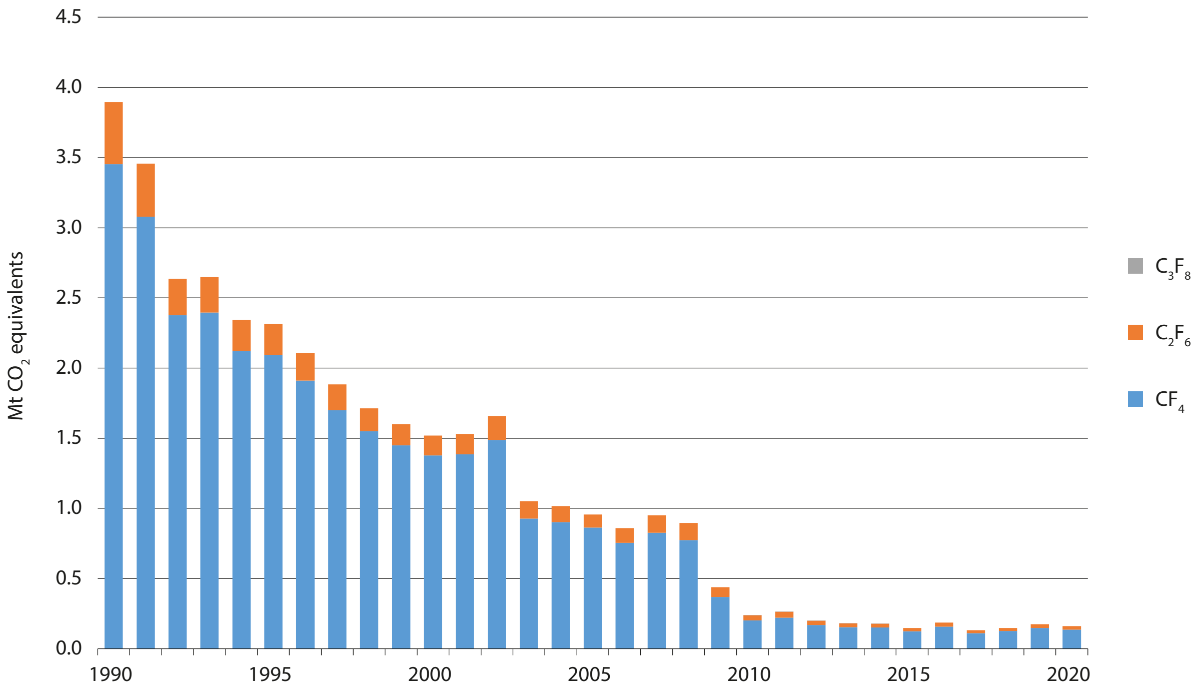
Source: Statistics Norway/ Norwegian Environment Agency

3.2.1.4 Emissions of perfluorochemicals (PFCs)

Aluminium production was the only source of PFC emissions in 2020. Perfluorcarbons tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) emissions from Norwegian aluminium plants were reported at 18.3 and 2.1 tonnes respectively, corresponding to a total of 0.16 million tonnes of CO_2 equivalents. Total PFCs emissions have decreased by 96 per cent since 1990 following a steady downward trend as illustrated in Figure 3.10.

Improvement of technology and process control in aluminium production led to a significant emissions decrease. In 1990, PFCs emissions were 4.48 tonnes CO_2 equivalents per tonne aluminium produced. It was reduced to 0.70 tonnes CO_2 equivalents per tonne aluminium produced in 2007 and to 0.12 tonnes CO_2 equivalents per tonne aluminium produced in 2020.

Figure 3.10 Emissions (million tonnes CO_2-equivalents) of PFCs in Norway, 1990–2020



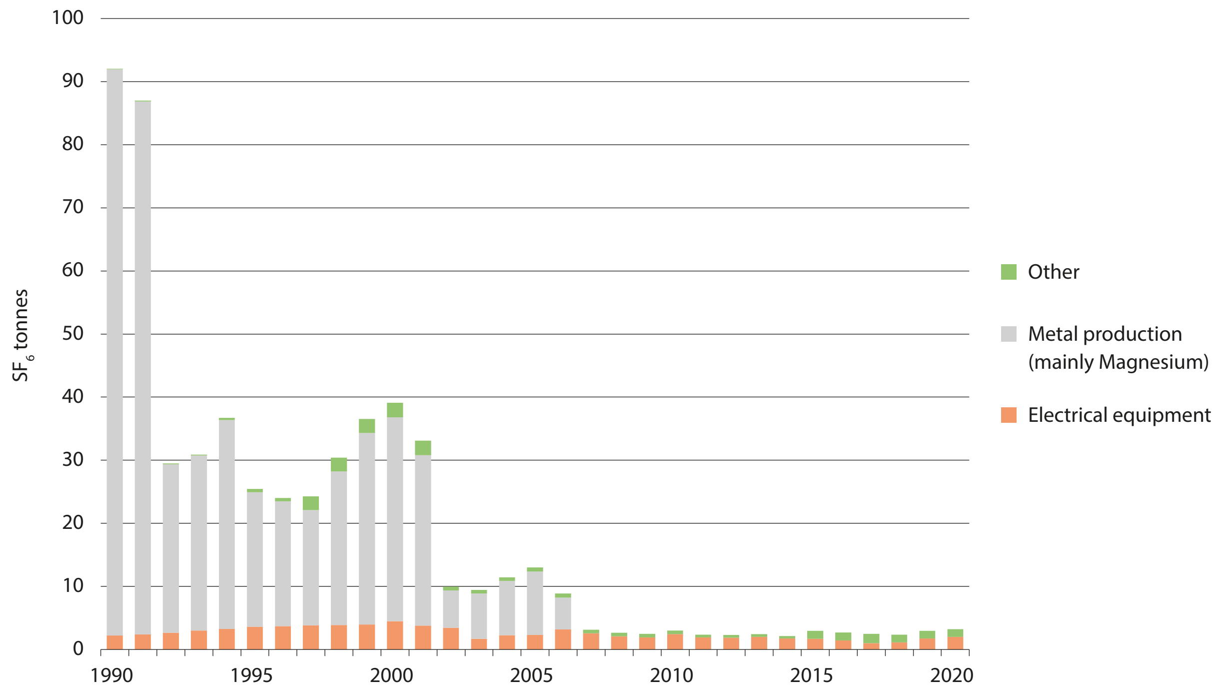
Source: Statistics Norway/ Norwegian Environment Agency

3.2.1.5 Emissions of sulphur hexafluoride (SF_6)

Until 2006, the largest source of SF_6 emissions in Norway was magnesium production. The consumption of SF_6 was reduced through the 1990s due to improvements in technology and process management, and to reductions in production levels. In 2020, the SF_6 emissions were 96.5 per cent lower than in 1990. Until 2002, SF_6 emission reductions were mainly due to the improved technology and process control within the metal industries. In 2002, production of cast magnesium closed down. In 2006, production of secondary magnesium closed down.

The main other use of SF_6 is in electrical equipment such as gas insulated switchgears (GIS) and other high-voltage applications. Since the signing of a voluntary agreement in 2002, emissions from these sources have decreased and were about 41.2 per cent lower in 2020 than in 2002.

Figure 3.11 Emissions of SF_6 (tonnes) in Norway 1990–2020



Source: Statistics Norway/ Norwegian Environment Agency

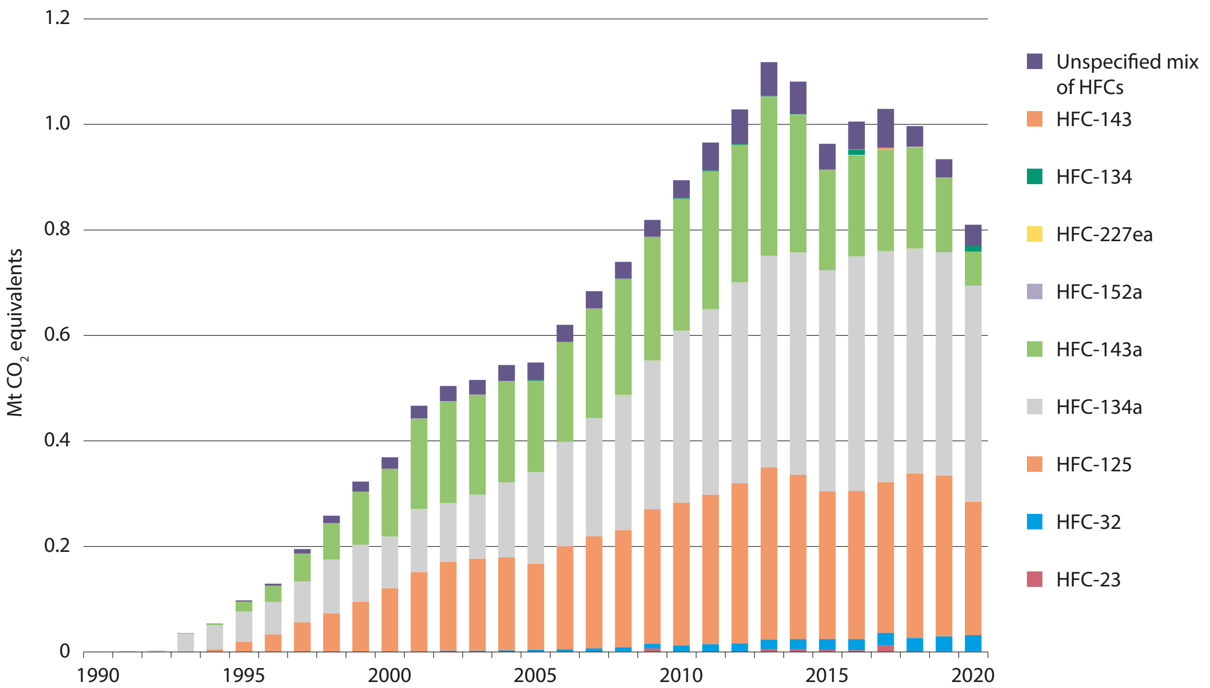
3.2.1.6 Emissions of hydrofluorocarbons (HFCs)

The total emissions from HFCs used as substitutes for ozone depleting substances amounted to 0.8 million tonnes of CO_2 equivalents in 2020. The emissions in 1990 were insignificant (44 tonnes CO_2 equivalents) but have increased substantially over the years. The emissions decreased by 13.3 per cent from 2019 to 2020.

The application category refrigeration and air conditioning contributes by far the largest part of the HFC emissions. The other categories foam/foam blowing agents and fire extinguishers contribute to small amounts of the overall emissions.

Figure 3.12 displays the development of HFC emissions since 1990. The trend is due to the strong demand for substitution of ozone depleting substances. The increase in HFC emissions has been moderated by a recent and rapid decline of emissions from transport refrigeration and industrial refrigeration. The decline was mainly a consequence of restrictions from the EU F-gas regulation (implemented in Norway) which includes restrictions to place on the market refrigeration equipment that contains HFCs with GWP of 2500 and restricts the use of HFC refrigerants with GWP of 2500 or more for servicing and maintenance of refrigeration equipment.

Figure 3.12 Actual emissions of HFCs (million tonnes CO_2-equivalents) in Norway, 1990–2020



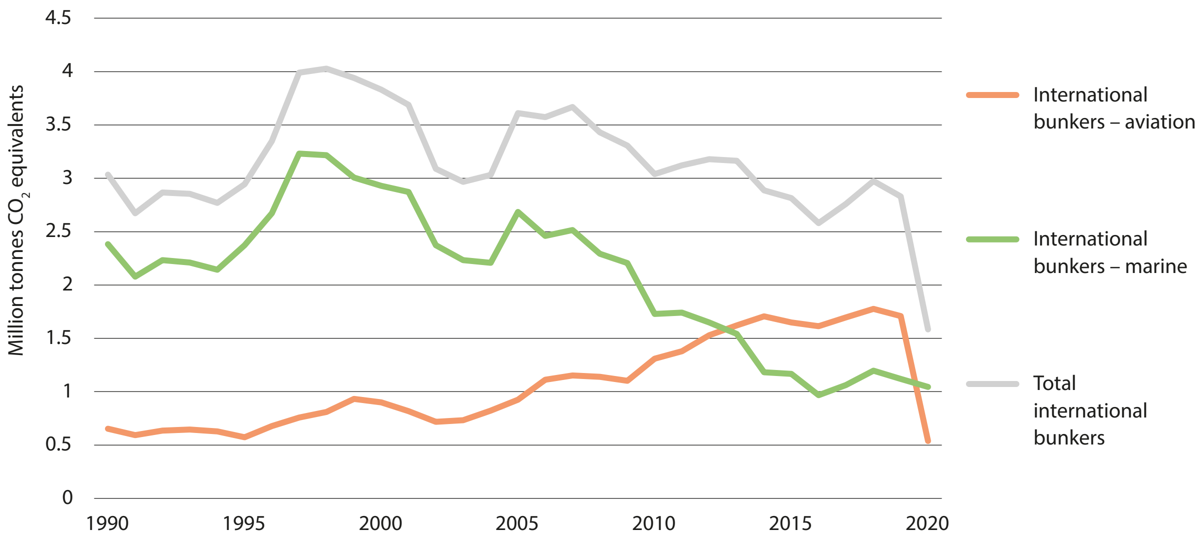
Source: Statistics Norway/ Norwegian Environment Agency

3.2.1.7 International bunkers

Norway reports emissions from international marine and aviation bunker fuels, but these emissions are not included in the national total, in accordance with the UNFCCC reporting guidelines. They are therefore reported separately as memo items in the NIR and in the CRF.

In 2020, CO_2, CH_4 and N_2O emissions from ships and aircraft in international traffic bunkered in Norway totalled 1.6 million tonnes CO_2 equivalents, which corresponds to about 3 per cent of the total Norwegian GHG emissions. The emissions from bunkers have decreased by 48 per cent from 1990 to 2020 and by 44 per cent from 2019 to 2020.

Figure 3.13 Emissions (CO_2, CH_4 and N_2O) from international bunkers, given in million tonnes of CO_2 equivalents



Source: Norwegian Environment Agency and Statistics Norway

During the period 1990–2020, emissions from marine bunkers decreased by 56 per cent. The emissions have varied greatly in this period and reached a peak in 1997. Thereafter there has been a descending trend in emissions.

The emissions from international air traffic bunkered in Norway was in 2020 0.5 million tonnes. The emissions in 2020 were about 18 per cent lower than in 1990. This is due to the covid-19 pandemic. In 2020 the emissions were 68 per cent lower than in 2019. In 2019, the emissions from international air traffic bunkered in Norway was almost three times higher than in 1990. However, as aircraft engines are improving their fuel-efficiency, it follows that the increase in international air traffic has in fact been higher than that of the emissions.

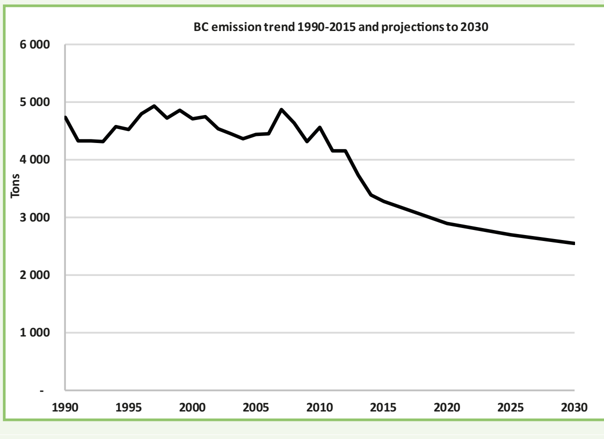
Box 3.1 Black carbon and organic carbon

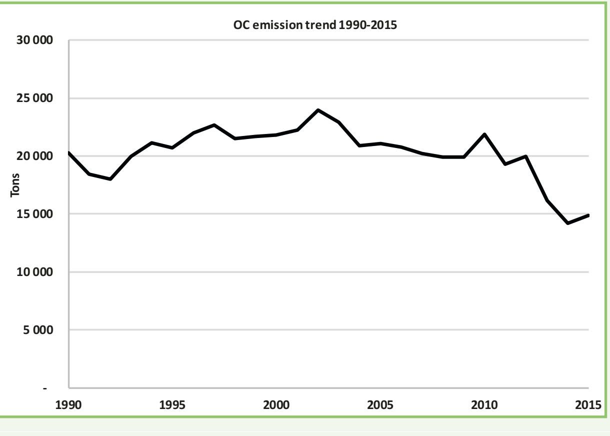
Black carbon and organic carbon are not regulated under the UNFCCC. On a voluntarily basis, Norway has reported BC annually under the Convention on Long-range Transboundary Air Pollution (LRTAP) since 2015. Norway has also reported BC biannually to the Arctic Council since 2015. In 2013, the Norwegian Environment Agency (NEA) published the first Norwegian emission inventories for black carbon (BC) and organic carbon (OC) in cooperation with Statistics Norway.[1] The developed methodology is documented in the report "Emissions of black carbon and organic carbon in Norway 1990–2011". These two climate forcers are always co-emitted but have the opposite effect on climate. In general, BC warms the climate, while emissions of OC leads to a cooling. The emissions are primarily estimated based on shares of BC and OC of fine particulate matter (PM2.5). Specific emission factors are available for two sources, namely wood combustion in the residential sector and flaring of natural gas onshore and offshore. Uncertainties have not been quantified but are anticipated to be high relative to uncertainties in other more "mature inventories".

NEA has assessed mitigation measures both in the short- and long term as well as health effects.[2,3] The largest single source of BC and OC in Norway is residential wood burning. NEA has therefore contracted experts to measure and analyse emissions from wood burning and suggest mitigation measures.[4,5,6] The country specific emission factors are used to develop the inventories.

For flaring emission from off-shore petroleum activity and on-shore refineries, the emission factor was developed based on a study by McEwen and Johnson.[7]

The emissions of BC and OC in 2020 were 2 907 and 10 304 tonnes respectively. The emission trends 1990–2020 and projections for BC and OC up to 2035 are shown in the figures below.





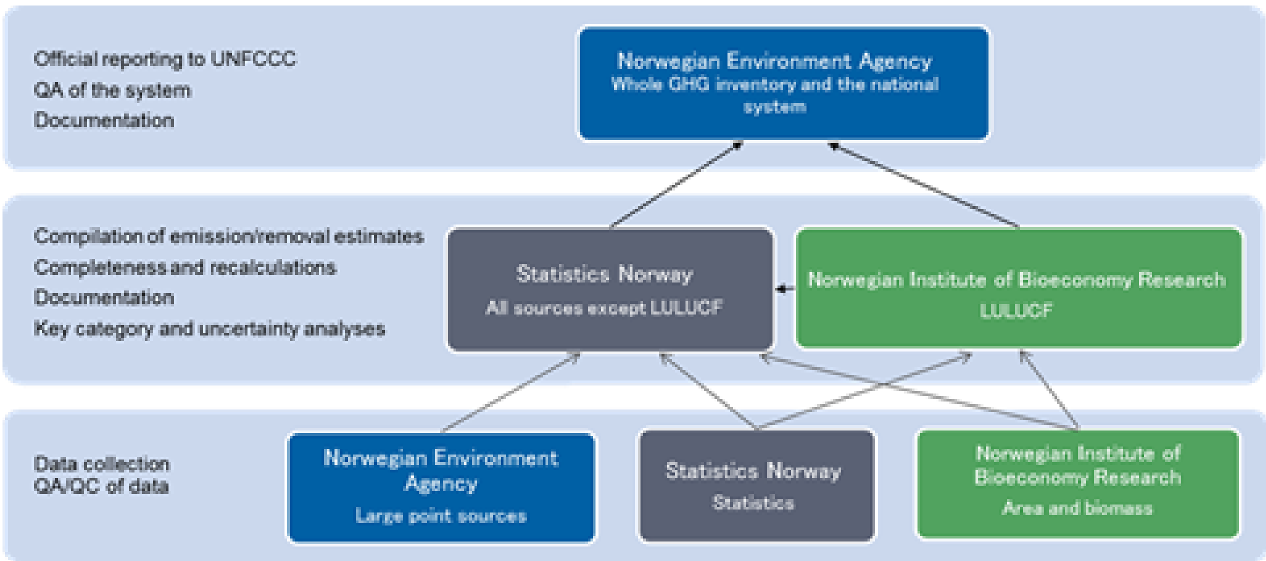
1. *http://www.ssb.no/natur-og-miljo/artikler-og-publikasjoner/_attachment/107884?_ts=13dfd568678*
2. Klimakur 2030: *https://www.miljodirektoratet.no/globalassets/publikasjoner/m1625/m1625.pdf#page=542*
3. *https://www.miljodirektoratet.no/publikasjoner/2021/mars-2021/mitigation-analysis-for-norway-20212030-short-term-climate-impacts-and-co-benefits/*
4. *https://www.miljodirektoratet.no/publikasjoner/2017/februar-2017/tiltaksutredning-vedrorende-utslipp-av-klimadrivere-fra-vedfyring/*
5. *https://www.miljodirektoratet.no/globalassets/publikasjoner/m518/m518.pdf*
6. *https://www.vista-analyse.no/no/publikasjoner/virkemidler-for-a-redusere-utslipp-fra-vedfyring/*
7. *James D.N. McEwen and Matthew R. Johnson (2012): Black Carbon Particulate Matter Emission Factors for Buoyancy Driven Associated Gas Flares. Journal of the Air & Waste Management Association, Volume 62, 2012, Pages 307-321. http://dx.doi.org/10.1080/10473289.2011.650040*

Source: Norwegian Environment Agency and Statistics Norway

3.3 National system / national inventory arrangements

The Norwegian 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 3.14.

Figure 3.14 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 1990–2020, National Inventory Report" (Norwegian Environment Agency Report M-2268).

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.

In the Norwegian greenhouse gas emission inventory key categories are identified by means of approach 1 and approach 2 methods. A description of the methodology as well as background tables and the results from the analyses are presented in the annual National Inventory Report.

The Norwegian greenhouse gas emission inventory has in 2022 been routinely recalculated for the entire time series 1990–2019 for all components and sources, in order to account for new knowledge on activity data and emission factors and to correct errors in the calculations. There is also a continuous process for improving and correcting the inventory and the documentation of the methodologies employed, based on questions and comments received in connection with the annual reviews together with needs of improvements recognised by the Norwegian inventory experts.

In general, the data contained in the Norwegian emission inventory are available to the public, both activity data and emission factors. In terms of spatial coverage, the emission reporting under the UNFCCC covers all activities within Norway's jurisdiction.

The data collection and data management are secured through three main acts, the Pollution Control Act, the Greenhouse Gas Emissions Trading Act and the Statistics Act.

For a complete description of the national inventory arrangements, see chapter 1.2 of the 2022 NIR. For comprehensive information regarding the national system under the Kyoto Protocol, see Annex V of the NIR. There have been no changes to the national inventory arrangements since Norway's fourth Biennial Report was reported.

Designated representative – contact information
Name: Siri Sorteberg
Position: Director, Department of Climate
Organisation: Norwegian Environment Agency
Postal address: P.O. Box 5672 Sluppen, 7485 Trondheim, Norway
Phone number: +47 73 58 05 00
Fax number: +47 73 58 05 01
E-mail address: *siri.sorteberg@miljodir.no*

3.4 National registry

Directive 2009/29/EC adopted in 2009, which was incorporated in the EEA agreement in July 2012, provides for the centralization of the EU ETS operations into a single European Union registry operated by the European Commission as well as for the inclusion of the aviation sector. At the same time, and with a view to increasing efficiency in the operations of their respective national registries, the EU Member States who are also Parties to the Kyoto Protocol (26) plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries – in particular Decision 13/CMP.1 and Decision 24/CP.8. The consolidated platform which implements the national registries in a consolidated manner (including the registry of the EU) is called the Union registry. A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

Terms of cooperation between the European Commission (Central Administrator) and the national administrators have been agreed by the administrators' working group. They include common operational procedures for the implementation of the sixth and seventh Registry Regulation (Regulation (EU) No 389/2013 and Regulation (EU) No 2019/1122) and change and incident management procedures for the Union Registry.

Information on the Union Registry
The Union Registry is developed on the basis the following modalities:

- Each Party has the role as National registry administrator and is responsible for all the obligations of Parties that are to be fulfilled through registries;
- The Norwegian Environment Agency is the responsible entity for the administration of Norway's national emissions trading registry
- Each Kyoto unit issued by the Parties in the consolidated system is issued by one of the constituent Parties and continues to carry the Party of origin identifier and has a unique serial number;
- Each Party retains its own set of national accounts as required by paragraph 21 of the Annex to Decision 15/CMP.1. Each account within a national registry has a unique account number with the country code (ISO 3166-alpha-2) of the Party as a prefix;
- Kyoto transactions is forwarded and checked by the UNFCCC Independent Transaction Log (ITL), which is responsible for verifying the accuracy and validity of those transactions;
- The transaction log and registries reconcile their data with each other in order to ensure data consistency and facilitate the automated checks of the ITL;
- All registries reside on a consolidated IT platform sharing the same infrastructure technologies. The chosen architecture implements modalities to ensure that the consolidated national registries are uniquely identifiable, protected and distinguishable from each other;
- Each national registry connects to the ITL directly and establishes a secure communication link through a consolidated communication channel (VPN tunnel).
  a. The ITL remains responsible for authenticating the national registries and takes the full and final record of all transactions involving Kyoto units and other administrative processes.

b. The consolidated platform is keeping data confidential and protected against unauthorized manipulation.
c. The data storage architecture also ensures that the data pertaining to a national registry are distinguishable and uniquely identifiable from the data pertaining to other consolidated national registries.
d. Each national registry keeps a distinct user access entry point (URL) and a distinct set of authorisation and configuration rules.
e. The detailed security measures cannot be shared in detail, as that would compromise security.

Following the successful implementation of the Union registry, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on 20 June 2012. During the go-live process, all relevant transaction and holdings data were migrated to the Union registry platform, and the individual connections to the ITL were re-established for each National registry.

In the following table, we provide an update on any changes to the Norwegian national registry that have occurred since the last National Communication report. Any changes are reported annually in the National Inventory Report.

Table 3.3	Changes to the Union Registry

Reporting Item	Description
15/CMP.1 Annex II.E paragraph 32.(a) Change of name or contact	Changes have occurred since 2018, see annual submissions of NIRs. The current registry administrators are Mona Marstrander Rødland, Helga Soppeland Larsen, Åshild Færevåg, Carina Lillestøl, Thomas Pallesen and Tor Egil Tønnessen Kjenn.
15/CMP.1 Annex II.E paragraph 32.(b) Change regarding cooperation arrangement	In 2021 there was a change in the cooperation arrangement as the United Kingdom of Great Britain and Northern Ireland no longer operate their registry in a consolidated manner within the Consolidated System of EU registries.
15/CMP.1 Annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	In 2020 there was a new EUCR release (version 11.5), and some changes were applied to the database. The updated database model is provided each year in Annex A of chapter 14 of Norway's NIR. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(d) Change regarding conformance to technical standards	Each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and are carried out prior to each release of a new version in Production (Annex B of chapter 14 in NIR). The test reports are provided to the UNFCCC as part of the annual inventory submissions. No other change in the registry's conformance to the technical standards occurred for the reported period.
15/CMP.1 Annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(f) Change regarding security	In January 2022 the mandatory use of software tokens (mobile app) for authentication and signature was introduced for registry users (not administrators).
15/CMP.1 Annex II.E paragraph 32.(g) Change to list of publicly available information	Publicly available information is provided via the Union registry homepage for Norway: *https://unionregistry.ec.europa.eu/euregistry/NO/public/reports/publicReports.xhtml*
15/CMP.1 Annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reporting period.
15/CMP.1 Annex II.E paragraph 32.(j) Change regarding test results	The site acceptance tests are carried out by quality assurance consultants on behalf of and assisted by the European Commission. The acceptance test report is provided to the UNFCCC in Annex B of chapter 14 of the inventory submission.

Registry administrators – contact information
The Registry administrator is still within the Norwegian Environment Agency.
Post address: Postboks 5672 Torgarden, 7485 Trondheim, Norway
Functional mailbox: *kvoteregister@miljodir.no*

Publicly available information
Norway is fulfilling the requirements of paragraphs 44 to 48 of the Annex to Decision 13/CMP.1 concerning making non-confidential information accessible to the public. This is done by publishing the information on the Union registry web page. In addition, the Standard Electronic Format reports are available on the national information website of the Norwegian registry: (*https://www.miljodirektoratet.no/ansvarsomrader/klima/klimakvoter/public-reports/*).

The registry information web page (*www.kvoteregister.no*) also provides links to the Union Registry web page containing additional public information.

In line with the General Data Protection Regulation (EU) No 2016/679, and in accordance with Article 110 and Annex XIV of Commission Regulation (EU) No 389/2013, the information on account representatives, account holdings, account numbers, legal entity contact information, all transactions made and carbon unit identifiers, held in the EUTL, the Union Registry and any other KP registry (required by paragraph 45 and paragraph 48) is considered confidential. This information is therefore not publicly available.

More information about the accounts and the account holders in the Norwegian registry, can be found on the search pages of EUTL: http://ec.europa.eu/environment/ets/account.do?languageCode=en&account.registryCodes=NO&identifierInReg=&accountHolder=&search=Search&searchType=account&currentSortSettings

Internet address
The internet address of the Norwegian registry has changed since the last National Communication: *https://unionregistry.ec.europa.eu/euregistry/NO/index.xhtml*

To help our users and the public to easily find registry specific information, the redirecting web address *www.kvoteregister.no* has been set up. The page redirects a person to the Agency's subpage *https://www.miljodirektoratet.no/ansvarsomrader/klima/klimakvoter/klimakvoteregisteret/*

4 POLICIES AND MEASURES

4.1 Policymaking process

4.1.1 Overview

Norway's climate policy is based on the objective of the United Nations 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.

Climate change and emissions of greenhouse gases have featured on the policy agenda in Norway since the late 1980s. Today, Norway has a comprehensive set of measures covering almost all emissions of greenhouse gases as well as removals.

Norway has ratified the Paris Agreement and is working towards its overall objectives, including by:

- contributing to efforts to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change
- increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production
- making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development

Norway has ambitious climate targets that are set out in various policy documents: the updated cross-party agreement on climate policy from 2012 (published as a recommendation to the Storting (Innst. 390 S (2011–2012)) in response to the white paper on Norwegian climate policy from the same year (Meld. St. 21 (2011–2012)); the white paper *New emission commitment for Norway for 2030 – towards joint fulfilment with the EU* (Meld. St. 13 (2014–2015)) and a subsequent recommendation to the Storting (Innst. 211 S (2014–2015)); the documents relating to the Norwegian Parliaments consent to ratification of the Paris Agreement (Innst. 407 S (2015–2016) and Prop. 115 S (2015–2016)); and the Climate Change Act that the Norwegian Parliament adopted in June 2017. The previous government's strategy for fulfilling the 2030 climate target (Meld. St. 41 (2016–2017) was issued in June 2017 and a climate action plan for 2021–2030 was issued in January 2021 (Meld. St. 13 (2020–2021). The Støre Government presented a climate status and plan for the 2030 climate target in a separate attachment to Prop. 1 S (2022–2023) in October 2022.

Box 4.1 Norway's climate targets

1. Under the Paris Agreement, reduce emissions by at least 55 per cent by 2030 compared to 1990.
2. As an interim goal on the road to net zero emissions and the low-emission society, the government has set a transition target for the entire economy in 2030. This is formulated in the government platform as a target to cut Norwegian emissions by 55 per cent compared to 1990.
3. Be climate neutral from 2030.
4. Become a low-emission society by 2050 and reduce emissions by 90–95 per cent compared to 1990.

4.1.1.1 NDC for 2030

Following the decision 1/CMA.3 Glasgow Climate Pact paragraph 29, Norway revisited the 2030 target in its Nationally Determined Contribution (NDC). In November 2022, Norway communicated its updated NDC to reduce emissions by at least 55 per cent by 2030, compared to 1990 levels. Norway's NDC is economy wide, covering all sectors and greenhouse gases. Norway's intention is to fulfil this target in cooperation with the EU. The updated 2030 target of at least 55 per cent has not yet been updated in the Norwegian Climate Change Act, but the Government will make a proposal to Parliament in order to amend the Act to update the target in line with this NDC.

Iceland and Norway entered into an agreement with the EU in October 2019 to cooperate to fulfil their respective climate targets. Under the agreement, Norway will take part in EU climate legislation from 2021 to 2030. The legislation is designed to achieve emission reductions of at least 40 per cent compared with the 1990 level. This is an overall target for all EU member states, Iceland and Norway and for all sectors.

The EU's climate policy has three main pillars. The first pillar of EU climate policy deals with ETS emissions. The EU Emissions Trading System applies to the largest emission sources within Norwegian manufacturing industries and the petroleum industry. The cap, or number of emission allowances in the system, is being gradually reduced to achieve a reduction of 43 per cent in emissions in 2030 compared with 2005. This is an overall reduction for all installations covered by the EU ETS. Emissions from European aviation have been included in the EU ETS since 2012.

The second pillar of EU climate policy deals with emissions not covered by the EU ETS, but by the effort sharing regulation (ESR). Norway's target for the ESR emissions under its agreement with the EU is a 40 per cent reduction by 2030 compared with the 2005 level. This has been translated into a binding emission budget with emission ceilings for each year in the period 2021–2030. The legislation allows for each country's emission budget to be met through a combination of emission reductions within the country and transfers of emission units from other European countries.

The third pillar of EU climate policy deals with the Land Use, Land Use Change and Forestry (LULUCF) sector. This includes anthropogenic emissions and removals of greenhouse gases from land use, land use change and forestry. The factors that particularly influence emissions and removals are the level of harvesting (relative to harvest level modelled in the forest reference level FRL), land-use change such as deforestation and afforestation, and the natural spread of forest and scrub. The EU's climate legislation includes accounting rules for emissions and removals in the LULUCF sector. Norway has an obligation to ensure that overall greenhouse gas emissions from the LULUCF sector do not exceed removals (this is known as the 'no debit' rule). According to the regulation, the obligation can be fulfilled by implementing measures in the national LULUCF, and/or through extra national reductions in non-ETS emissions, for example in the transport and agriculture sectors, and/or through purchasing buy emission units from EU countries or Iceland.

When Norway and the EU concluded their agreement, the target both parties had communicated to the UN was still a 40 per cent reduction in emissions by 2030 compared with the 1990 level. The EU will be making necessary amendments to its the legislation to ensure that the new and enhanced 2030 climate target is achieved. Once the legislation has been adopted by the EU, Norway will need to consider whether the updated legislation should also be made applicable in Norway, and if so on what conditions. The legislation will not apply in Norway until the Storting has given its consent.

Norway is not mentioned in the proposed amendments to the EU legislation. From the proposed targets for ESR emissions for comparable countries, it is likely that Norway can get a reduction target of 50 per cent compared to 2005 should the climate agreement with the EU be updated. Such a target will translated into a binding emission budget with emission ceilings for each year in the period 2021–2030. For information on the climate status and plan for the 2030 climate target, see Box 4.2

Norway seeks to fulfil the updated NDC of least 55 per cent reductions through the climate cooperation with the European Union. Final accounting towards the target may depend on any further arrangements in Norway's cooperation with the European Union and Iceland, including in the European Trading System. If necessary, Norway will use voluntary cooperation under Article 6 of the Paris Agreement to fulfil the part that goes beyond what is achieved through the climate cooperation with the European Union.

Box 4.2 Annual climate status and plan

The Støre Government presented a climate status and plan in a separate attachment to Prop. 1 S (2022–2023) in October 2022. The climate status and plan will be updated annually and summarises the government's climate policy. The climate status and plan has not yet been debated by the Norwegian Parliament.

Norway will report on its progress made and implementing its NDC in its first Biennial Transparency Report in 2024. Since Norway and the EU both have individual NDCs/targets under the Paris Agreement, the cooperation is envisaged to include transfers and acquisitions of ITMOs and follow the guidance under Article 6 of the Paris Agreement. See box 4.3 for further information.

ESR emissions

Chapter 5 of this National Communication presents updated projections of GHG emissions. Table 5.2 shows that the projections for the ESR emissions are estimated to decrease from 24.8 million tonnes CO_2 equivalents in 2020 to 20.5 million tonnes CO_2 equivalents in 2030. The projections for the period 2021–2030 are about 13 million tonnes CO_2 equivalents higher than the given emission budget under the current EU legislation for the ESR sector (40 per cent reduction in 2030 compared to 2005).

Correspondingly, the emissions are about 21 million tonnes CO_2 equivalents higher than the estimated emission budget Norway may get should the climate agreement with the EU be updated and Norway gets a reduction target of 50 per cent compared to 2005, based on the proposal from the EU Commission. The Støre-government is therefore making provisions for, and is planning to, reduce the ESR emissions by 50 per cent by 2030.

In the budget proposal for 2023, the Støre-government proposes climate measures that can reduce the GHG emissions. It is estimated that measures proposed in the budget in aggregate can reduce the non-ETS emissions by 9.3–9.9 million tonnes of CO_2 equivalents in the period 2021–2030. The majority of this, about 5.6 million tonnes CO_2 equivalents can come from increased climate taxes. 3.3 million tonnes CO_2 equivalents can come from increased mandatory biofuels turnover for road traffic and the introduction of mandatory biofuels turnover for non-road machinery. The government has also decided to establish Bionova, a financial mechanism for supporting climate measures in the agricultural sector. It is estimated that Bionova could reduce the emissions within the agricultural sector by 0–0.6 million tonnes CO_2 equivalents and a further 0.4 million tonnes CO_2 equivalents could come as a result of strengthening Enova (see chapter 4.3.3.2).

A further 10.4 to 11 million tonnes of CO_2 equivalents in the period 2021–2030 can come from policies and measures that are under consideration The estimates are uncertain, but further increases in the mandatory biofuels turnover for road traffic and non-road machinery combined with the introduction of mandatory biofuels turnover for domestic shipping and fisheries could result in emission reductions of 4.5 million tonnes of CO_2 equivalents Further measures in the agricultural sector can reduce the emissions by 3.4–4.0 million tonnes CO_2 equivalents An additional 2.5 million tonnes CO_2 equivalents can come from several public procurement processes to promote the development and deployment of zero- and low-emission solutions in the transport sector.

In total, the upper estimates of proposes climate measures and policies and measures that are under consideration could add up to 20.3 million tonnes of CO_2 equivalents With these measures the estimated emission reductions for ESR emissions would be close to 50 per cent by 2030.

These policies and measures have not been adopted. The potential effect is visualized in figure 5.3.

Land Use, Land Use Change and Forestry sector (LULUCF)
New projections for the LULUCF sector indicate that Norway is likely to have a total annual net emission (i.e. a gap to the "no debit rule"). The annual gap may be 3.2 million tonnes of CO_2 equivalents in the period 2021–2025 if Norway uses the Managed forest land flexibility mechanism which the LULUCF-regulation (2018/841) allows for. Without this mechanism, the total annual emissions gap for the forestry and land use sector may be 6.7 million tonnes of CO_2 equivalents

Box 4.3 Pursuing cooperation with the EU on implementing the respective NDCs

Norway pursues cooperation with the EU on implementing their respective NDCs. Norway, Iceland and Liechtenstein have been participating in the EU ETS since 2008. For the period from 1st January 2021 to 31st December 2030, Norway is pursuing its cooperation with the EU on implementing their respective NDCs and have together with Iceland agreed to implement the EU Effort Sharing Regulation (ESR) and LULUCF Regulation in accordance with the EEA Agreement Protocol 31.

Cooperation on implementation of the NDC enables Norway to have a higher level of ambition and thus gives a benefit to the atmosphere. In 2019, the EU, Iceland and Norway agreed on cooperation to fulfil our respective prevailing NDCs. Since then the EU, Iceland and Norway have updated their NDCs and strengthened their respective targets substantially. The EU is updating its legislation to be in line with the updated NDC. This process is ongoing. The main elements of the European legislation will need to be agreed before any cooperation between EU and Norway on implementation of the updated NDCs can be finalised.

Details concerning the possible flow of internationally transferred mitigation outcomes ((ITMOs), any accounting approaches, national arrangements, registries, other reporting requirements including related to adaptation finance and overall mitigation of global emissions, will be addressed in future reporting under the Paris Agreement.

4.1.1.2 Transition target for 2030

As an interim goal on the road to net zero emissions and the low-emission society, the government has set a transition target for the entire economy in 2030. This is formulated in the government platform (Hurdal) as a target to cut Norwegian emissions by 55 per cent compared to 1990. This means that the government has a national target to transition both the EU-ETS and the ESR sectors. The purpose is for the entire Norwegian economy to transition in the direction of a low-emission society.

The Norwegian transition goal and our international targets complement each other. The target from the Hurdal platform will not be registered as a NDC under the Paris Agreement, or enshrined in the Climate Act.

The transition target will be achieved through an ambitious and responsible climate policy, and we are dependent on both Norwegian and international technological development to be able to achieve it. Which specific measures are to be implemented will be assessed on an ongoing basis based on what is appropriate in the long term transition perspective, and will be assessed in consultation with the business community. The aim is to promote a sensible long-term transition for the entire economy and promote the technological development on which we depend. Emphasis must be placed on Norwegian business and industry being competitive in the future, and that it is assumed that Norway will still have a surplus in the electric power balance. The goal must not entail an ineffective climate policy or disproportionately expensive measures.

Many technology projects can have a long and unpredictable lead time, but provide significant emission reductions in the long term. In the case of large point sources, for example, it will be possible to get significant contributions to Norwegian emission reductions as old technology is replaced with new. This means that one cannot expect a linear reduction in emissions. Electrification of fossil energy use and new power-intensive industries require sufficient power generation and grid capacity. Electrification projects on the continental shelf will be assessed on a case-by-case basis, and must take into account the consequences for the power system and access to affordable renewable power for other industries and households.

4.1.1.3 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. Climate neutrality can be achieved through the EU Emissions Trading System (ETS), international cooperation on emission reductions, emission allowance trading and project-based cooperation. The full operationalization of the target is not yet finalized.

The Paris Agreement provides for cooperation between countries to implement their NDCs and national climate targets. The Government is working on the development of pilots for market cooperation under the Paris Agreement that can be used towards the climate neutrality target. Cooperation of this kind will make it possible to cut emissions more rapidly and at lower cost, and will contribute to a green transition in other countries. This will in turn enable countries to set more ambitious targets.

4.1.1.4 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 90–95 per cent from the level in the reference year 1990. The effect of Norway's participation in the EU ETS is to be taken into account in assessing progress towards this target. 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.

Norway's long-term low-emission strategy for 2050 was adopted by the Norwegian Parliament in October 2019. A translation into English was submitted to the UNFCCC in November 2020.

4.1.2 Policy instruments

The polluter pays principle is a cornerstone of the Norwegian policy framework on climate change. Policies should be 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 eco-nomic policy instruments that put a price on emissions (i.e. the taxes on emissions of greenhouse gasses and the EU emission trading system) form the basis for decentralised, cost-effective and informed actions, where the polluter pays. As a main rule, areas subject to general policy instruments, should not be subject to additional regulation. For non-ETS emissions, taxes on greenhouse gases is the main mitigation measure. If the tax is not considered to be an adequate or appropriate instrument, other instruments that reduce emissions will be considered, including direct regulation under the Pollution Control Act and voluntary agreements. Norway also employs biofuel sales mandates as an important policy instrument for reducing ESR emissions.

Over the last ten years, the scope of Norwegian carbon pricing has steadily increased. Close to 85 per cent of domestic greenhouse gas emissions are from 2022 either covered by the emissions trading scheme or taxes on greenhouse emissions. The level of carbon pricing is also among the highest in the world, with over 80 per cent of emissions being priced at or above approximately 80 USD in 2022. There is also a broad political consensus on increasing the taxes on ESR emissions to above USD 200 in 2030, and to continue the participation in the EU-ETS.

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 pro-vide the solutions.

4.1.3 Responsibilities for the different institutions

The overall national climate policy is decided by the Storting, and the government implements and administers the most important policies and measures, such as economic instruments and direct regulations. Most policies and measures in the area of climate policy are developed through interministerial processes before the political proposals are tabled. The Ministry of Climate and Environment has the overarching cross-sectoral responsibility for co-ordination and implementation of the Norwegian climate policy. It also operates the Norwegian carbon credit procurement program. The Ministry of Finance is responsible for the tax schemes. The other ministries are responsible for policies in their respective sectors.

Local governments are responsible for implementing policies and measures at the local level, for example through waste management, local planning and some transport measures. In 2009, guidelines were introduced for climate and energy planning in the municipalities. New guidelines describing how the municipalities and counties can incorporate climate change adaptation work into their planning activities are currently being developed.

The Norwegian Environment Agency is a government agency under the Ministry of Climate and Environment. The Environment Agency implements government pollution and nature management policy. Important fields of work in relation to pollution control include climate, hazardous substances, water and the marine environment, waste management, air quality and noise. The

Environment Agency manages and enforces the Pollution Control Act, the Product Control Act and the Greenhouse Gas Emission Trading Act, and the Nature Diversity Act, among others.

The Environment Agency grants permits, establishes requirements and sets emission limits, and carries out inspections to ensure compliance.

The Environment Agency also monitors and informs about the state of the environment. The Environment Agency has an overview of the state of the environment and its development. Together with other expert agencies, the Environment Agency provides environmental information to the public. The main channel is State of Environment Norway: www.environment.no

The Environment Agency supervises and monitors the County Governors' work on pollution, coordinates the County Governors' inspection work and organises joint inspections. The Environment Agency provides guidelines for the County Governors and also deals with appeals against decisions made by the County Governors.

The Environment Agency participates in a series of international processes, to promote regional and global agreements that reduce serious environmental problems. Moreover, the Environment Agency also cooperates with the environmental authorities in other countries, sharing competence and furthering environmental improvements.

The Norwegian Water Resources and Energy Directorate (NVE) is a directorate under the Ministry of Petroleum and Energy. NVE's mandate is to ensure an integrated and environmentally sound management of the country's water resources, promote efficient energy markets and cost-effective energy systems and promote efficient energy use. For more information, see: www.nve.no/en. Pursuant to changes in the Solberg Government in January 2018, the Minister for Climate and Environment is responsible for the state owned enterprise Enova www.enova.no/about-enova, which contributes towards Norway's emission reduction commitments and contributes to the transition to a low-emission society.

Norway has actively addressed sustainable development since the World Commission on Environment and Development submitted its report Our Common Future in 1987. In 2015 UN presented new and ambitious sustainable development goals. There are 17 main goals and 169 intermediate objectives. Through Agenda 2030 the international community has made a commitment that no people are left behind in the implementation of the goals. The goals are global, and all countries must do their part. In 2016 Norway was among the first countries to report to the UN on status for their follow up of the goals. A new Norwegian status report ("One Year Closer") was presented this year.

The Government underscores that the follow-up of the sustainable development goals shall be integrated in the ordinary government decision-making processes. Each of the 17 sustainable development goals has been assigned to one responsible Ministry. All ministries shall report on the follow-up of their responsibilities in the budget documents. The Foreign Ministry coordinates the processes at international level.

4.1.4 Assessment of the economic and social consequences of response measures (and minimisation of adverse impacts)

Norway strives 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 minimise adverse effects of climate policies and measures on the economy.

In developing environmental, as well as the economic and energy policy, Norway endeavours to include 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 climate taxes and by participation in the European Emissions Trading Scheme (EU ETS). These instruments place a price on emissions of greenhouse gases. The Norwegian Government contends that the best way to reduce emissions on a global scale, in line with the aims limiting the global average temperature increase to 1.5 °C above pre-industrial levels, would be to establish a global price on emissions. Pursuing a global price on emissions would be an 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 minimise adverse impacts of mitigation. For more information about climate taxes and the design of the EU ETS, see chapter 4.3.2.

Norway is involved in several international and regional initiatives that contribute to technology development and transfer and enhanced capacity building to developing countries with the aim of contributing to maximize the positive and minimize the negative effects of response measures, including economic diversification and a just transition. One important aspect is to facilitate the shifting of the energy mix away from high emission sources to more renewable energy systems and low-emission sources and diversifying economies. These initiatives are reported here as relevant activities under Article 3.14 of the Kyoto Protocol. In addition, Norway has a member in the Katowice Committee for the Implementation of Response Measures.

The former 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. An expert commission presented its report with an analysis of Norway's exposure to climate risk in December 2018. The report has 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. For further information, see chapter 15.2 of Norway's National Inventory Report for 2022.

The Norwegian Oil for Development (OfD) programme, which was launched in 2005, aims at assisting developing countries, at their request, 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. A description of the OfD program can be found at: *https://www.norad.no/en/front/thematic-areas/oil-for-development/*. The programme is currently engaged in 8 countries, mainly in Africa.

The operative goal of the program is "economically, environmentally and socially responsible management of petroleum resources which safeguards the needs of future generations." OfD takes a holistic approach meaning that management of petroleum resources, revenues, environment and safety are addressed in a coherent manner. OfD assistance is tailor-made to the particular needs of each partner country. It may cover the designing and implementing legal frameworks, mapping of resources, environmental impact assessments, handling of licenses, establishing preparedness to handle accidents and oil spills, health, safety and environmental legislation, petroleum fiscal regimes and petroleum sovereign wealth fund issues as well as initiatives related to transparency, anti-corruption, and climate change.

In 2021 the prior government decided to gradually phase out the OfD and discontinue the programme by 2024. This change was conducted to steer the development assistance in a greener direction with focus on climate change and renewable energy. In accordance with the Norwegian development policy with focus on renewable energy, the OfD programme shall be transformed into an Energy for Development (EfD) programme, which is in the process of being developed.

The policy of the Norwegian government is to integrate development and climate, as these major challenges are highly interlinked. Increased access and transition to renewable energy is the main priority. Renewable energy has been part of Norway's development assistance policy for several years. In addition to extensive support through multilateral and multi-donor funding, several countries, mainly in Sub-Saharan Africa, have received bilateral Norwegian renewable energy funding. The overall objective of Norway's contribution to renewable energy is to contribute to access SDG 7 and the Paris Agreement. The intervention in renewable energy is also seen as a contribution to reduce further development of coal power. For further information, see chapter 15.4 of Norway's National Inventory Report for 2022

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. Transparency, predictability and participation for all interest groups and authorities involved are key aims, and it is intended that long-term solutions and awareness of effects on society and the environment will be promoted.

4.2 Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures

4.2.1 Domestic and regional legislative arrangements and enforcements

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. The relevant arrangements will be discussed in more detail in 4.3.

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. See further description of Norway's climate targets in 4.1.

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. Since 2018, the Government has annually reported information as required by the Climate Change Act as part of the state budget process in October each year.

4.2.2 Provisions to make information publicly accessible

Norway has undertaken extensive provisions to make climate information publicly available. This issue is discussed further in chapter 9.

4.3 Policies and measures and their effects

4.3.1 Introduction

The main instruments of Norwegian climate policy are cross-sectoral: taxes on greenhouse gas emissions and emissions trading. Use of these instruments will contribute to fulfilment of emission targets at lowest cost to society. In addition to instruments that put a price on emissions, the Government uses other policy instruments to reduce barriers and correct market failures related to technology development, and in specific markets. It can be appropriate to use direct regulation on its own when an alternative technology or a different solution is mature enough to be deployed. Which policy instruments are suitable and where depends partly on which low- and zero emission alternatives are available and how mature they are. Different forms of market failure and barriers require different combinations of policy instruments.

This chapter describes some of the most important policies and measures (PaMs) for reducing greenhouse gas emissions in Norway. The chapter consists of textual descriptions of cross-sectoral and sectoral PaMs, and each sector has a summary table for the PaMs. Through these summary tables, the reporting of the PaMs is clearly subdivided by gases. The summary tables present the effects on greenhouse gas emissions of many PaMs and the total aggregated effects are summed up in chapter 5.6.

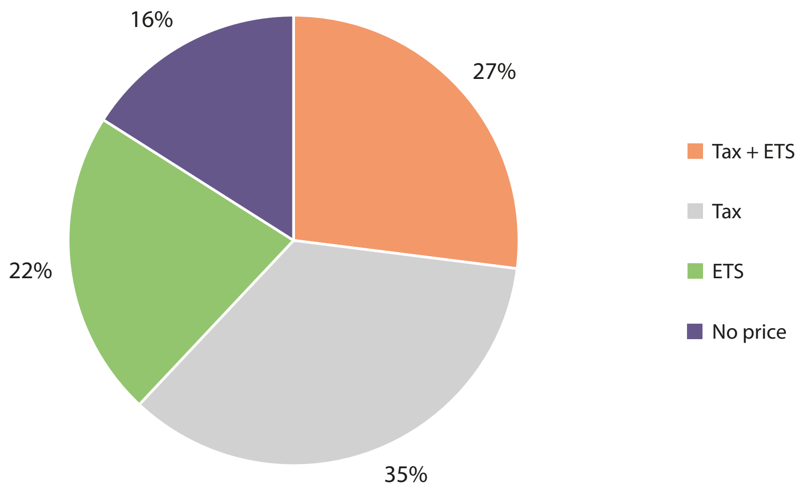
4.3.2 The Norwegian system of carbon pricing

4.3.2.1 Introduction

The main instruments of Norwegian climate policy are taxes on greenhouse gas emissions and emissions trading. Both these instruments put a price on emissions and make it more expensive to release greenhouse gases. Taxes provide an incentive to reduce emissions both through immediate action and through investment in research and development that will make it possible to reduce emissions at a later date. General policy instruments are a key part of the domestic climate policy. Cross-sectoral economic policy instruments (climate taxes) form the basis for decentralized, cost-efficient and informed actions, where the polluter pays. In areas subject to general policy instruments, additional regulation should as a main rule be avoided. The Government has implemented instruments in addition to emissions trading and climate taxes in some sectors.

Cost-efficient policy instruments ensure that reductions in emission are implemented in a way

Figure 4.1 Emissions covered by economic measures by instrument type.



that leads to the lowest cost to society as a whole. If policy instruments are not cost-efficient, 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.

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 Norway, CO_2 taxes and quotas (EU ETS) cover close to 85 per cent of greenhouse gas emissions. In 2022, the standard tax rate on non-ETS emissions is 766 NOK per tonne CO_2 and is levied on most uses of mineral oils, petrol and diesel, natural gas, LPG and HFC/PFC see Table 4.1 and Table 4.2.

The price on greenhouse gas emissions varies 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 taxes in addition to the EU ETS, and the total price on emissions is about NOK 1 500 in 2022. 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.

If *natural gas and LPG* 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) fishing in distant waters, chemical reduction or electrolyses, metallurgical and mineralogical processes and international shipping and aviation. EEA state aid regulation will in certain cases prevent Norway from exempting emissions covered by the EU ETS from taxes. The Norwegian parliament has adopted a tax on chemical reduction etc., but the tax will only be put into effect in the case where an exemption for emissions covered by the ETS can be implemented.

The development in Norwegian taxes on GHGs from our last report is illustrated in figure 4.2. Overall price levels have increased due to increases in the tax rates and the increase in the price of allowances in the EU ETS. Furthermore, the reduced rate for fisheries was abolished in 2020, and a new tax on emissions from waste incinerations was introduced in 2022.

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.

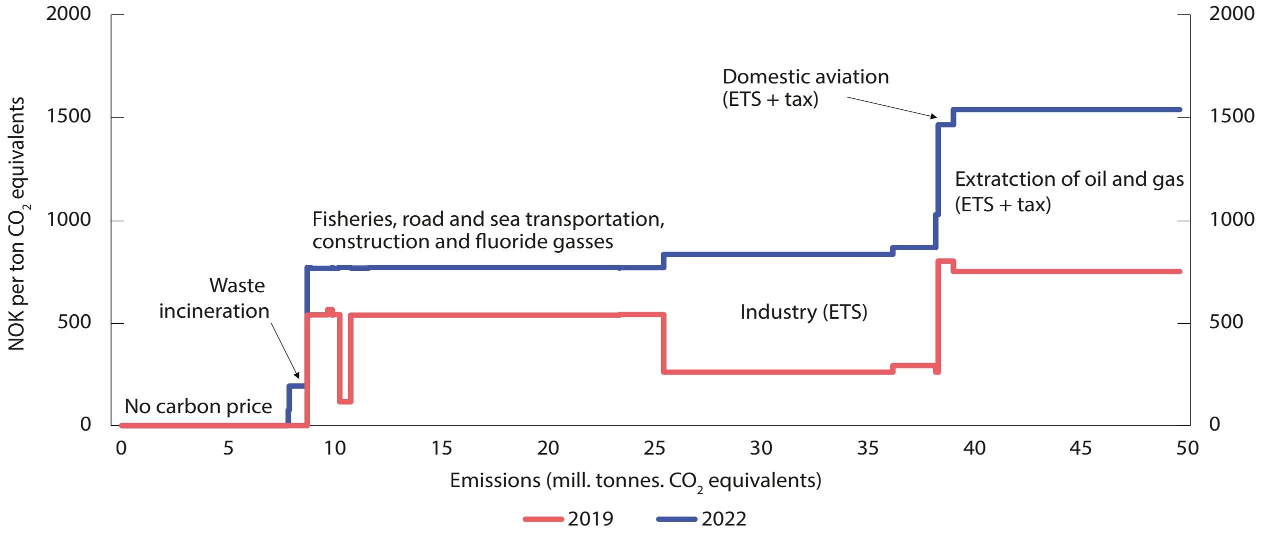
Table 4.1 shows all current taxes on emissions of greenhouse gases. Below follows a description of the effect of green taxes on mainland emissions. Chapter 4.2.3 discusses in more detail the CO_2 tax on petroleum activities and its effects on emissions offshore.

Table 4.1 Norwegian taxes on emissions of greenhouse gases in 2022.

	NOK. per l/Sm³/kg/ ton	NOK. per ton CO_2
CO_2-tax on mineral products		
Petrol	1.78	766
Mineral oil		
Standard rate	2.05	766
Domestic aviation (non-ETS)	1.96	766
Domestic aviation (ETS)[1]	1.61	631
Natural gas		
Standard rate	1.52	766
Use covered by the ETS[1]	0.066	33
Greenhouse industry	0.15	77
LPG		
Standard rate	2.30	766
Use covered by the ETS[1]	0.00	0
Greenhouse industry	0.23	77
Tax on waste incineration		
Non-ETS emissions	106	192
ETS emissions[1]	106	192
Tax on HFC and PFC	-	766
CO_2-tax for offshore petroleum		
Mineral oil[1]	1.65	620
Natural gas[1]	1.65	705
Natural gas emitted to the atmosphere	10.66	766

[1]These emissions are also subject to the EU ETS.

Figure 4.2	Explicit carbon prices in 2019 and 2022. (NOK per ton CO_2, 2022 price levels and 2020 emission data)



4.3.2.2 The Norwegian tax scheme on emissions of GHGs under the ESR

The standard tax rate on emissions under the ESR is NOK 766 in 2022, and there is a broad consensus in Norway that this tax rate is to increase to more than NOK 2 000 by 2030. The taxes cover approximately two thirds of emissions under the ESR, and the tax base has been gradually broadened over the last decades. In 2022 a tax on waste incineration was introduced. The most important tax is the CO_2-tax on mineral products, which covers close to 100 per cent of all use of fossil fuels covered by the ESR.

The taxes on emissions from petroleum and aviation under the ETS are treated as separate policies and reported under petroleum and transport below.

Estimated effect on national emissions

The Norwegian Ministry of Finance has developed a model to analyse the mitigation effects of changes in the taxes on GHGs. The model combines price data, volume data from the tax authorities, and elasticities from economic literature to predict the mitigation effect of each tax for the different sectors and products that the tax covers. Results from this model indicates that removing the CO_2-tax in 2022 would increase annual emissions by roughly 1 million tonnes of CO_2. This includes the effects of the tax on waste incineration and the tax and reimbursement scheme on HFC/PFC, as they are part of the taxes on ESR emissions. This does not include the effect of the taxes on road transport. The effects on road transport is included in 4.3.7.2.

4.3.2.3 Tax on waste incineration

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. The tax had a specific CO_2-component aimed at reducing emissions of CO_2 from waste incineration. In 2022, a tax on emissions of CO_2

from waste incineration has been reintroduced. The tax rate is currently at NOK 192 per ton CO_2, which equals to 25 per cent of the standard tax rate for non-ETS emissions. The tax currently applies to emissions both outside and inside the scope of the ETS.

Estimated effect on national emissions

Using the same model as for the other taxes on GHGs, we find that the recently introduced tax on waste incineration is expected to reduce emissions by 20 000 tonnes of CO_2 annually, given the current reduced rate. This effect is included in the PaM the Norwegian tax scheme on emissions of GHGs under the ESR (see chapter 4.3.2.2).

4.3.2.4 Tax and reimbursement scheme on HFC and PFC

To curb the expected 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 2022 the tax is NOK 766 (appr. 76 Euro) per tonne CO_2-equivalents, after relatively large increases since 2014. Emissions of HFC/PFC are taxed at the same level as the standard tax rates for CO_2, measured in NOK per ton CO_2-equivalents. Since the tax is levied on imports of the gases, and not on actual emissions of HFC, the tax- is combined with a refund scheme to target 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, such as CO_2, ammonia or hydrocarbons and in recent years the use of HFC with very low GWP (HFOs), 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, such as domestic heat pumps, the international development as regards legislation (such as the EU F-gas regulation and the Montreal Protocol) and commercialization of new technology 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 by 0.6 million tonnes of CO_2 equivalents. Due to lack of specific information, estimated effect is held constant over the period. This effect is included in the PaM the Norwegian tax scheme on emissions of GHGs under the ESR (see chapter 4.3.2.2).

The emissions of HFCs increased steadily from 1990 to 2013, when they peaked. Since then, there has been a significant downward trend. This is likely due to the combined effect of the tax- and refund scheme and the implementation of the EU F-gas regulation and Mobile Air Conditioning Directive. Recent commercialization of natural refrigerants in commercial refrigeration and other applications, as well as the switch to HFOs in new cars, has also contributed to this change in emission trend.

4.3.2.5 Emission trading (onshore)

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 EU ETS at that stage. In addition to the sectors included in the EU 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 EU ETS. From 2013, phase III (2013–2020), the coverage of the EU 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 EU ETS.

From 2021, phase IV (2021–2030), there is no change in the coverage of sectors and gases compared to phase III for stationary installations. Emissions covered by the EU ETS in this phase amounts to about 50 per cent of the Norwegian emissions. In July 2021, as part of the Fit for 55 legislative package, the European Commission proposed a comprehensive set of changes to Phase IV of the EU ETS, for instance an increased level of ambition and extending the scope of the scheme to cover maritime transport. In addition, the Commission has proposed to create a new, self standing ETS for buildings and road transport.

Cap

Norway participates in the EU ETS. The aggregated future emissions covered by the scheme cannot exceed the EU-wide cap, which was 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 number of allowances added pursuant to this expansion of the system. The reduction rate for the cap was further increased from 2021 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 EU ETS, allowances were allocated based on rules developed nationally (see NC6). The average amount of Norwegian emissions covered by EU ETS was 6 and 19.1 Mt/year in the respective phases. Up to and including 2020, the EU ETS allowed for the use of Kyoto units from the Clean Development Mechanism (CERs) and Joint Implementation (ERUs) for compliance purposes. A total volume of about 15 million CERs and ERUs have been surrendered from the installations for their compliance, and there was also a net transfer of Assigned Amount Units (AAUs) between EU and Norway, which has been used for compliance in the first commitment period under the Kyoto Protocol. A similar clearing mechanism between EU and Norway has been applied for the second commitment period (2013–2020) 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 was harmonized across Europe. The general rule for allocation in phase III was based on performance benchmarks rather than historical emissions levels. The average amount of Norwegian emissions covered by EU ETS in this phase was 22,9 Mt (excluded emissions from aircraft operators covered by the EU ETS). For phase IV (2021–2030), the same principles for allocation as in phase III were applied. In 2021, total free allocation to Norwegian installations represented about 60 per cent of their emissions for the same year.

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 the deadline, the Norwegian Environment Agency suspends 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 number of allowances is surrendered by 30 April. In addition, the operator must surrender an

Table 4.2 Summary of policies and measures, cross-sectoral.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
The Norwegian tax scheme on emissions of GHGs under the ESR (excluding road transport) *[g]	Cross-cutting	CO_2, HFC	Cost-effective reductions of emissions	Fiscal	Implemented
Tax on waste incineration *	Energy	CO_2	Cost-effective reductions of emissions	Fiscal	Implemented
Tax and reimbursement scheme on HFC and PFC *	Industrial processes	HFC	Improved control of fugitive emissions from industrial processes	Economic	Implemented
Emissions trading (2008–2012) onshore *	Industrial processes, Energy	CO_2, N_2O	Reduce emissions	Economic	Implemented
Emissions trading (2013–) onshore *[h]	Industrial processes, Energy	CO_2, N_2O, PFC	Reduce emissions	Economic	Implemented

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available). Abbreviation: GHG = greenhouse gas.
[a] Parties should use an asterisk (*) to indicate that the policy or measure is included in the 'with measures' projection.
[b] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes and product use, agriculture, forestry/land use, land-use change and forestry, waste management/waste, other sectors and cross-cutting, as appropriate.
[c] To the extent possible, the following types of instrument should be referred to: economic, fiscal, voluntary agreement, regulatory, information, education, research and other.

amount of allowances equivalent to the deficit the following year.

Starting in 2021, the operators of installations to which free allocation has been given, must report their verified allocation data yearly to the Norwegian Environment Agency by 31 March. Where the report shows that there has been changes in the activity of the installation, the Norwegian Environment Agency adjusts the allocation accordingly.

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.

There are no national emission targets for ETS emissions as there are for non-ETS emissions. However, earlier estimates made by Statistics Norway show that the emission trading scheme in phase II (2008–2012) may have led to overall national emission reductions of up to 0.3 million tonnes of CO_2 equivalents 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) was about 18 Mt/year for the trading period 2013–2020, while demand from Norwegian installations was approximately 24 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, and the effect for the period 2013–2020 is therefore indicated as IE in the table 4.2.

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
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	1991	Ministry of Finance	1 000	1 000	1 000	1 000
Introduced in 2022. Incentivizes reduced inceneration of fossil materials, increased recycling of plastics and the implementation of CCS technology.	2022	Ministry of Finance	NA	IE	IE	IE
Has resulted in better maintenance and improved routines during discharge of old equipment.	2003	Directorate of Customs and Excise, Norwegian Environmental Agency	IE	IE	IE	IE
Part of the EU Emissions Trading Scheme, see text for further details.	2008	Norwegian Environment Agency	300	300	300	300
Part of the EU Emissions Trading Scheme, see text for further details.	2013	Norwegian Environment Agency	IE	IE	IE	IE

[d] To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted and planned.

[e] Additional information may be provided on the cost of the policy or measure and the relevant timescale.

[f] Optional year or years deemed relevant by the Party

[g] Custom footnote. The effects of the taxes on HFCs and waste incineration are included in the effect of the Norwegian tax scheme on emissions of GHGs under the ESR.

[h] Custom footnote. The ETS may have contributed to some of the estimated effects reported for industry.

4.3.3 Other Cross-sectoral policies and measures

4.3.3.1 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.

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 utilise energy. 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.

4.3.3.2 The Planning and Building Act

The Planning and Building Act sets the framework for the planning and use of land areas and building requirements. Planning pursuant to the Act shall ensure sustainable development for the whole country and requires the participation of all those that are concerned by the decisions made in accordance with the Act.

The Act is a process law, regulating how decisions concerning land use and building must be made, as well as outlining some core topics that must be taken into consideration in decisions made in accordance with the Act. The legislative purpose of the Act is to ensure sustainable development in the interest of individuals, society and future generations. Among the core tasks and considerations required in all planning in accordance with the Act, are reducing climate gas emissions and adaptation to climate change. This is further elaborated in guidelines and the building code (energy requirements in the building code are further elaborated in chapter 4.3.6.4.)

Estimated effect on emissions

The effect ons emissions reduced through the regulations in the Planning and Building Act is difficult to estimate, as the emission reduction potential includes transport, land use change and buildings from all Norwegian municipalities. In addition, the base line is not defined. The Norwegian Ministry of Local Government and Regional Development is currently assessing the possibilities to strengthen the tools for dealing with climate gas emission reductions through the Act, including increased measuring and estimating of emission reduction potential.

4.3.3.3 Enova

Enova (www.enova.no) is a state-owned enterprise, owned by the Ministry of Climate and Environment. Enova is managed by the ministry based on four-year rolling agreements. The Government has given Enova a clearer climate profile for the current four-year period, so that its purpose is to contribute to Norway's emission reduction commitment and contribute to Norway's transition to a low-emission society. Enova contributes to the development of technologies necessary towards 2030 and the low emission society in 2050.

Enova provides funding and advice for climate and energy projects, and supports both companies and individual households, as well as local and regional governments. Funding for projects is drawn from the Climate and Energy Fund, which was provided NOK 4.1 billion in 2022. The rolling four-year agreements between Enova and the Ministry and flexible, long-term funding through the Climate and Energy Fund gives Enova a wide degree of freedom and flexibility to respond quickly to new opportunities and to support those projects that offer the greatest opportunities to influence developments. Given uncertainties about how rapid technology development may be in various sectors, freedom and flexibility within the framework of the four-year agreement is important.

Enova's activities focus on late-phase technology development and early-stage market introduction. Grants for late-phase technology development help to speed up the pace and scale of pilot and demonstration projects and full-scale testing, so that new technologies and solutions reach the market more quickly. 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 climate and energy 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.

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. 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 with an aim to contribute to Norway's emission reduction commitment and contribute to Norway's transition to a low-emission society. The technology projects Enova supports are intended to have immediate climate implications, but also long-term effect through dissemination and adoption of the new technologies including outside Norway. It is difficult to calculate these effects, but the potential impacts are substantial also on a global scale. 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. In 2021, Enova supported TiZir Titanium and Iron to carry out a demonstration project that will lead to the use of hydrogen instead of coal to reduce ilmenite in the production of titanium dioxide. If the technology succeeds, and spreads globally, it may contribute to large emission reductions globally. 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. An effect of the signalled steep increase in the carbon tax toward 2030 and onwards may be to reduce the need of financial support from Enova to drive early market diffusion. This illustrates the interplay between different instruments.

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 calculates 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.

Only Enova-supported projects with final report delivered in 2017 or later contain direct emission reduction results. Therefore, projects with final report delivered before 2017 are not included in the estimate of Enova's direct contribution to reducing greenhouse gas emissions.

The estimated effect from Enova's project portfolio is based on the yearly direct effect from each project on emissions, from the project start (defined as the date where the final report was delivered) and over the project's expected lifetime. Other instruments such as the CO_2 tax also play an important role when it comes to the profitability of the project, but the grant from Enova is assumed to be the factor that triggers the project, and the entire direct effect on emissions is in this case credited to Enova.

In the estimates, a project's lifetime is assumed to be equal to the average lifetime of projects in the relevant sector. The assumed average lifetime of projects is based only on those applications in each sector where a full profitability analysis is required, and thereby expected lifetime is stated. For example, the expected lifetime of projects in transport, industry and the energy system is assumed to be 9, 13 and 23 years, respectively.

For the years after 2021 some assumptions need to be made when it comes to emission effects from the various sectors. Based on historic projects, we assume the following yearly effect from new projects: 300 000 tons CO_2 in total, where 180 000 comes from transport projects, 80 000 from ESR within industry, 30 000 from ETS industry and 10 000 from other sectors. As the time goes by and the carbon price rises, it is likely that the carbon price increasingly will trigger projects in the market introduction phase. This will possibly result in Enova increasing the focus on technology development and decreasing the focus on market introduction. Technology developing projects usually contribute to less direct emission results than projects in the market introduction phase. Therefore, it is assumed a 20 per cent reduction in direct emission result for projects supported during the years 2025–2035, compared to the assumed results from 2022–2024.

Enova reports direct emission results as emissions compared to a fossil alternative. This means that in some cases, the reported emission results are not direct reduction of existing emissions, but rather projects that prevents an increase in emissions. An example is a company without a vehicle, that then buys an electric duty vehicle (supported by Enova) instead of a fossil duty vehicle.

The most important effects of Enova are not the direct emission reductions, but rather technology development and market change that in the longer run contributes to emission reductions. This effect is difficult to estimate and does not show in these estimates.

The estimated accumulated contribution to direct greenhouse gas emission reductions from Enova's project portfolio is about 0.9 million tonnes of CO_2 equivalents in 2020 and about 2.4–2.7 million tonnes in 2025, 2030 and 2035, see table 4.4 for details.

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.

Box 4.4 Examples of projects supported by Enova

Fast-charging infrastructure for electric vehicles: NOK 250 million allocated through several rounds of competitive bidding, since 2015. Funding has been provided for a total of 320 charging stations. The first years, Enova focused on developing a basic charging infrastructure network along Norway's main roads. The latest fundings have focused on the more rural parts of Norway.

Production of ammonia from natural gas with CCS: NOK 482 million to Vår Energi to build the first large-scale production facility for ammonia in Europe based on natural gas with carbon capture and storage. The project will demonstrate a new and energy-efficient technology.

Electrification of industry process: NOK 137.9 million to Inovyn in to electrify their production of vinyl chloride by using a new and world leading technology. The project will reduce emissions by 21 000 CO_2 per year and contribute with important technology development in the petrochemical industry.

Fishing boat using hydrogen: NOK 92.5 million to the world's first sea-going fishing boat using hydrogen. The boat will be out at sea for 4–6 weeks in a row and needs several energy sources to supply its energy consumption. This will be covered by a container-based storage of hydrogen, two fuel cells, a large battery and conventional diesel engines.

4.3.3.4 Klimasats

In 2016, the Solberg Government introduced a financial support scheme to promote emissions reduction projects in Norwegian municipalities and counties. 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 and reduction of methane emissions from former landfills. 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.

From 2016 to 2021, Klimasats allocated NOK 1064 million to 1589 projects all over Norway. An additional NOK 202 million has been allocated to facilitate the introduction of zero- and low-emission solutions for high-speed vessels in the public transport system, during 2019 – 2021.

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 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 estimated since it supports a variety of projects and there is limited data available. All projects can be found at the website of the Norwegian Environment Agency (in Norwegian only).[6]

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 2021, NOK 677 million was granted from the environmental technology scheme to 110 projects. Total investments in these projects (including the companies' own funds) are NOK 2.3 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

6 https://www.miljodirektoratet.no/ansvarsomrader/klima/for-myndigheter/kutte-utslipp-av-klimagasser/klimasats/klimasatsprosjekter/

Table 4.3	Summary policies and measures, other cross-sectoral.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]
Regulation by the Pollution Control Act *	Industrial processes, Energy	CO_2, HFC, CH_4, NO_2, PFC, SF_6	Reduce pollution	Regulatory
The Planning and Building Act *	Cross-cutting	CO_2	Energy consumption	Regulatory
Enova *	Transport, Industrial processes, Energy	CO_2	Efficiency improvements of buildings; Efficiency improvement in industrial end-use sectors; Demand management/reduction; Low carbon fuels; Electric road transport; Reduce emissions from international air or maritime transport; Installation of abatement technologies	Economic; Information
Klimasats *	Cross-cutting	CO_2, HFC, CH_4, NO_2, PFC, SF_6	Reduce emissions	Economic
The environmental technology scheme – Innovation Norway *	Cross-cutting	CO_2	Contribute to sustainable business development in Norway and realize Norway's environmental goals	Research
Nysnø Klimainvesteringer AS (Nysnø) *	Cross-cutting	CO_2	Contribute to reducing greenhouse gas emissions through investments with such an effect directly or indirectly.	Economic

For note and footnotes, see under table 4.2.

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.

4.3.3.5 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 so far received NOK 2 925 million in capital. 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. Nysnø's effect on national emissions will have to be calculated based on future avoided emissions. Methodology to do this with sufficient precision is under development, but does not exist as of today.

Status of implementation [d]	Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents) 2020	2025 [f]	2030 [f]	2035 [f]
Implemented	The Act lays down a general prohibition against pollution. Pollution is prohibited unless one has a specific permission.	1983	Norwegian Environment Agency	NE	NE	NE	NE
Implemented	State act regulating the management of land use in Norway. Planning pursuant to the act shall ensure sustainable development and take climate into account. The PaM "Energy requirements in the building code" follows the planning- and building act.	1985	Ministry of Local Government and Regional Development	NE	NE	NE	NE
Implemented	Financial support to climate projects aiming for technology development or early market diffusion.	2002	Ministry of Climate and Environment	959	2 411	2 629	2 662
Implemented	Reduce emissions at local level and contribute to the transition to a low carbon society.	2016	Norwegian Environment Agency	NE	NE	NE	NE
Implemented	The Environmental Technology Scheme offers grants and other support for development and investments in pilot and demonstration projects for new Norwegian environmental technology.	2010	Norwegian Ministry of Trade, Industry and Fisheries	NE	NE	NE	NE
Implemented	Nysnø invests in non-listed companies and funds aimed at non-listed companies that have operations in Norway. It focuses on early-stage companies and invests primarily in the transition from technology development to commercialisation.	2018	Norwegian Ministry of Trade, Industry and Fisheries	NE	NE	NE	NE

4.3.4 Petroleum Sector

4.3.4.1 General policy instruments

Environmental and climate considerations are an integral part of Norway's policy for the petroleum industry. A range of policy measures ensures that actors in the industry take environmental and climate considerations into account during all phases of their activities, from exploration to development, operations, and field cessation.

Environmental and climate standards in the Norwegian petroleum industry are very high compared with those in other petroleum producing countries. This is a result of effective policy instruments and joint initiatives between the authorities and oil companies on research, technology development and increased knowledge.

Emissions to air from petroleum activities originate from the combustion of natural gas and diesel in turbines, engines, and boilers, flaring of natural gas for safety reasons, venting of diffuse emissions of gas, and storage and loading of crude oil. These activities result in emissions of waste gas containing CO_2, NO_x (nitrogen oxides), NMVOCs (non-methane volatile organic compounds), CH_4 (methane) and sulphur dioxide (SO2).

Emissions from Norwegian petroleum activities are regulated through several acts, including the Petroleum Act, the CO_2 Tax Act on petroleum activities, the Sales Tax Act, the Greenhouse Gas Emission Trading Act and 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 territorial waters 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 (NOROG), has established a national database for reporting all releases from the industry, called EPIM Environmental Hub (EEH). All operators on the Norwegian continental shelf report data on emissions to air and discharges to the sea directly in EEH.

4.3.4.2 Climate policies that affect the petroleum sector

The taxes on emissions of GHGs 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, mostly methane (CH_4) from the sector is not covered by the CO_2 tax or ETS.

The CO_2 tax on petroleum activities on the continental shelf

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 2022, the tax rate is NOK 1.65 per standard cubic metre of gas or per litre of oil or condensate. For combustion of natural gas, this is equivalent to NOK 705 per tonne of CO_2. Emissions of natural gas to the atmosphere is not subject to the ETS. The tax rate is NOK 10.66 per standard cubic metre, equivalent to the standard rate for non-ETS emissions of NOK 766 per tonne of CO_2

Emission Trading

Norwegian installations in the petroleum industry are included in the EU ETS, and 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 more of their allowances free of charge, following harmonised allocation rules. A certain proportion of the petroleum-sector emissions to which the ETS applies, is considered to be at risk of carbon leakage. 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 2022, face a price of approximately NOK 1 500 per tonne for their CO_2 emissions, which is very high compared to emission prices in other petroleum producing countries.

Estimated effect on national emissions

In 2021, greenhouse gas emissions from petroleum activities corresponded to about 12 million tonnes CO_2 equivalents (carbon dioxide equivalent). Emissions from the petroleum sector account for about one quarter of Norway's aggregate greenhouse gas emissions.

The companies operating on the Norwegian continental shelf are front runners in the use of solutions to reduce and prevent greenhouse gas emissions. Emissions per unit of oil and gas produced are therefore lower compared to similar operations in other petroleum producing countries.

Energy efficiency measures, including the introduction of energy management systems and the installation of more energy-efficient equipment such as compressors and pumps, have helped to reduce emissions from petroleum activities. Combined-cycle gas turbines (CCGT) are one technological solution, in which waste heat from the turbines is used to produce steam, which in turn is used to generate electricity. CCGT plants improve energy efficiency and reduce emissions. Power from shore is increasingly being applied as power solutions on terminals and offshore fields and there are CCS projects in some fields.

Estimated effect on national emissions have been calculated by comparing the emission intensity of Norwegian production with another petroleum producing country with a modern infrastructure, mostly offshore production, but little to no pricing and less direct regulation of emissions. Australia has been chosen for this analysis. Estimated effect for 2020 is calculated by comparing actual Norwegian emission and counterfactual Norwegian emissions calculated using Norwegian production figures and the Australian emission intensity. For the ex ante analysis we create a counterfactual emission scenario for 2022–2035 using projected Norwegian petroleum production and the average Australian emission intensity for 2018 through 2021. The estimated effect is given by the difference between the counterfactual emissions and the emissions given by the projections in chapter 5. The estimated effect in 2020 is 7 million tonnes CO_2, 11 million tonnes in 2025, 10 million tonnes in 2030 and 8 million tonnes in 2035.

4.3.4.3 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 2020, the petroleum sector accounted for 26 per cent of the total NMVOC emissions, with 38 kilotonnes emitted. The NMVOC emissions in the petroleum sector in Norway peaked in 2001. Since then, there has been a decline of 85 per cent until 2020. From 1990, NMVOC emissions in the petroleum sector have been reduced by 69 per cent in total.

The NMVOC emissions in the petroleum sector are mainly from loading of crude oil offshore, with offshore storage as another important source. The petroleum sector's share of total NMVOC emissions has decreased as a result of regulations and because oil production has been reduced by approximately 45 per cent from 2001 to 2020. 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, all vessels have been required to install equipment for recovering NMVOCs (vapour recovery units, VRUs). A large proportion of the shuttle tankers operating on the NCS have installed a technology that enables a 100 per cent reduction during the loading operations.

Several 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 because, in the case of floating storage installations, the need to gas-free the tanks for inspections.

Regulations onshore are based on the Industrial Emission Directive (2010/75/EU) and corresponding BAT conclusion 2014/738/EU. Loading of crude oil and other hydrocarbons has been governed under the emission permit system, pursuant to the Pollution Control Act. A vapour recovery unit (VRU) 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. On the Nyhamna gas processing plant, gas displaced from loading condensate cargo tanks of the ship is returned to an onshore VRU. The VRU at Nyhamna has been in operation since start-up of the gas plant in 2007. At the Kårstø gas processing plant, gas return from condensate loading is burned in an incinerator.

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 almost 0.10 million tonnes CO_2 in 2020. The estimated effects are based on reported data from the oil fields operators to the Norwegian Environmental Agency. In 2025, 2030 and 2035 the projected effects are 0.11, 0.10 and 0.09 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 terminals are estimated with and without measures. The emissions in 2025, 2030 and 2035 without measures have been back-calculated from the projected amount of crude oil loaded and an implied emission factor equal to the latest year ahead of the implementation. The emissions in 2025, 2030 and 2035 with measures have been calculated with an implied emission factor equal to 2021, which is the most recent year with historical emissions data from the installation. The effect of the regulations is approximately 0.05 million tonnes of CO_2 equivalents per year since 2017, and the projected effect is also approximately 0.05 million tonnes of CO_2 equivalents per year.

The regulations are expected to reduce methane emissions, as well as NMVOC emissions. However, it has not been possible to quantify this effect.

Box 4.5 Examples of measures implemented in the petroleum sector

Energy efficiency

Energy efficiency measures, including the introduction of energy management systems and the installation of more energy-efficient equipment such as compressors and pumps, have helped to reduce emissions from petroleum activities. Combined-cycle gas turbines (CCGT) are one technological solution, in which waste heat from the turbines is used to produce steam, which in turn is used to generate electricity. CCGT plants improve energy efficiency and reduce emissions. They have been installed on the fields Oseberg, Snorre and Eldfisk.

CCS

Since 1996, about 1 million tonnes of CO_2 per year has been separated during processing of natural gas from the Sleipner Vest field, and stored in the subsea Utsira Formation. Since 2014, CO_2 has also been separated from natural gas from the Gudrun field and stored in the Utsira Formation together with the CO_2 from Sleipner. The Snøvhvit facility on Melkøya has since 2008, separated CO_2 from the natural gas before the gas is chilled to produce liquefied natural gas (LNG). The CO_2 is transported back offshore, injected and stored.

Power from the onshore electrical grid

The Storting (parliament) resolved in 1996 that power from the onshore electricity grid should be explored by developers and followed up by the government for each new project on the NCS. The abatement cost of installing power from the onshore grid on facilities varies considerably between different developments. Features which make this approach more cost-effective include closeness to shore, a limited need for process heat, a substantial demand for power, a well developed onshore electricity grid at the shore point, and a long lifetime for the field.

The fields Ormen Lange, Snøhvit, Troll A, Gjøa, Goliat, Valhall, Martin Linge and Johan Sverdrup are already supplied with power from shore. A joint solution for supplying power from shore to the Utsira High region will be in place by the end of 2022 , and the fields Edvard Grieg, Ivar Aasen and Gina Krog will all be connected to it. Sleipner Øst willo also be connected to the grid within 2022, and further electrification of Troll (B and C) has been approved for development. In addition, the onshore facilities Kårstø, Kollsnes, Melkøya LNG and Nyhamna are supplied partly or wholly with power from the grid. At present, these fields and facilities account for the majority of Norwegian gas production.

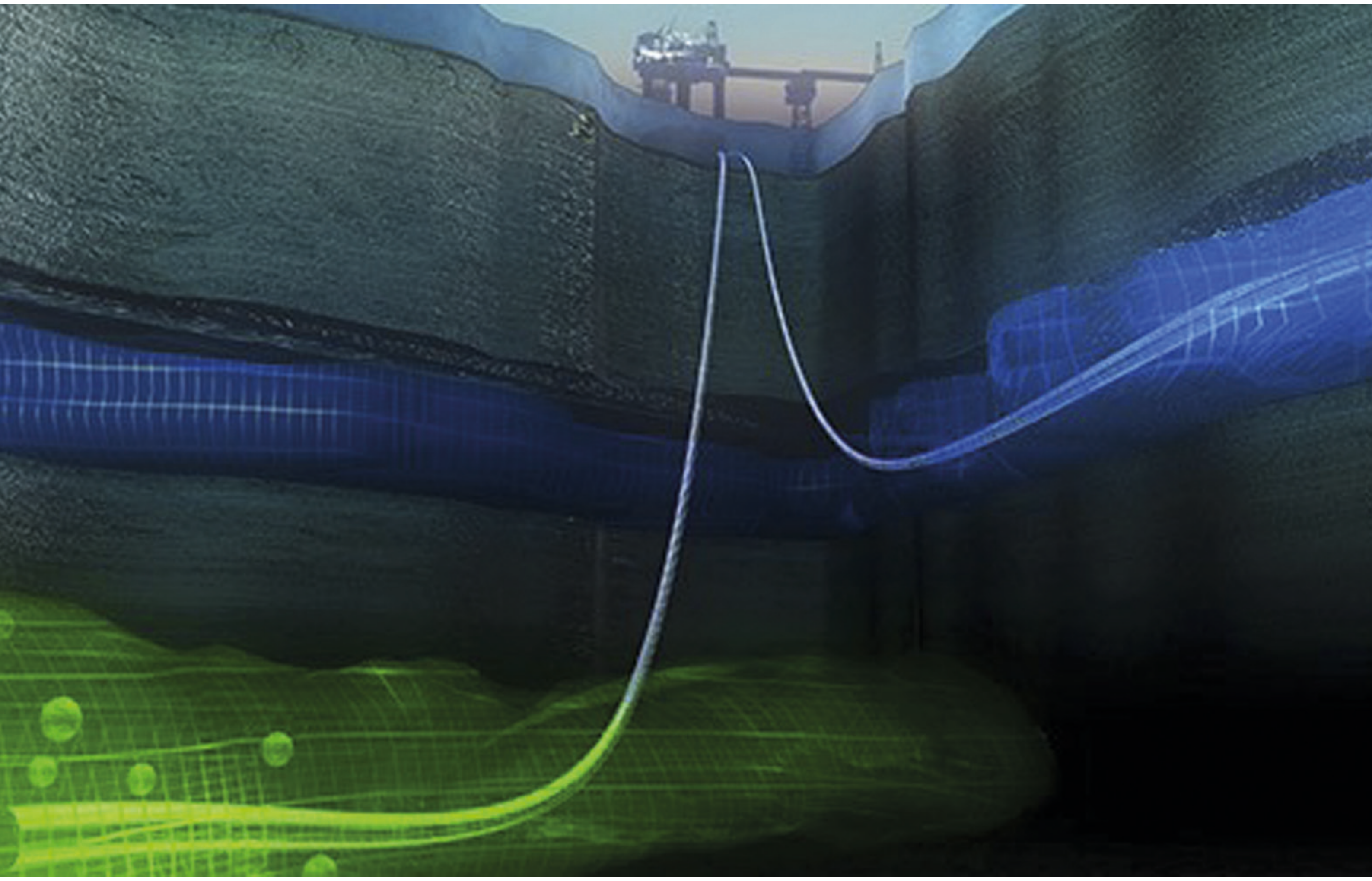
Floating offshore wind

The Hywind Tampen project is a floating offshore wind farm consisting of 11 wind turbines that will provide electricity for the Snorre and Gullfaks fields in the North Sea. It will be the first floating wind farm to power offshore oil and gas platforms with a system capacity of 88 MW. The first wind turbines are on stream, and all 11 turbines will be generating within 2023.

Table 4.4 Summary policies and measures, petroleum.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Climate policies that affect the petroleum sector *	Energy	CO_2	Reduce emissions	Regulatory	Implemented
Indirect CO_2 emissions from offshore NMVOC regulation *	Energy	CO_2, CH_4	Reduce indirect CO_2 emissions from offshore oil and gas production	Regulatory	Implemented
Indirect CO_2 emissions from onshore NMVOC regulation *	Energy	CO_2, CH_4	Reduce indirect CO_2 emissions from offshore oil and gas industries	Regulatory	Implemented

For note and footnotes, see under table 4.2



Picture: Illustration of CO_2 injection and storage on the Sleipner field in the North Sea. The gas from the field has a high content of CO_2. During processing of the gas on the platform, CO_2 is separated and injected into the Utsira formation far below the seabed. Since 1996, up to 1 million tonnes of CO_2 a year has been stored here. Statoil is the operator for Sleipner (Photo: Alligator film/BUG, Statoil).

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
Coverage and rates changed since 1991, see text for further details.	1991	Ministry of Finance/ Norwegian Environment Agency	7 000	11 000	10 000	8 000
Phase in of vapour recovery units technology, see text for further details.	2002	Norwegian Environment Agency	96	112	104	88
Installation of vapour recovery units.	1996	Norwegian Environment Agency	55	55	55	55

4.3.5 Carbon Capture and Storage (CCS)

The Norwegian government will continue its work on promoting CO_2 management as a global climate mitigation tool. The Norwegian Government's CCS strategy span activities from research, development and demonstration to large-scale projects and international work promoting CCS.

CCS comprises capture, transport and permanent geological storage of CO_2 emissions from fossil-fuel combustion, industrial production and waste incineration. According to the Intergovernmental Panel on Climate Change (IPCC), CCS is a key measure for reducing global greenhouse gas emissions. Technology development in an international perspective and ways of reducing costs are key to the deployment of CCS at a global scale.

Norway has demonstrated experience with safe and secure CCS. Since 1996, CO_2 from natural gas production on the Norwegian Continental shelf has been captured and reinjected into sub-seabed formations in the Sleipner and Snøhvit petroleum fields.

Since 1996, nearly one million tonnes of CO_2 per year have 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 there.

Since 2008, the Snøhvit facility on Melkøya has separated 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.

4.3.5.1 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.

Picture: Technology Center Mongstad (TCM) Photo: Helge Hansen/Statoil

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.

4.3.5.2 Research and technology development

In Norway, government 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 (governmental agency), industry and research partners.

4.3.5.3 Large-scale CCS

A full-scale CCS demonstration project, Longship, for capture, transport and storage of CO_2 is under development in Norway. The Longship project is a central part of the Norwegian government's policy for CO_2-management, and of Norway's contribution to developing necessary climate technologies. The project consists of two Norwegian CO_2 capture

Table 4.5 Summary policies and measures, CCS.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Carbon capture and storage (CCS) *	Industrial processes, waste	CO_2	Reduce emissions	Economic, research	Adopted [g]

For note and footnotes, see under table 4.2

[g] Custom footnote. Under construction.

facilities, Hafslund Oslo Celsio (waste incineration) and Norcem (cement), and a CO_2 transport and storage project, The Northern Lights (Equinor, Shell and Total). The permanent storage will take place on the Norwegian continental shelf. Northern Lights is engaging with industrial emitters around the North Sea to enlarge the project in a possible next phase.

The Longship project is a result of close cooperation between the Government and the industrial partners over many years. Gassnova, the state enterprise for CCS in Norway, is responsible for coordination of the entire CCS chain. The Government has funded the two above mentioned capture projects in Norway, as well as the storage facility. The expected costs for Longship are NOK 27.6 billion, of which the expected government contribution is NOK 17.9 billion.

The Northern Lights project is expected to be operational in 2024. In its first phase, the potential is 1.5 million tonnes of CO_2 stored annually for 25 years. In its second phase, the potential is of 5 mill tonnes stored annually. In addition, the Government has awarded two new exploration permits for CO_2 storage acreage, in the North Sea and in the Barents Sea respectively.

4.3.5.4 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 relevant countries on a bilateral basis, as well as the European Commission, and various regional and international fora. Examples of such fora are North Sea Basin Task Force, The Clean Energy Ministerial, The 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.

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 full-chain demonstration project in Norway, Longship, should contribute to knowledge sharing and technology development in an international perspective. The Norwegian government's policy includes research, development and demonstration, and international work for the implementation of CCS as an international mitigation measure.

The full-scale project will lead to emission reductions from 2025, if the projects at the cement factory and waste-to-energy plant are realized. It is estimated that the CCS on these plants will reduce the emissions 0.4 million tonnes annually from 2025, and 0.8 million annually from 2027. It is difficult to quantify the emission reductions that will be realized through the policy beyond this.

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
CCS is a key tool for reducing global greenhouse gas emissions. Work in this field is focusing on the development of technology and ways of reducing costs. The government supports a full-scale CCS demonstration project, which consist of two capture sites in Norway, and transport and storage of CO_2 at the continental shelf.	2005	Ministry of Petroleum and Energy	0	400	800	800

Box 4.6 Ambition for offshore wind production

The Norwegian government has announced an ambition to allocate areas for 30 GW offshore wind power production, by 2040. This is nearly equivalent to the total amount of electricity produced in Norway today. The Norwegian government is currently preparing to allocate seabed for the first commercial scale offshore wind projects in Norway. Two of the projects will be bottom-fixed with a capacity of 1,5 GW each, placed in Sørlige Nordsjø II next to the Danish boarder. The other 3–4 projects will be floating offshore wind farms totalling 1,5 GW, placed in Utsira Nord on the Norwegian west coast.

Norway had an early start with floating offshore wind. The world's first floating turbine, Hywind Demo, was installed in 2009. Building on this experience, The Hywind Tampen project is a floating offshore wind farm consisting of 11 wind turbines that will provide electricity for the Snorre and Gullfaks fields in the North Sea. It will be the first floating wind farm to power offshore oil and gas platforms with a system capacity of 88 MW. The first wind turbines are on stream, and all 11 turbines within 2023.

This is, as of today, the largest floating wind farm under development.

4.3.6 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 85 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.

4.3.6.1 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 2022 is NOK 0.0891 per kWh for January to March and NOK 0.1541 per kWh for April to December. Electricity used in chemical reduction and in electrolytic, metallurgical and mineralogical processes, greenhouses and rail transport, as well as households and public services in the action zone in the county of Troms and Finnmark, 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 2022 is NOK 0.00546 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.

4.3.6.2 Base tax on mineral oils etc.

The base tax on mineral oil was introduced in 2000. The original intention of the base tax was to avoid substitution of electricity in the heating market when the electricity tax was raised. From 2020 the use of mineral oil for heating of buildings has been banned, so the original intention of the tax is no longer relevant. Today the tax is mainly a fiscal tax. The tax applies to mineral oil used for other purposes than road transport, but aviation, shipping and fishing are exempted. In 2022 the base tax is NOK 1.76 per litre. A reduced rate (in 2022 NOK 0.23 per litre) applies to the pulp and paper industry and dyes and pigment industry.

Estimated effect on national emissions

The base tax on mineral oil is not regarded as a climate policy instrument. estimated. Mineral oil encompassed by the base tax is also encompassed by the CO_2-tax on mineral products. The Norwegian Ministry of Finance has developed a model to analyse the mitigation effects of changes in the taxes on GHGs. The model combines price data, volume data from the tax authorities, and elasticities from economic literature to predict the mitigation effect of each tax for the different sectors and products that the tax covers. Results from this model indicates that removing the base tax on mineral oil in 2022 would increase annual emissions by roughly 40 000 tonnes of CO_2.

4.3.6.3 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 electticity 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. The new goal of 46.4 TWh was achieved in March 2021. The policy change of 18th September 2020, and resulting laws in Sweden, establish a common end date for the certificate scheme 31st December 2035. In both Norway and Sweden renewable energy plants with an operating date after 31st December 2021 is not eligible for electricity certificates. 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 2019.*

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.

4.3.6.4 Energy requirements in the building code

The building code (Byggteknisk forskrift – TEK17[7]) is the main legal instrument for improving energy efficiency. The energy requirements specify that installation of fossil fuel heating installations are not permitted and that larger buildings (more than 1000 m^2 heated usable floor space) must have flexible heating solutions.

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

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 m^2 of heated floor area per year) for 13 different building categories, as shown in table 4.6.

Table 4.6 Total net energy requirements for various buildings according to the new building code of 2016.

Building category	Total net energy requirement [kWh/m^2 heated gross internal area per year]
Small houses and leisure homes with more than 150 m^2 of heated gross internal area	100 + 1.600/m^2 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 4.7.

Table 4.7 Energy efficiency measures for individual building components.

	Energy-saving measures	Small house	Block of flats
1.	U-value outer walls [W/(m^2 K)]	≤ 0.18	≤ 0.18
2.	U-value roof [W/(m^2 K)]	≤ 0.13	≤ 0.13
3.	U-value floors [W/(m^2 K)]	≤ 0.10	≤ 0.10
4.	U-value windows and doors [W/(m^2 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/(m^3/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 m^2 is stated as heated gross internal area [W/(m^2 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 chapter 2, 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. The effect is therefore not estimated. Ban on the *use* of fossil fuels for heating of buildings from 2020 are elaborated below.

4.3.6.5 Ban on the use of mineral oil for heating of buildings from 2020 and house construction sites from 2022
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 heating 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. From 2022, the ban was extended to also cover temporary use of mineral oil for heating and drying on construction sites. 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 has been regulated through different measures such as CO_2 tax, mineral oil tax, standards in the building code and support schemes from Enova and municipalities. The ban on the use of mineral oils for heating of most buildings from 2020 means that most residential, public, and commercial buildings has phased out emissions from such use.

Total direct emissions from heating of households and businesses have declined by more than 80 per cent since 1990, from 2.7 to 0.5 million CO_2 equivalents. The remaining emissions are mostly from the use of gas and from wood burning. The projection estimates emissions of 0.25 million tonnes of CO_2 equivalents in 2030.

It is difficult to separate the emission effect of different measures, 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 CO_2 equivalents in 2030. The expansion to include buildings under construction or renovation is estimated to reduce emissions by an additional 80 000 tonnes per year from 2022.

4.3.6.6 Renewable Scheme
The Ministry of Agriculture and Food offers funding for investments in small scale bioenergy or combined with solar energy (earlier The Bioenergy Scheme). Funding is provided through grants for investments, studies and training measures. The budget is substantially increased over the last years, responding to increasing demand. The main objective is to encourage farmers and forest owners to produce, use and supply feedstocks for bioenergy or heating. From 2023 the Scheme will be organized as a part of Bionova (see box in chapter 4.10). Support is also granted to develop

Table 4.8 Summary policies and measures, energy and transformation industries.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Electricity tax *	Cross-cutting	CO_2	Reduce electricity consumption	Fiscal	Implemented
Base tax on mineral oils etc *	Cross-cutting	CO_2	Increase in renewable energy	Fiscal	Implemented
Electricity Certificate Act *	Energy	CO_2	Increase in renewable energy	Economic	Implemented
Energy requirements in the building code *	Energy	CO_2	Efficiency improvements of buildings	Regulatory	Implemented
Ban on the use of mineral oil for heating of buildings from 2020 and house construction sites from 2022 *	Energy	CO_2	Efficiency improvements of buildings	Regulatory	Implemented
Renewable Scheme *	Energy	CO_2	Replace fossil energy with bioenergy	Economic	Implemented

For note and footnotes, see under table 4.2.

small scale climate friendly technology adjusted for the agricultural sector.

Estimated effect on national emissions

By 2021, installations funded through the Renewable Scheme had an accumulated production capacity of 552 GWh. This is estimated to have reduced emissions from fossil fuels by about 100 kt CO_2-equivalents by 2020. 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 110 kt tonnes CO_2 -equivalents in 2025, rising to 175 kt CO_2-equivalents in 2030 and 2035.

4.3.7 Transport

4.3.7.1 Introduction

The transport sector accounts for about 1/3 of Norwegian greenhouse gas emissions, and around 2/3 of the ESR emissions. There are several measures in place that affect 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 4.3.2.3.). In addition, the vehicle tax policy contributes to shifting vehicle demand towards low and zero emission vehicles. Norway also has a quota obligation for biofuels for road traffic, see chapter 4.3.7.2.4. In addition there are several other measures, such as Enova's grant schemes, requirements in public procurement processes etc.

4.3.7.2 Taxes and regulations affecting emissions from road transport

Norway has several overlapping and impactful policies affecting emissions from road transport. The Norwegian tax scheme on emissions under the ESR, tax advantages and incentives towards the purchase of low and zero emission cars, a road usage tax levied on fuels and a biofuel sales mandate all affect emissions. Due to the overlap of these measures the effect of one measure will

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
Tax on electricity consumption	1951	Ministry of Finance	NE	NE	NE	NE
Excise duty on mineral oils	2000	Ministry of Finance	40	40	40	40
Norway and Sweden will increase their renewable electricity generation by 28.4 TWh from 2012 to the end of 2020 (an average of 3.2 TWh yr.)	2012	Ministry of Petroleum and Energy	NE	NE	NE	NE
Energy requirements in buildings to ensure more energy efficient buildings.	2007	Ministry of Local Government and Regional Development	NE	NE	NE	NE
The ban covers the use of mineral oil for both main heating (base load) and additional heating (peak load), in residential buildings, public buildings, commercial buildings, and for temporary heating og drying of materials in buildings under construction or alteration.	2020	Ministry of Climate and Environment/ Ministry of Petroleum and Energy	400	430	380	330
Monetary support schemes for converting to bioenergy.	2003	Ministry of Agriculture and Food	100	110	175	175

depend on whether the other measures are present or not. We therefore report the total effect on emissions for all measures with a substantial effect on emissions from road transportation. The individual measures are described below the discussion of effects on national emissions, under chapter 4.3.2.7.1 – 4.3.2.7.4. The taxes on emissions under the ESR are described under chapter 4.3.2.2.

Estimated effect on national emissions
Electric vehicles Norway has the largest EV share in the world. Without the incentives, the EV share would probably be more in line with what is observed in countries without incentives. To analyse the effect on emissions we compare the EV share to a country with few incentives towards the purchase of EVs. The EV-share in Australia is approximately 1.5 per cent In total, Norwegian EVs drove approximately 6 bill. kilometeres in 2022, and the EV share is 17 per cent of personal cars. If the EV share was 1.5 per cent instead, 5.5 mill. of those kilometeres is assumed to be driven by conventional cars with internal combustion engines (ICE) instead, with an average fuel efficiency of 0.8 and 0.65 litres per ten kilometeres for petrol and diesel cars. The effect covers both the VAT-exemption, one off registration taxes and other advantages for EVs. While the registration tax also favours hybrid cars over pure ICEs, the main effect of the tax going forward is assumed to be incentivizing the sales of EVs, thus the effect on emissions due to increased sales of hybrid vehicles is not calculated explicitly.

The use of biofuels, blended or pure, has led to reduced CO_2 emissions from road vehicles. The estimated emission reduction for 2020 is based on estimated consumption of fossil fuels adjusted for the increased consumption an abolishment of all EV-incentives would entail. Due to double counting of advanced fuels the actual share of biofuels is represented by an interval. The observed share of biofuels in 2021 is used as a point estimate. In the calculation of the CO_2 effect, it is taken into account that the energy content in biofuel is lower than in fossil fuel, i.e. 1 litre of biofuel replaces less than 1 litre of fossil fuel. Since biofuels are more expensive than fossil fuels the sales mandate will lead to an increase in prices.

The taxes on emissions under the ESR and the road usage tax both levy a price on fossil fuels, reducing consumption and thereby emissions. The Norwegian Ministry of Finance has developed a model to analyse the mitigation effects of changes in the taxes on GHGs. The model combines price data, volume data from the tax authorities, and elasticities from economic literature to predict the mitigation effect of each tax for the different sectors and products that the tax covers. The analysis has been adjusted to include the increased sales volumes of fossil fuels stemming from an abolishment of the biofuel sales mandates and abolishing the incentives towards purchasing low and zero emission vehicles.

The total effect on emission is estimated to approximately 4 million tonnes of CO_2 in 2020. The effect of these measures is also estimated to increase drastically toward 2035, largely due to the gradual influx of EVs in the passenger car fleet. Effects for 2025, 2030 and 2035 are calculated assuming that without these measures, emissions from Norwegian road transportation would remain stable over the period 2020–2035 instead of being reduced by half by 2035. Effects for 2025, 2030 and 2035 are estimated to be 5.4, 6.8 and 9 million tonnes respectively.

4.3.7.2.1 Tax advantages for electric vehicles

Norway provides very strong tax incentives for zero emission vehicles, through the value added tax, the one-off registration tax and the road usage tax on fuels.

The *value added tax* is a general tax on the domestic consumption of goods and services which is intended to raise revenues for the central government. The standard rate of value added tax in Norway is 25 per cent and to most goods and services, including vehicles.

Since 2001, electric cars (EVs), has been zero-rated in the value added tax. This gives a very strong incentive to choose electric cars, but also a considerable revenue loss, as the share of EVs increases. In the budget proposal for 2023, the Norwegian Government has proposed to introduce value added tax on the purchase amount for electric cars over NOK 500 000.

The *one-off motor vehicle registration tax* was introduced in 1955. The original intention of the tax was to slow down the import of foreign capital-intensive goods. Now the tax is regarded as a fiscal tax, but that has been used extensively to give economic incentives to choose low and zero emissions vehicles.

Since 1990, electric cars have been exempted from the one-off registration tax. As the one-off-registration tax for an ICE car can typically be NOK 200 000, the exemption gives a very strong incentive to choose electric cars, but also gives a considerable revenue loss, as the share of EVs increases.

The *traffic insurance tax* was introduced in 1917 and is an annual tax on car ownership. Between 1996 and 2020, electric cars were exempted. In 2021, a reduced rate applied to electric cars, and from 1. March 2022, the tax rate for electric cars is the same as for ICE cars.

The *re-registration tax* was introduced in 1956. It's a fiscal tax instead of value added tax on the sale of used vehicles. Between 2018 and 2021, electric cars were exempted. In 2022, a reduced rate (25 per cent of the general rate), applies to electric vehicles.

The *road usage tax on fuel* was introduced in 1931. The intention of the tax, besides creating revenue, is to price the external costs of road transport, except emissions of CO_2. The major external costs are congestion, noise, accidents, wear and tear and local emissions. The road usage tax applies to petrol, mineral oil, biodiesel, bioethanol, natural gas and LPG. Electricity is not encompassed by the road usage tax. This gives an economic incentive for electric cars.

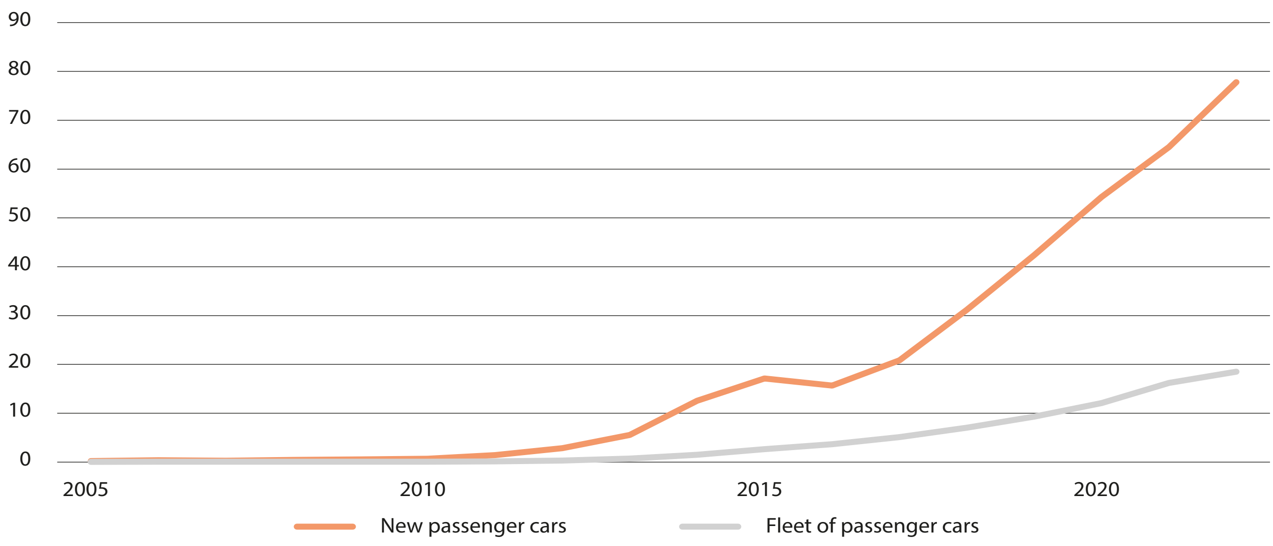
Tax expenditures are provisions of tax law, regulation, or practice that reduce or postpone revenue for a comparatively narrow population of taxpayers relative to a benchmark tax. Table 4.9 shows the estimated tax expenditures related to EVs in Norway in 2022.

Table 4.9 Tax expenditures for EVs in 2022. Mill. NOK.

EVs are zero-rated in the VAT	13 400
EVs are exempted from the one-off registration tax	10 000
EVs have reduced traffic insurance tax (until 28 February 2022)	265
EVs have reduced re-registration tax	225

Source: Ministry of Finance

Figure 4.3 Share of EVs of new passenger cars and in the fleet of passenger cars. 2012–2022[1]. Per cent.



[1] January to August 2022.

Source: Norwegian Road Federation and Ministry of Finance

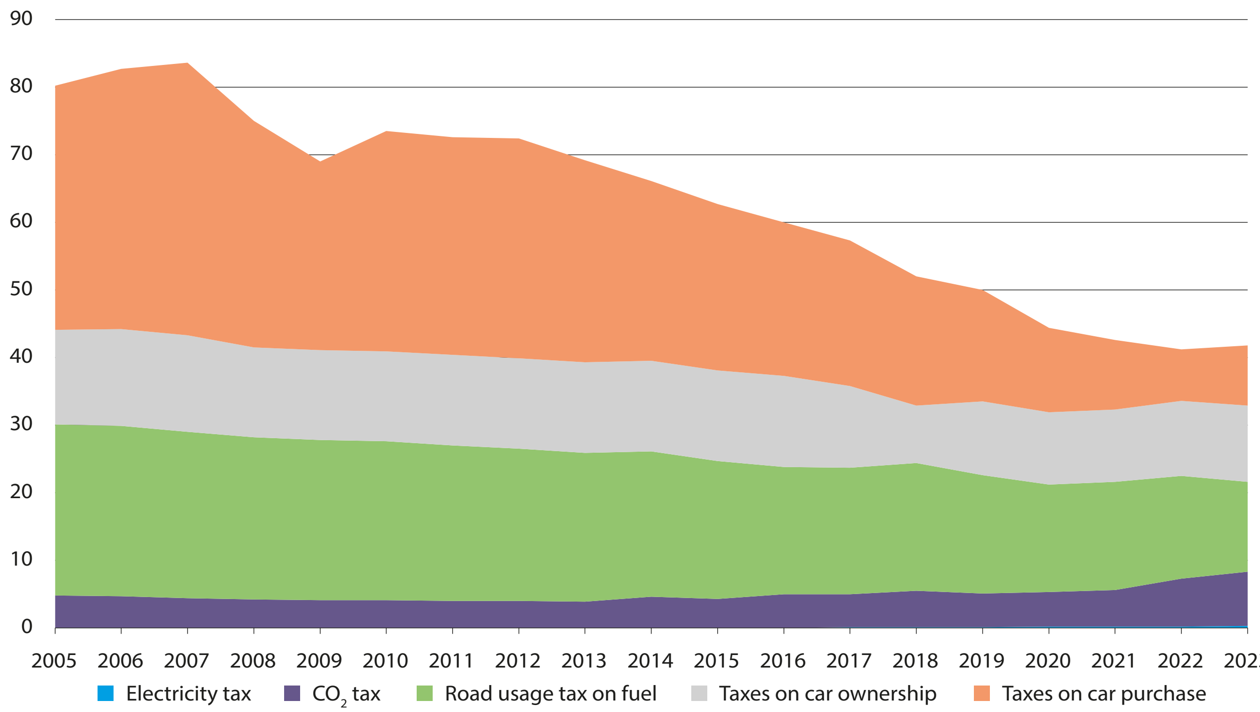
The non-inclusion of electricity in the road usage tax is not considered a tax expenditure, but it constitutes a tax advantage of EVs of approximately 1 500 mill. NOK in 2022.

As the one-off registration tax is dependent on CO_2-emissions, the tax in itself is an advantage for zero-emission vehicles. This is not considered as a tax expenditure. If the average one-off registration tax on ICE cars also would apply to EVs, the revenue from the one-off registration tax would increase with 23 700 mill. NOK in 2022.

The tax incentives for electric vehicles, together with non-tax incentives, has had a major effect on the sale of electric vehicles, ref. figure 4.4. The share of new zero emission cars in the sales of new cars in 2021 was about 65 per cent. By the end of 2021, 16.2 per cent of the Norwegian passenger car fleet was battery electric. This is the largest share of electric cars as percentage of the entire passenger car fleet in the world.

The tax incentives for electric vehicles, combined with a rapid increase in the share of electric vehicles, has resulted in reduced revenue from car related taxes and the value added tax. Figure 4.4 shows that the revenue from car related taxes has been reduced by approximately 50 per cent, in real terms, from 2007 to 2022. Figure 4.5 shows the rapid increasing tax expenditure related to EVs being zero-rated in the VAT.

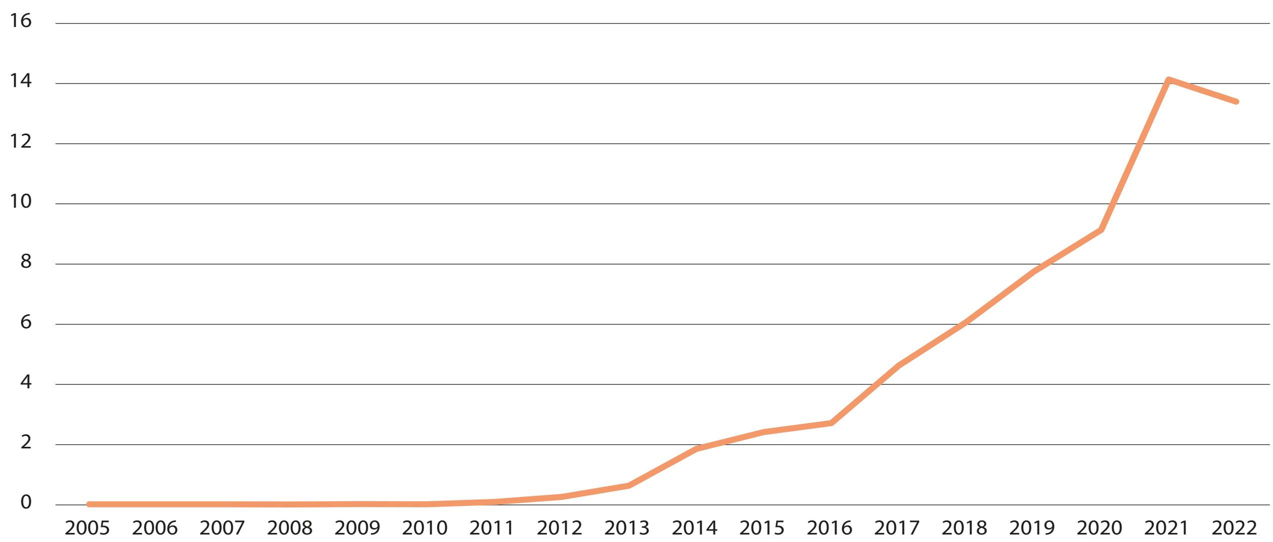
Figure 4.4 Revenue from motor vehicle taxes and fuel taxes in road transport, 2023-bill. NOK.



Source: Statistics Norway and Ministry of Finance.

The National Transport Plan 2018–2029 (Meld. St. 33 (2016–2017) Report to the Storting (white paper)) set targets for the sales of zero emission vehicles. These targets were continued in the National Transport Plan 2022–2033 (Meld. St. 20 (2020–2021) Report to the Storting (white paper)). 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.

Figure 4.5	Tax expenditure from EVs being zero-rated in the VAT, 2022-bill. NOK.



Source: Ministry of Finance.

Box 4.7 Other advantages for electric vehicles

In addition to the tax benefits, EVs have other benefits, such as access to bus lanes (decided locally), reduced toll fares, a rebate on car ferry crossings, and reduced parking fees on public parking spots. Norway has more than 20 000 publicly available charging points, and over 5000 of these are fast charging points. Many publicly available charging points have received funding via the state-owned enterprise Enova.

4.3.7.2.2 One-off registration tax based on CO_2-emissions

The one-off motor vehicle registration tax was introduced in 1955. The original intention of the tax was to slow down the import of foreign capital-intensive goods. Now the tax is regarded as a fiscal tax, but that has been used extensively to give economic incentives to choose low and zero emissions vehicles.

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. Since 2007 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 NO_x 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 2007 CO_2 emissions was introduced in the tax base of the one off registration tax. This resulted in an immediate drop in average CO_2 emissions from new passenger cars, see figure 4.7. From 2006 to 2007, the average CO_2 emissions from new passenger cars in Norway was reduced by 10.2 per cent. For comparison, from 2006 to 2007 the average CO_2 emissions from new passenger cars in EU was reduced by 1.6 per cent. The decline in average

CO_2 emissions of new passenger cars continued to be somewhat higher in Norway than in EU, until 2013. Since 2014, the average CO_2 emissions from new passenger cars have dropped considerably in Norway due to the increased share of electric vehicles.

Since diesel cars have lower CO_2 emissions than petrol cars, the introduction of the one-off registration tax for new passenger cars based on CO_2-emissions resulted in a decrease in the sales of petrol cars and an increase in the share of diesel cars, see figure 4.8. In addition, the share of fuel-efficient cars increased. Since 2011, the share of electric vehicles has increased rapidly, due to the tax advantages for electric vehicles (see 4.3.7.2).

4.3.7.2.3 Road usage tax

The road usage tax on fuel was introduced in 1931. The intention of the tax, besides creating revenue, is to price the external costs of road transport, except emissions of CO_2. CO_2 emissions from road transport are priced by the CO_2 tax on mineral products, see 4.3.2.2 The major external costs are congestion, noise, accidents, wear and tear and local emissions. The road usage tax applies to petrol, mineral oil, biodiesel, bioethanol, natural gas and LPG. The 2022 tax rates are shown in table 4.10.

Figure 4.6 CO_2-component of the one-off registration tax on motor vehicles. Total tax in NOK and marginal tax in NOK per g/km CO_2-emissions (WLTP). 2022.

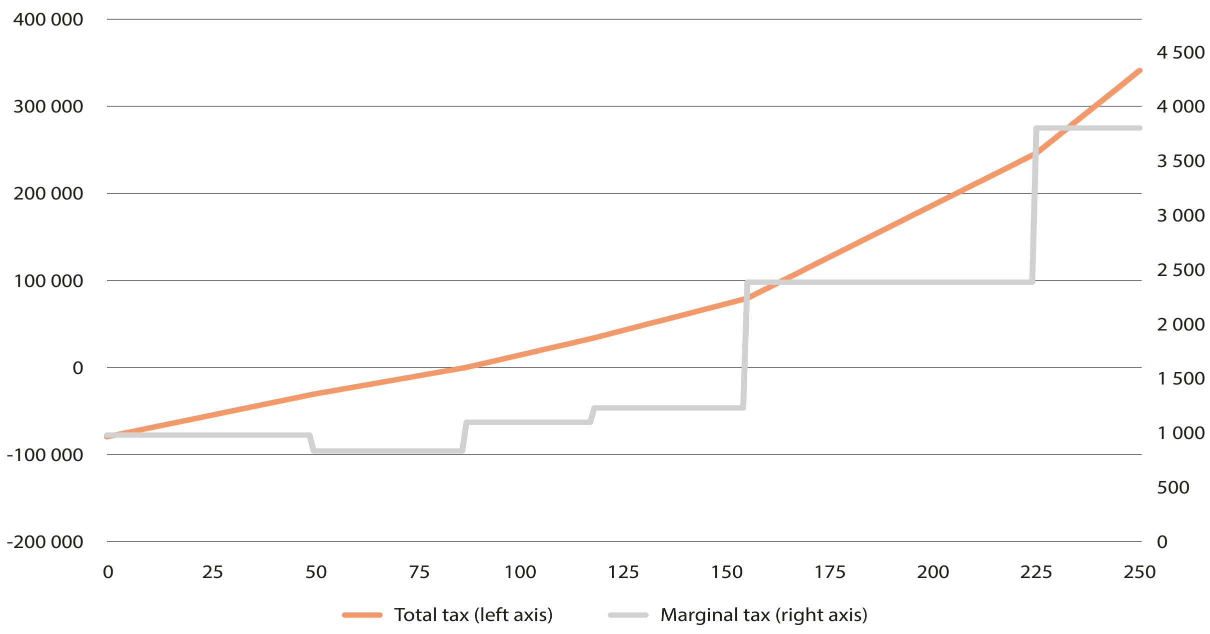
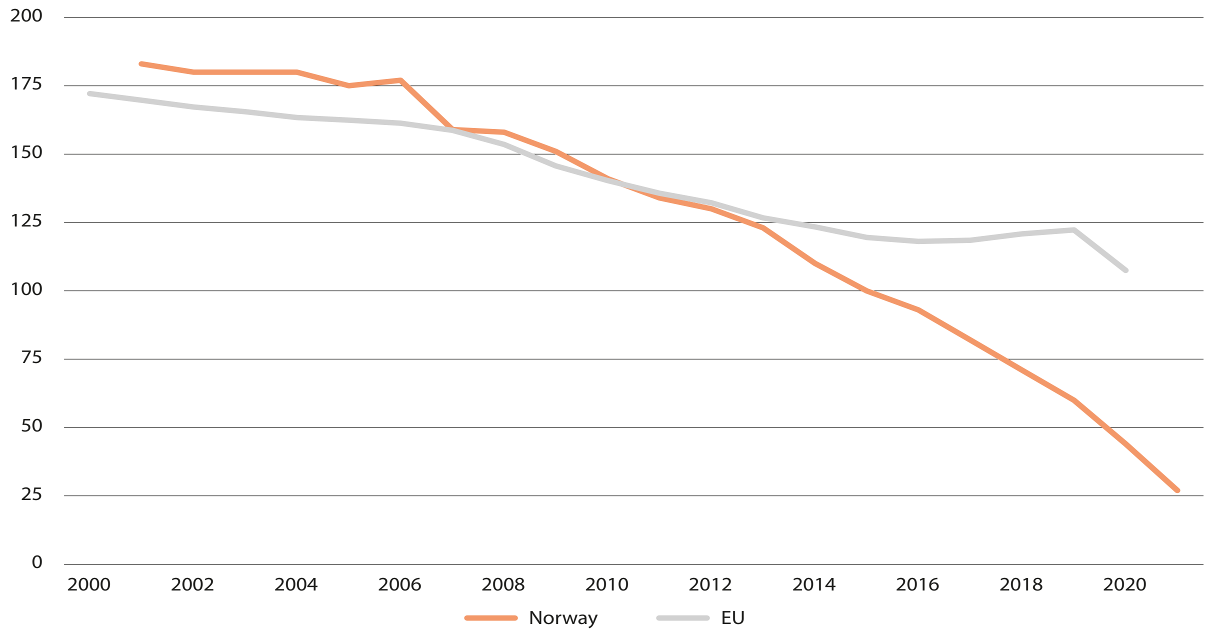
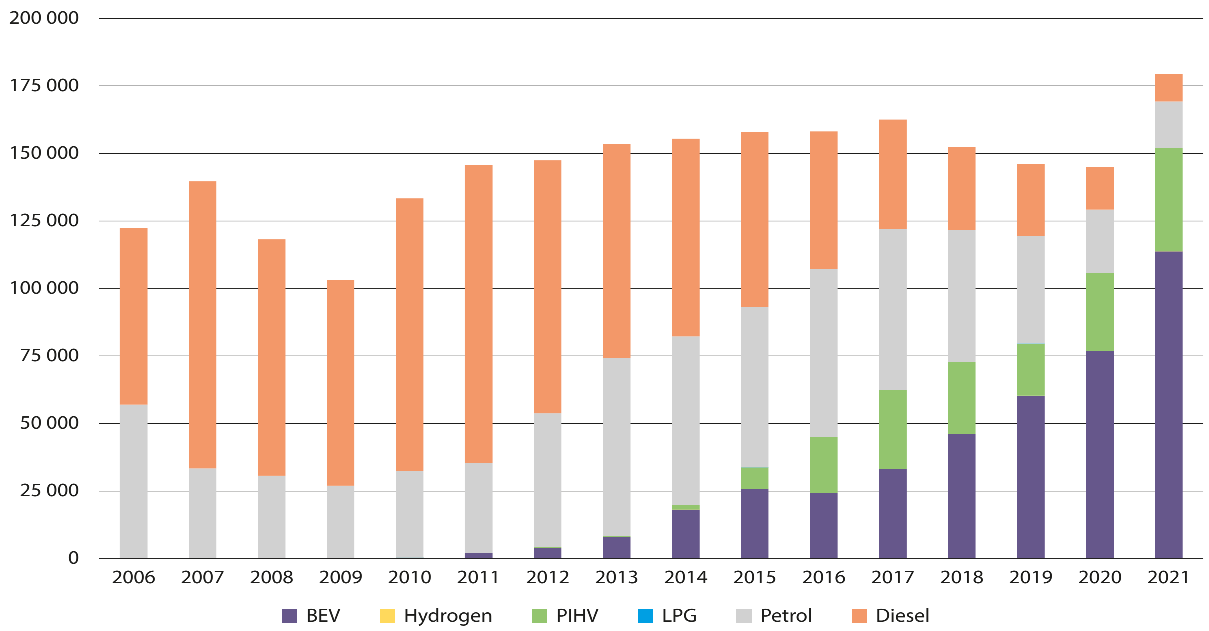


Figure 4.7 Average CO_2 emissions from new passenger cars. Grams/km.



Source: European Environment Agency and Norwegian Road Federation.

Figure 4.8 New passenger cars by fuels.



Source: The Norwegian Public Roads Administration.

Table 4.10	Road usage tax on fuels.

Fuel	Tax rate
Petrol, NOK per litre	4.95
Mineral oil, NOK per litre	3.52
Bioethanol, NOK per litre	2.02
Biodiesel, NOK per litre	3.09
Natural gas, NOK per Sm^3	2.76
LPG, NOK per kg	5.05

Source: Ministry of Finance

4.3.7.2.4 Biofuel requirement road transport

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. The obligation is 24.5 per cent (since January 1st, 2021) 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'. 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 has been increased several times and is at 9 per cent (since January 1st, 2021).

In addition to the quota obligation, 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. The amount of biofuels in petrol and auto diesel sold has increased since 2006, cf. Table 4.11.

Table 4.11	Content of biofuels in petrol and auto diesel. 2005–2020. Per cent by energy.

	2005	2010	2015	2020
Petrol	0.0 %	0.4 %	1.1 %	5.8 %
Auto diesel	0.2 %	5.1 %	5.0 %	14.5 %

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

4.3.7.3 CO_2-tax on domestic aviation under the EU-ETS

Mineral oil for domestic aviation under the ETS is also subject to the CO_2-tax on mineral products. The tax rate is NOK 631 in 2022. It covers close to all of Norwegian emissions from domestic aviation. The combined marginal carbon price from the tax and the ETS is estimated to be approximately NOK 1 500 per ton CO_2 in 2022.

Estimated effect on national emissions

The estimated CO_2 effect is 10 000 tonnes CO_2 in 2025, 2030 and 2035. This is estimated using the price elasticity model developed by the Norwegian Ministry of Finance, cf. item 4.3.2.2.

4.3.7.4 Blending mandate for advanced jet biofuel in aviation

On January 1st, 2020, a requirement that 0.5 per cent of aviation fuel sold in Norway is advanced biofuels was introduced. The quota obligation applies to all suppliers of aviation fuel and covers all types of aviation fuels for both domestic and international flights. Fuel sold to flights carried out by military aircrafts, however, are exempted from the regulation due to technical requirements in the defence sector. The same definition of advanced biofuel and sustainability criteria apply as in road transport.

Estimated effect on national emissions
The estimated CO_2 effect is six thousand tonnes CO_2 in 2025, 2030 and 2035.

4.3.7.5 Pilot projects for fossil free construction sites

To speed up the introduction of zero-emission machines and vehicles on construction sites in the transport sector, the government established in 2021 a 6-year support scheme for increased use of zero emission equipment. With financial support from the scheme the three main public infrastructure builders have established twelve different pilot projects. The main objectives of the pilot projects are to speed up implementation, gain knowledge and experience, identify risks and potential barriers and support technology development. In the National Transport Plan 75 mill NOK per year has been proposed as a financial scope. For 2022, 62 mill NOK was granted by Parliament.

Estimated effect on national emissions
The first pilots have very recently started. Thus, the direct effect from the scheme has not been possible to estimate, but the emissions from machines and vehicles used in transport infrastructure projects are estimated to be at least 4–5 per cent of the total emissions from the transport sector, 600–700 000 tonnes CO_2 equivalents. Speedier introduction of non-emission machines and advanced technology development could also benefit other sectors and thereby lead to an even larger reduction in national emissions.

4.3.7.6 Urban growth agreements and reward schemes for public transport.

To prevent car-based traffic growth that contributes to greenhouse gas emissions, queues and air and noise pollution, Norway has a goal of zero growth in passenger transport by car in large urban areas.

The zero-growth target is followed up through comprehensive, long-term urban growth agreements that include road-, public transport-, bicycle-, walking- and land use-measures as well as restrictive measures for car traffic such as road tolls and parking restrictions. The purpose is better coordination between the state and local authorities that are responsible for various measures and instruments in urban areas. The solutions chosen shall contribute to reduce the need for car-based transport and facilitate that more people can walk, cycle and use public transport. Great efforts are required to achieve the zero-growth target and significant government contributions, in addition to other policy instruments.

The nine largest urban areas in Norway either have an urban growth agreement or a reward scheme for public transport. The agreements are concluded between the government, the municipalities and the county council in urban areas.

Estimated effect on national emissions
It is difficult to single out the effect of measures in the urban growth agreements and the reward schemes for public transport. For instance, the effect on greenhouse emissions of more cycling and walking depends on this transport being replaced by travels with fossil cars. Nevertheless, the Norwegian Public Roads Administration has made a simplified analysis of the effect of the zero growth target, aggregates for all measures. The analysis indicates that zero growth in passenger traffic by cars in the nine largest urban areas could reduce emissions by 60 000 tons CO_2 equivalents by 2030, compared to a reference path. The figures are uncertain. The reference path includes population growth, economic growth, and growth in electric car sales. It does not include technology

developments such as autonomous vehicles or Intelligent Transport Systems.

4.3.7.7 Green shipping

Green shipping is a focus area for the government. The Governments ambition is to reduce emissions form domestic shipping and fisheries by half by 2030. Norway has a leading role in the climate negotiations in the UN Maritime Organization IMO and is working to ensure that a new ambition on zero emission shipping by 2050 is achieved. To cut national emissions from domestic shipping and fisheries, and to contribute to the green transition in the shipping sector, a number of policies and measures have been implemented over the years. These measures work in combination, and some emission effects will depend on several measures being in place at the same time.

4.3.7.7.1 Maximum CO_2 emissions from the coastal services Bergen-Kirkenes

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 contracts with Hurtigruten Coastal AS and Havila Kystruten AS entered into force in 2021 and expires December 31, 2030. Havila Kystruten's four newbuilds run on natural gas (LNG) while Hurtigruten's seven vessels run on a blend of marine diesel oil and biofuel. Mainly due to the pandemic Havila Kystruten's vessels were delayed from the yard and only two vessels are in operation as of October 2022. In order to comply with the emission limits in the contracts, three of Hurtigruten Coastal's vessels are upgraded in 2022–2024 by installation of battery packs and engine/hull modifications.

The contract sets the limit for 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 per cent (wt. %) sulphur content of the fuel used is required. It is also not permitted to use heavy oil as fuel.

Estimated effect on national emissions

Emissions from the coastal route Bergen-Kirkenes in 2016, was 230 000 tonns CO_2-equivalents. Based on the annual maximum allowed emissions level, it is estimated that the emissions will be reduced by approximately 60 000 tonnes CO_2-equivalents in 2030. There is no contract beyond 2030, but the effect for 2030 is also assumed for 2035.

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".

Several measures 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 4.3.2). In addition, the vehicle tax policy contributes to shifting vehicle demand towards low and zero emission vehicles. Norway also has a quota obligation for biofuels for road traffic, see chapter 4.3.7.2.4.

4.3.7.7.2 Requirements for zero and low-emission technology in tenders for public ferries

In 2015 the CO_2-emissions from both national and regional ferry routes in Norway were approximately

600 000 tonnes, and almost all the ferries used conventional technology and marine gas oil or liquid natural gas as energy carriers. In 2021 one third of the ferries on these routes had batteries installed. The ferries are operating either all-electric or with hybrid solutions. 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. The National Public Road Administration (NPRA), the body responsible for the procurement of ferry services on the national highways, estimates that in 2030, more than two-thirds of domestic car ferry routes will be possible to operate with ferries powered by electricity.

Due to high energy demand or lack of access to electricity, there are a few 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 part of the domestic ferry routes. In 2019, the NPRA signed a development contract, with the result of an electric hybrid fuel cell battery powered car ferry. The car ferry will be powered by equal amounts of hydrogen and electricity as energy carriers, and the final equipping is due in 2022. The objective of the development contract was to make zero emission technology available for ferry routes that would not be suitable for all-electric operation, and has led to yet another signed contract with the requirements of two hybrid fuel cell powered car ferries in operation in 2025. These car ferries will be powered by hydrogen in addition to biodiesel as energy carriers.

Estimated effect on national emissions
The emissions from ferries have decreased by about 100 kt CO_2 from 2015 until 2020 and is estimated to decrease by a further 100 kt CO_2 by 2025. This is likely as a result of the requirements for zero and low-emission technology in tenders for ferries on the national highways, on tenders that have been awarded, announced or expected as of today It's likely that the downward trend will continue, but this is not certain. The potential emission reductions described in box 4.8 from possible new tenders from 2023 are additional.

4.3.7.7.3 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[8] 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 it is assumed that 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 2035.

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

Box 4.8 Zero emission public ferries

The current political platform in Norway states that it wants to require zero emission public ferries from 2023. The Norwegian Maritime Authority, The Norwegian Environment Agency, National Public Road Administration (NPRA), and The Norwegian Agency for Public and Financial Management (DFØ) has delivered a report to the ministry on how the requirement may be structured. The agencies suggested a strict zero emission requirement for vessels in new tenders from 2023. Furthermore, they opened for exemptions under certain criteria, such as lack of infrastructure.

Estimating the emissions effect from this requirement includes a high degree of uncertainty, because there's a high probability that measures would have been taken in the segment without the regulation, mainly because of climate ambitions in the county councils and from the NPRA and current requirements to valuate emission reductions in new tenders. However, based on knowledge of upcoming tenders, the difficulty of the routes and assumptions of available technology, the Norwegian Environment Agency has estimated that the emission effect of the requirement could be 84 000 tonnes CO_2 in 2025, 184 000 tonnes in 2030 and 364 000 tonnes in 2035.

Since the initiation of the Norwegian Aid Scheme for Shortsea Shipping, 10 projects have been approved by the Norwegian Coastal Agency (NCA). However, due to various reasons, several of the projects have been cancelled. Five of the ten approved services are in operation today. The NCA's estimates of emission reductions is about 23 000 tonnes CO_2 in 2020 and 24 000 tonnes CO_2 from 2025 and onwards.

4.3.7.7.4 Green shipping programme

The government's policy on green shipping has been developed through close cooperation between the authorities and the industry. A good example is the cooperation on the Green Shipping Programme (GSP), a public-private partnership that aims to advance the Norwegian government's strategy and plans. The GSP perform studies, start pilots, transfer knowledge between theory and practice and facilitate dialogue and collaboration between all stakeholders. The program consists of 114 partners, 103 private companies as well as 11 government observers. The GSP is finances partly by public allocations from the state budget and partly by the members themselves. Since the program was started in 2015, 44 green pilot projects have been initiated, of which 14 have been implemented or are under construction.

Estimated effect on national emissions

Immediate effects are expected from the pilots that are realized, as well as the projects from the Service Center. The effects are ships in operation with dramatically reduced emissions, and in many cases with zero emissions. The potential in scaling of the successful pilots must not be underestimated, and the technologies that are proven feasible can be realized on a larger scale in 5–10 years. Hence, the emission reduction potential is substantially larger than what is shown in the individual projects within the programme. The effect of the pilots has not been quantified.

The emission reduction potential from the Service Center's projects is approximately 260.000 tonnes CO_2e/year. In the table below, realization of half of the projects are assumed in 2025. In 2030, an increase of projects in the portfolio is assumed, in addition to realization of the other half of today's portfolio. A further increase is assumed in 2035.

A primary role for GSP is also to funnel projects into available public and private funding schemes, e.g. from Enova, thus enhancing the impact of these schemes. Effects in the longer run and outside of GSP are expected, as results from barrier studies, roadmaps, and reduction of business risk after successful demonstration in the pilots. A primary function of the GSP is to identify barriers through work on concrete, actual projects – and to communicate these barriers, as well as possible measures and policies to overcome them, to stakeholders including government entities. One example is the GSP barrier study on electrical ferries that accelerated the implementation of emission requirements from the authorities. The Service Center's focus on the cargo owners stimulates the development of the market for green fuels and environmentally friendly transport services, increasing the demand for, and availability of such.

4.3.7.7.5 Risk loan scheme for Norwegian short sea vessels and fishing fleet

The loan scheme was established in 2020 and is similar to the Innovation Norway's innovation loan scheme, but is limited for vessels in short sea shipping fleet and the fishing fleet. The aim is to stimulate green fleet renewal and reduced greenhouse emissions. The short sea segment is characterized by older vessels, which vary in size and sail between different ports on short-term contracts. Risk loans can be given to investments in new vessels using low and zero emission technology or for upgrading existing vessels into low or zero emission vessels. The risk loan scheme is state aid under GBER and supplements other public and private market-based financing and loans.

Estimated effect on national emissions

Innovation Norway (IN) has issued loans of total 290 mill. NOK, for investments on a total of 14 ships, including two fishing vessels. The risk loan scheme has given an estimated emission reduction of average 39 per cent on the projects supported by the scheme, based on self- reporting from the shipowners. The emission reduction effect has not been estimated due to lack of data.

4.3.7.7.6 Recycling scheme for short sea vessels and offshore vessels

The recycling scheme for short sea vessels was established in 2020 with the aim of fomenting fleet renewal in a segment with little ability or incentives for green fleet renewal. The intention was to give incentives for shipowners to take on investments in new vessels or upgrading existing vessels using low and zero emission technology, provided an older ship was sold off for scrapping. The grant was calculated on the basis the eligible cost of the investment, was state aid under GBER and limited to 8 mill. NOK per undertaking. The funding of the scheme was 75. mill. NOK, and a total of 16 mill. NOK was allocated. The scheme was terminated in the 2022 revised national budget.

In 2021, the Storting funded 150 mill. NOK to a recycling scheme for offshore vessels. The scheme was similar to the scheme for short sea vessels except the limit of 8 mill. NOK per undertaking and was launched in June 2021. The funding was allocated by the end of the year, supporting investments on 20 offshore vessels by recycling 11 vessels.

Estimated effect on national emissions

The schemes have supported investments on 22 ships, and a total of 14 ships have been recycled. The recycling schemes have given an estimated emission reduction of 10–25 per cent per project, based on self- reporting from the shipowners. The results have not been aggregated and are reported as not estimated.

Both schemes constitute state aid under GBER, where the eligible cost for the most part is calculated according to art 36 which is investment aid enabling undertakings to go beyond Union standards for environmental protection or to increase the level of environmental protection in the absence of Union standards. The allocation of funds has contributed to investments on ships that are significantly greener than corresponding older tonnage.

4.3.7.7.7 High speed passenger ferries scheme

In 2019, the Government introduced a new policy instrument to promote emissions reduction project for high-speed passenger ferries in Norwegian municipalities and counties called "Hurtigbåtprogrammet". The Norwegian Environment Agency is responsible for administering the financial support scheme. The Norwegian Environment Agency assesses and prioritises the application based on given criteria. The objective of the programme is to reduce emissions from the segment and contribute to the transition to a low carbon society. Examples of supported projects are feasibility studies for zero emission vessels, development of new technologies such as battery-electric and hydrogen powered vessels, dedicated funding of new tenders that require zero emission technologies and cooperative projects between country councils.

"Hurtigbåtprogrammet" has allocated NOK 240 million to 19 different projects since it was started in 2019. There have been 5 different tenders where municipalities and county councils have competed for funding. There has been substantial interest in the scheme, and it has so far contributed to significant and necessary development of zero emission high-speed ferries.

Estimated effect on national emissions

Some projects will directly reduce emissions by implementing zero emission vessels. The estimated effect of this is around 12 000 tonnes of CO_2 per year from 2025, possibly more in 2030 and 2035 depending on funded projects in upcoming tenders. The emission reduction estimates are based on the county councils own actual emissions data for current vessels in operation. These vessels will be replaced with zero or lower emission vessels. Actual emission reductions will in some tenders depend on what operators will offer, while some set clear minimum emission standards because of support from the scheme.

4.3.7.7.8 Maritime Zero 2050

The initiative Maritime Zero 2050 is directed towards development of zero emission solutions for large ships sailing long distances. The research council of Norway is responsible for the call and the funding will go to projects that will achieve new knowledge and develop new technologies and solutions, suitable for vessel segments and sailing distances which do not already have available zero emission solutions. The initiative is important for the Norwegian Government's ambition to reduce emissions from domestic shipping and fishing vessels by half by 2030 and promote the development of zero- and low emission solutions for all vessel categories. The Norwegian government has allocated NOK 38.5 million to the initiative Maritime Zero 2050. The Research Council of Norway has distributed this to the Collaborative Project to Meet Societal and Industry-related Challenges and the calls for Innovation Project for the Industrial Sector 2022 and Demonstration Project for the Industrial Sector 2022. In June 2022, two applications related to energy efficient operation of hydrogen powered vessels and one application related to nuclear propulsion of merchant ships were approved.

Estimated effect on national emissions

The Maritime Zero 2050 call was first initiated in 2022, and the three research projects given funding this year will start up in 2023 and last until 2025 (when prototypes will be tested on board vessels etc). This means that the effect on national emissions resulting from these projects the earliest can be seen from 2025 and after. The funded projects will provide new knowledge and potential new zero-emission solutions for large ships sailing long distances, but it is not given how many ships that will be converted or replaced from conventional fossil fuel ships to zero-emission fuel ships based on this. As the relevant ships are large ships sailing long distances, it should also be noted that some of the emission reductions may be outside of Norway. The emission reduction effect has not been estimated due to lack of data.

However, it is possible to give high-level indications on emission reduction potential per ship that is converted or replaced based on the project results. For an example, looking at the project related to nuclear propulsion of merchant ships, this nuclear solution may replace a conventional LNG carrier typically consuming almost 40 000 metric tons HFO per year, which will result in emission reductions of roughly 120 000 metric tons of CO_2 per ship.

The results from the two hydrogen projects will be essential elements in a combined knowledge base and technology platform that will facilitate the widespread, efficient, sustainable and safe use of liquid hydrogen for merchant ships. Optimizing entire power and propulsion systems will save large amounts of power and energy, and this is a necessary step to enable use of hydrogen and obtain reduction in GHG emissions in the maritime sector.

4.3.7.8 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 and maintenance of existing railways. The railway sector was granted, NOK 26.6 billion in 2020, NOK 31.9 billion in 2021 and NOK 31.8 billion in 2022.

One of the main objectives for increased investments in railways is related to the goal "zero traffic growth for passenger cars" (see above 4.3.7.8) in the nine largest city-areas in Norway. All of these cities are working towards urban growth agreements with national authorities, which obliges them to reduce growth in passenger car transport.

Estimated effect on national emissions

Investments in railway in the first six years in the National Transport Plan (2022–2033) is by the Norwegian Railway Directorate estimated to reduce the emissions with approximately 40 000 tonnes CO_2 equivalents in 2026, 41 000 tonnes CO_2 equivalents in 2030 and 52 000 tonnes CO_2 equivalents in 2035. The reduction is mainly caused by transferred traffic from road to railway, both passengers and freight. The estimate also includes emissions from railway transport. It does not include emissions from operation, maintenance and construction of the infrastructure and land-use change. The first six years of the plan includes different projects for developing the freight and passenger services, but the concrete plan and implementation of the projects have to be decided upon in the annual budgets.

4.3.7.9 Grant funding to transport freight by rail

In order to reduce the negative external effects of transport, such as local and global air pollution, climate gases, noise, congestion and accidents, the Norwegian government aims to encourage a modal shift from road to rail and sea transport. It is a political goal to transfer 30 per cent of the freight transports that occur on distances of more than 300 km from road to rail or sea by 2030. However, rail freight companies in Norway have scarce opportunities to invest and expand due to strong competition from road transport. To improve conditions for rail freight operators, and to facilitate a shift from road to rail, the Norwegian government issued a temporary support scheme which was approved by ESA and adopted by the parliament in 2019.

According to Section 6-5 of the Regulation on Railways Operations, the Ministry of Transport has the possibility to introduce, under certain conditions, a support scheme for Railways. The Ministry have delegated this power to the Norwegian Railway Directorate. The Directorate draws up the detailed provisions in guidelines, in accordance with the notification to ESA, and administer the scheme. The scheme is financed through the annual national budget.

Estimated effect on national emissions
During 2019 to 2021, the freight transport by rail increased by annual average growth-rate of approximately 10 per cent. In the first six months of 2022, the freight transport increased by eight per cent as compared to the corresponding period in 2021. Further, rail freight companies have applied to transport 30 per cent more freight in 2023 compared to 2022. However, it is not possible at this time to single out the effect of the support scheme on national emissions. Increased rail capacity, freight transport demand and restrictive measures for road transport are key drivers for a modal shift from road to rail. The support scheme is thus one of multiple measures that works simultaneously to increase transport freight by rail. Additionally, the Covid 19 pandemic had an impact for both global and national demand for goods, which increased national freight transport by rail in the second half of 2020. This sudden increase occurred simultaneously as the first payment from the support scheme took place.

To determine the effect of the support scheme on national emissions, more data over time is needed to isolate different explanatory variables. Nevertheless, the support scheme did improve market conditions for rail freight companies, and thus contributed to the growth observed in the last years.

Box 4.9 Electrification of railways

Roughly 80 per cent of all trains driven each year in Norway runs by electricity, while the rest is driven by fossil fuels. In 2019, the total amount of greenhouse gas emissions from rail transport was approximately 50 000 tonnes CO_2-equivalents Electrification of the rail network is an important measure to reduce emissions, and parts of the rail network (Trondheim–Stjørdal, Hell–Riksgrensen and Stavne–Leangen) are currently being electrified. The Norwegian Railway Directorate will present a concept study in 2023 with recommended zero or low-emission solutions for the rest of the non-electrified lines.

4.3.7.9 Enova
Enova provides support for both late-phase technology development and early market introduction of climate- and energy solutions in the transport sector, both at land at sea. In 2021 Enova granted a total of 2.1 billion NOK to 4 949 projects in the transport sector. Among the supported projects are emission free light duty vehicles, heavy duty vehicles and construction machines. They have also supported charging infrastructure on land and onshore power supply for ships. At sea they support installation of batteries in ships, as well as more innovative projects like hydrogen powered fishing boats, etc. For further description and estimated effect of this mitigation action in chapter 4.3.3.2.

4.3.7.10 International transport
Norway has for a number of years worked actively through the International Maritime Organisation

(IMO) to pursue limitation of greenhouse gas emissions from international shipping. Since the last National Communication submitted by Norway, the IMO has adopted energy efficiency requirements which entered into force on 1 January 2013. This framework has been expanded further in 2014, and further tightening and expansion of the energy efficiency requirements is adopted with entry into force in April 2022 (EEDI strengthening) and November 2022 (EEXI and CII). Further, proposals for mid- and long-term measures for reduction of GHG emissions from shipping are under consideration. The IMO data collection system which will collect fuel consumption data entered into force on 1 March 2018. At present Norway is contributing actively to strengthen the ambition for the Revised IMO strategy on the reduction of Greenhouse Gases from international shipping to zero by 2050. The revised IMO GHG Strategy is planned to be adopted at MEPC 80 in July 2023. Further the IMO is also addressing short-lived climate forcers through the ongoing work on Black Carbon emissions from shipping. The existing regulation on emissions on volatile organic compounds also addresses these emissions.

In 2020 the IMO updated the estimate of the global greenhouse gas emissions from international shipping. Further, new studies on emission reduction pathways will be executed in 2022/2023.

At the national level, Norway implements all relevant provisions of the IMO to limit or reduce emissions. In addition, Norway has promoted the introduction of battery-electric ferries through public procurement as a climate measure. Development of more energy-efficient technologies for shipping is also enhanced through research and development programmes under the Research Council of Norway, Innovation Norway and Enova. Pilot projects on low- and zero-emission shipping are being developed through the Green Shipping Programme which is a private-public partnership.

ICAO has set a goal of achieving carbon neutral growth from 2020 for international aviation. The general assembly reiterated two global aspirational goals for the international aviation sector of 2 per cent annual fuel efficiency improvement through 2050 and carbon neutral growth from 2020 onwards, as established at the 37th Assembly in 2010. The largest emission challenge in air traffic is related to large aircraft and long-distance flights and Norway therefore welcomes international regulations on international aviation.

Within the ICAO, Norway has as an observer in the Civil Aviation Environment Programme (CAEP). Further, as a member of the European Civil Aviation Conference (ECAC), Norway participates actively with a view to limit greenhouse gas emissions from international aviation. To achieve the global aspirational goals and to promote sustainable growth of international aviation, ICAO is pursuing a basket of measures including aircraft technology improvements, operational improvements, sustainable aviation fuels, and market-based measures (CORSIA). Norway supported the development of the global market-based measure (CORSIA), and has since 2021 taken part of its voluntary phase.

During ICAO's 40th Assembly in 2019, it was decided to initiate a process to investigate the feasibility of new long-term climate goals for international aviation (Long Term Aspirational Goals, or "LTAGs"). The matter was dealt with at the 41st General Assembly of ICAO in October 2022. Norway has expressed support, as a member of ECAC, for the long-term goals to be in accordance with the Paris Agreement and net zero carbon emission by 2050. This has further been underlined through support for the "International Aviation Climate Ambition Coalition", which was formed during COP26 in Glasgow in 2021, and the "Declaration on Future Sustainability and Decarbonisation of Aviation" presented during the French presidency of the EU's European aviation summit in 2022.

Norway participates in the EU Emission Trading Scheme (EU ETS) for aviation, through the implementation of EU Directive 2008/101/EC in the EEA Agreement.

Table 4.12 Summary policies and measures, transport

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Taxes and regulations on emissions from road transportation * [g]	Transport	CO_2	Reduce emissions from road transport	See below	Implemented
The Norwegian tax scheme on emissions of GHGs under the ESR (road transport only) *	Transport	CO_2	Cost-effective reductions of emissions	Fiscal	Implemented
Road usage tax *	Transport	CO_2	Besides creating revenue, the intention is to price the external costs of road transport, except emissions of CO_2	Fiscal	Implemented
One-off registration tax based on CO_2-emissions and with special rules for plug-in hybrid cars *	Transport	CO_2	Reduce emissions from new cars	Economic	Implemented
Tax advantages for electric vehicles *	Transport	CO_2	Reduce emissions from new cars	Economic, regulatory	Implemented
Biofuel requirement in road transport *	Transport	CO_2	Reduce emissions from road transport	Regulatory	Implemented
CO_2 tax on domestic aviation (ETS) *	Transport	CO_2	Cost-effective reductions of emissions	Fiscal	Implemented
Blending mandate for advanced jet biofuel in aviation *	Transport	CO_2	Reduced emissions from aviation	Regulatory	Implemented
Pilot projects for fossil free construction sites *	Transport	CO_2	Reduces emissions from construction machinery	Economic	Implemented
Urban growth agreements and reward schemes for public transport *	Transport	CO_2	Modal shift to public transport or non-motorized transport, demand management/reduction	Economic; Voluntary/negotiated agreements	Implemented
Maximum CO_2-emissions from the coastal service Bergen-Kirkenes *	Transport	CO_2	Reduce emissions	Regulatory	Implemented
Requirements for zero and low-emission technology in tenders for public ferries *	Transport	CO_2	Reduce emissions from ferries	Economic, regulatory	Implemented, planned
Aid Scheme for Short Sea Shipping *	Transport	CO_2	Reduce emission from freight transport	Economic	Implemented, Planned
Green Shipping Programme *	Transport	CO_2	Reduce emission from freight transport	Economic	Implemented, Planned
Recycling scheme for Norwegian short sea vessels and offshore vessels *	Transport	CO_2	Reduce emission from freight transport	Economic	Implemented

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
Several policies affecting road traffic, see below	See below	Ministry of Finance	4 000	5 400	6 800	8 300
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	1991	Ministry of Finance	IE	IE	IE	IE
The road usage tax applies to petrol, mineral oil, biodiesel, bioethanol, natural gas and LPG	1931	Ministry of Finance	IE	IE	IE	IE
Registration tax is based on CO_2 emissions, NO_x emissions and weight. CO_2 emissions included in 2007 – increasingly emphasised. Additional weight rebates for plug-in hybrids in the registration tax.	2007	Ministry of Finance	IE	IE	IE	IE
Exception from registration tax and VAT for EVs. Reduced rate in annual motor vehicle tax. Other user advantages as free or low charges for toll roads, ferries and public parking.	2001	Ministry of Finance	IE	IE	IE	IE
From January 1st 2021, the requirement is that 24.5 % of total fuel sold to road traffic is biofuel, with a sub requirement that 9 % should be advanced biofuel. Advanced biofuel is double counted within the overall requirement.	2009	Ministry of Climate and Environment	IE	IE	IE	IE
Mineral oil for domestic aviation under the ETS is also subject to the CO_2-tax on mineral products.	1999	Ministry of Finance	10	10	10	10
From January 1st 2020, 0.5 % of total fuel sales in aviation is required to be advanced biofuel.	2020	Ministry of Climate and Environment	6	6	6	6
Support scheme for increased use of zero emission equipment on construction sites for public transport infrastructure	2022	Ministry of transport and communication	NE	NE	NE	NE
The 9 largest urban areas either have urban environment agreements, urban growth agreements or a reward scheme for public transport, which all share the same common goal of zero growth in passenger traffic by car.	2012	Ministry of transport and communication	NE	NE	60	60
Requirements for maximum CO_2-emissions from the coastal route Bergen to Kirkenes.	2016	Ministry of transport and communication	NE	NE	60	60
Low- and zero emission criteria for ferries from 2023 where suitable	2015	Ministry of transport and communication	100	200	200	200
Shipowners may receive financial aid for operational costs or for investments costs over a three-year period in order to establish a sustainable maritime transport route.	2017	Ministry of Trade, Industry and Fisheries	23	24	24	24
The Green Shipping Programme (GSP) is a public-private partnership working to reduce barriers for the introduction of low and zero emission solutions within the maritime sector. The program has initiated 28 green pilot projects since its beginning in 2015, and completed 8 of them. Since 2019, the programme has had a special focus on fleet renewal within the short shipping segments.	2019	Ministry of Trade, Industry and Fisheries	NA	130	360	600
Established with the aim of fomenting fleet renewal in a segment with little ability or incentives for green fleet renewal.	2020	Ministry of Trade, Industry and Fisheries	NE	NE	NE	NE

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
High speed passenger ferries scheme *	Transport	CO_2	Reduce emission from freight transport	Economic	Implemented
Maritime Zero 2050	Transport	CO_2	Reduce emission from freight transport	Economic	Implemented
Investments in railways *	Transport	CO_2	Reduce emission from transport	Economic	Implemented, planned
Grant funding to transport freight by rail *	Transport	CO_2	Reduce emission from freight transport	Economic	Implemented

For note and footnotes, see under table 4.2

[g] Custom footnote. The effects of the Norwegian tax scheme on emissions of GHGs under the ESR (road transport only), road usage tax, one-off registration tax based on CO_2 emissions and with special rules for plug-in hybrid cars, tax advantages for electric vehicles and biofuel requirement in road transport are included in the effects of taxes and regulations on emissions from road transportation.

4.3.8 Industry

4.3.8.1 Introduction

This sector covers primarily emissions from the manufacturing industry, including emissions from industrial processes. A number of policies and measures have been implemented over the years. From 2013, emissions of CO_2 PFCs and N_2O 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.

4.3.8.2 Arrangement to reduce emissions in the processing industry, 2004

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 F table 3 under the PaM N_2O reduction, production of nitric acid.

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. The effect is reported as included elsewhere (IE) since the effect is included under the PaM N_2O reduction, production of nitric acid.

4.3.8.3 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

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
Financial support scheme dedicated to projects in county councils aiming at reducing emissions for high speed passenger vessels.	2019	Ministry of Climate and Environment	NA	12	12	12
Directed towards development of zero emission solutions for large ships sailing long distances.	2022	Ministry of Trade, Industry and Fisheries	NA	NE	NE	NE
1) Investment in railway infrastructure in the larger capital area, the so called InterCity-project. 2) Investment in specific infrastructure measures for freight transport.	2011	Ministry of transport and communication	NE	40	41	52
To improve conditions for rail freight operators, and to facilitate a shift from road to rail.	2019	Ministry of transport and communication	NE	NE	NE	NE

years 2008–2012. The limit equalled a reduction of 39 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. This reduction is used as an estimate for the effect of the agreement for 2020, 2025, 2030 and 2035. From 2013 onwards, nearly all the emissions from the processing industry are included in the emissions trading scheme.

4.3.8.4 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).

4.3.8.5 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 CO_2 emissions from the production of cement and 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 these sectors is in the national emission projection anticipated to be at approximately the same level as today. The CO_2 effect of the use of biocarbon in 2025, 2030 and 2035 is set equal to the estimated emissions from biocarbon in 2020 (500 kt CO_2).

4.3.8.6 N_2O reduction, production of nitric acid

In 2020, the N_2O emissions from the production of nitric acid equalled about 0.1 million tonnes CO_2 equivalents. The N_2O emissions from the production of nitric acid decreased by 95 per cent from 1990 to 2020. 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 0.17 kg N_2O tonne of nitric acid in 2020.

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 effect in 2020 is estimated based on production levels and emissions from the emission inventory, while 2030 estimates are consistent with the GHG projections. The effects for 2020 is estimated to 2.8 million tonnes CO_2 equivalents, while the projected effect is estimated to 3.0 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.

4.3.8.7 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 97 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.

The effects assume a "business-as-usual" scenario from 1990, with no change in emission intensity since 1990 but with actual production level for 2020. For 2025, 2030 and 2035 the production levels and emissions are consistent with the latest GHG projections. The effect for 2020 is estimated to 5.8 million tonnes CO_2 equivalents and to about 6.2–6.3 million tonnes CO_2 equivalents in 2025, 2030 and 2035.

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

In 2002, a voluntary agreement between the Ministry of Climate and Environment and the business organisations representing most users of gas-insulated switchgear (GIS) and a producer of switchgear was established. 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, emissions 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. Although the installed amount of gas in GIS has increased considerably since 2000, the emissions from GIS in use have decreased.

Estimated effect on national emissions

Emission estimates from the Norwegian inventory have been used to calculate the emission reductions resulting from the agreement. Ex post evaluation for 2020 gives an estimated effect of 56 000 tonnes CO_2 equivalents. For 2025, 2030 and 2035, projections are compared to the emission estimates for the base year 2000. The effects are estimated to 69 000, 67 000 and 25 000 tonnes CO_2 equivalents in 2025, 2030 and 2035 respectively.

4.3.8.9 *F-gas regulations and the Kigali Amendment to the Montreal Protocol*

Norway has implemented the EU Regulations on certain fluorinated greenhouse gases (No. 842/2006 in 2010, revised by No. 517/2014 in 2018. The regulation sets up measures to prevent emissions of F-gases from existing equipment by requiring checks, proper servicing and recovery of the gases at the end of the equipment's life. It also bans the use of F-gases in many new types of equipment and products where less harmful alternatives are widely available.

Norway is exempted from the EU HFC phase-down scheme of the EU f-gas regulation. 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 its obligations under the Montreal Protocol.

Norway has implemented the EU Directive 2006/40/EC which gradually bans the use of HFCs with high GWP in air-condition systems in passenger cars and light commercial vehicles.

Estimated effect on national emissions

The Norwegian Environment Agency provided an updated assessment on the effect on HFC emissions of planned measures in 2016, based on the work of a national expert. For 2020, the Norwegian Environment Agency has estimated a reduction in HFC emissions of about 150 thousand tonnes CO_2-equivalents. Comparing projected emissions with emission levels in 2015 gives an estimated effect of approximately 0.66 million tonnes CO_2-equivalents in 2035. The effect in 2035 includes an effect of 27 thousand tonnes CO_2-equivalents from restrictions on SF_6 in certain products, such as windows. The effect is estimated as likely emissions without the measure.

Table 4.13	Summary policies and measures, industry

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Arrangement to reduce emissions in the processing industry, 2004 * [g]	Industrial processes	CO_2, HFC, CH_4, N_2O, PFC, SF_6	Reduce emissions	Voluntary/ negotiated agreements	Implemented
Arrangement to reduce emissions in the processing industry, 2009 *	Industrial processes	CO_2, HFC, CH_4, N_2O, PFC, SF_6	Reduce emissions	Voluntary/ negotiated agreements	Implemented
CO_2 compensation scheme *	Industrial processes	NA	Prevent carbon leakage	Voluntary	Implemented
Use of bio carbon in the production of cement and ferroalloys *	Industrial processes	CO_2	Reduce emissions	Voluntary/ negotiated agreements	Implemented
N_2O reduction, production and nitric acid *	Industrial processes	N_2O	Reduce emissions	Voluntary/ negotiated agreements	Implemented
Agreement with the aluminium industry *	Industrial processes	PFC	Reduce emissions	Voluntary/ negotiated agreements	Implemented
Agreement on SF_6 reduction from use and production of GIS *	Industrial processes	SF_6	Reduce emissions	Voluntary/ negotiated agreements	Implemented
F-gas regulation and the Kigali Amendment to the Montreal Protocol *	Industrial processes	HFC, SF_6	Reduce emissions	Regulatory	Implemented

For note and footnotes, see under table 4.2.
[g] Custom footnote. The effect is included under N_2O reduction, production of nitric acid.

4.3.9 Agriculture

Norwegian agriculture is covered by overall Norwegian climate targets and policies as specified in our NDC and our agreements with the EU. The 2022 agricultural agreement (Prop. 120 S (2021–2022)), as adopted per the subsequent recommendation to the parliament June 2022 (Innst. 462 S (2021–2022)), reaffirm that Climate targets are an integral part of agricultural policies. These policies also build on the 2021 White Paper on climate policies (Meld. St. 13 (2020–2021)). 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 informatorily measures. CO_2 from the use of fossil fuel in activities related to agriculture meets CO_2-taxation similar to other sectors. The government has proposed a mandatory biofuels turnover for non-road machinery from 2023 and this will also include agricultural machinery, whereas 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.

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
The Ministry of Climate and Environment entered into an arrangement with the processing industry.	2004	Ministry of Climate and Environment	IE	IE	IE	IE
The Ministry of Climate and Environment entered into an agreement with the processing industry that was not covered by the EU ETS.	2009	Ministry of Climate and Environment	200	200	200	200
The purpose of this compensation scheme is to prevent carbon leakage from Europe resulting from increased electricity prices due to the EU Emissions Trading System (EU ETS).	2013	Ministry of Climate and Environment	NA	NA	NA	NA
The producers have voluntarily replaced some of the coal consumption with bio carbon	1990s (cement), 2000 (ferro-alloys)		500	500	500	500
The producers have voluntarily restructured production	1992	Ministry of Climate and Environment	2 833	2 985	2 985	2 985
The major aluminium producers signed an agreement with the Ministry of Climate and Environment to reduce emissions.	1997	Ministry of Climate and Environment	5 830	6 260	6 300	6 240
Agreement between the Ministry of Climate and Environment and the business organisations representing most users of gas-insulated switchgear (GIS) and the single producer.	2002	Ministry of Climate and Environment	56	69	67	65
Implementation of the revised EU regulation No. 517/2014 and the Kigali Amendment to the Montreal Protocol.	2019	Norwegian Environmental Agency	154	377	600	662

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 output per animal.

Key measures to reduce N_2O include improving manure management and fertilizer use 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. The sector is making efforts to improve the use of fertilizers through improved storage, spreading, timing and dosage of fertilizer – according to crops' needs. Precision agriculture is under development with increasing use of GPS technology in land management. A combination of regulatory and economic instruments support such improved practices and emission reductions.

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. Collaboration between agriculture and climate experts has improved the technical understanding, and enables development of measures and instruments to further reduce emissions.

4.3.9.1 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 farmers' unions.

Based on the same co-operative approach, the Government and farmers' organisations negotiated a climate agreement for agriculture in June 2019. The letter of intent sets out a climate target for the agricultural sector, which is to reduce emissions and enhance removals by a total of 5 million tonnes CO_2-equivalents over the period 2021–2030, compared to a business-as-usual emission level of approximately 4.5 mill tonnes CO_2-equivalents annually. According to the letter of intent, responsibility for reducing emissions is shared between the agricultural sector and the Government. The agricultural sector will be in charge of on-farm improvements, while authorities will be responsible for efforts to promote changes in consumption patterns that may indirectly reduce greenhouse gas emissions from the agricultural sector. These efforts include initiatives to achieve the goal of reducing food waste by 50 per cent by 2030 and to persuade people to follow the dietary recommendations from the Directorate of Health. In 2020, farmers' organisation issued the "farmer's climate action plan". In this plan, farmers task themselves to take the lion's share of abatement through on-farm improvements. The plan lays out action in eight areas, including fuel switch and improvement in livestock, manure and soil management. Alongside; authorities will take due steps in areas such as reduced food losses and waste and persuade people to follow the dietary recommendations from the Directorate of Health. 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.

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 to control 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.

4.3.9.2 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.

In the 2022 agricultural agreement, funds for Regional Agri-environmental Programmes were upscaled. The lion's share of the additional funds were earmarked to reduce erosion and run-off, see PaM 4.3.10.2, while the upscale will also benefit climate goals. Other priority areas include support to environmentally friendly spreading of manure, which is primarily directed to abate ammonia, but will also have co-benefits for GHG-emissions. From 2022, delivery of on-farm climate extension services has also been eligible for support over regional agri-environmental programmes. Such extension is expected to increase the adoption of climate measures on farms and in this way indirectly lead to reduced emissions. From 2023, measures to advance soil health and soil carbon sequestration are established as a separate focus area in regional agri-environmental programmes.

Estimated effects of measures primarily targeted at abatement of emission to air

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 has risen over recent years and in 2020 the area with environmentally friendly spreading of manure reached 9 per cent of the agricultural area. The regional agri-environment programme was introduced in 2013 and to estimate the effect of the measure, activity data from 2013 was compared to activity data from 2020. The use of environmentally friendly spreading of manure reduced the emissions with about 3 900 tonnes of CO_2-equivalents in 2020. Spreading of manure in the growing season instead of in autumn reduced emissions by a further 1 700 tonnes CO_2-equivalents.

Estimated effects of measures primarily targeted at abatement of erosion and run-off

Various policies under regional agri-environmental programmes address erosion and run-off from arable cropping systems, with effects also for conservation of nutrients and soils, and thus for abatement of GHG emissions. In the abovementioned scale up of funds for Regional Agri-environmental Programmes in 2022, particular priority has been given to support such abatement. Furthermore, from 2023, farms in specific regions draining to the Oslofjord estuary meet requirements that zones adjacent to water courses shall have plant cover over winter, and 60 per cent of the cropland of individual farms shall be equipped with plant cover over winter. Similar policy development in other erosion-prone regions are due in coming years.

Practices to comply with support schemes and/or requirements targeted at arable cropping systems include use of buffer strips, no-autumn tillage, and catch-/cover-crops. There is general agreement that such practices support retention of soil organic matter and nutrients, and in this way sequester carbon and reduce N_2O emissions, while quantifying such effects is more complex. First, we can estimate that uptake of soil conserving practices in arable cropping increase substantially. Uptake currently amount to 1/3 of overall land allocated to arable crops, corresponding to around 100.000 ha of land. With policies and measures under implementation, we project that in the near future, uptake will increase to 1/2 of arable cropland (around 150.000 ha of land).

The effect of these measures is currently not included in the official inventory. The effect of no-autumn tillage has not been estimated due to lack of research. The carbon sequestration of catch crops can however be estimated using factors from the literature[9]. Assuming a carbon sequestration of 880 kg CO_2 pr ha pr year, an increase in direct N_2O emissions of 16 kg CO_2 equivalents pr ha pr year, a reduction in indirect N_2O from leaching of 70 kg CO_2-equivalents pr ha pr year, and an increase in CO_2 from field operations of 4 kg pr ha pr year, the net mitigation effect from use of cover crops on 8 000 ha correspond to 7 500 tonnes of CO_2-equivalents for 2020. If, as result of policies under implementation, uptake of catch-crops will double, we can project abatement of another 7 500 tonnes of CO_2-equivalents for 2030.

4.3.9.3 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. The mitigation effect of this measure has therefore not been estimated. 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 and mitigation effect we report retrospectively in the future.

4.3.9.4 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 estimate. Investment support is given only to storage constructions that are better than requirements established in overall regulations, e.g. capacity to store manures 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.

4.3.9.5 Drainage of agricultural soils

The main purpose of the scheme is to increase the quality of cultivated land by financial support for drainage of poorly drained soil, in order to

[9] *Microsoft Word – NIBIO_RAPPORT_2020_6_4 (unit.no)*

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. Additionally, yields on properly drained fields are higher, which lower the emissions pr kg of product. However, the effect also depends on e.g. fertilizer, time of fertilization, humidity 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.

4.3.9.6 Project Climate Smart Agriculture

A project called Climate Smart Agriculture was established in 2017. 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. Under the project, training has been provided for extension services in support of climate-smart agriculture, and a "climate calculator" has been developed for on-farm assessment and decision-making support in these areas.

Estimated effect on national emissions

The effect on emissions has not been estimated since the project should be considered as a support system and enabling condition for other, more specific improvements.

4.3.9.7 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 on-farm implementation. Examples of projects that have been supported by this programme are Climate smart agriculture, Quality of roughage and Effects of tillage on run-off 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. The effect on emissions has therefore not been estimated.

4.3.9.8 Delivery of manure for production of biogas

There is a support scheme for delivery of manure to biogas production plants, to compensate for additional costs arising from such delivery and increase the uptake of such treatment.

Estimated effect on national emissions

The effect of the support scheme is estimated to about 900 t CO_2-equivalents pr year. 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.

4.3.9.9 Restrictions on cultivation of peatlands

Land conversion from peatland to cropland has been extensive historically, and approximately 60 000 ha of croplands (7 per cent 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 4.2.10.5, 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.

Table 4.14 Summary policies and measures, agriculture.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Regional agri-environmental programme *	Agriculture, LULUCF	CO_2, CH_4, N_2O	Reduce emissions and leaching from agriculture	Economic, regulatory	Implemented
Requirements and support for livestock on pasture *	Agriculture, LULUCF	CH_4, N_2O	Increase the time on pasture to improve resource use and animal welfare	Economic, regulatory	Implemented
Support scheme for Special Environmental Measures in Agriculture *	Agriculture	CH_4, N_2O	Improved animal waste management systems	Economic	Implemented
Drainage of agricultural soils *	Agriculture	N_2O	Improve the drainage of fields to improve productivity, climate adaptation and reduce emissions from soils	Economic	Implemented
Project Climate Smart Agriculture *	Agriculture, LULUCF	CO_2, CH_4, N_2O	Data collection, councelling, sharing knowledge	Information	Implemented
Climate and environment programme *	Agriculture, LULUCF	CO_2, CH_4, N_2O	Develop knowledge	Information	Implemented
Delivery of manure for production of biogas *	Agriculture, Transport	CH_4, N_2O	Reduce emissions from storage of manure	Economic	Implemented
Restrictions on cultivation of peatlands *	LULUCF, Agriculture	N_2O	Reduce emissions from cultivated organic soils	Regulatory	Implemented

For note and footnotes, see under table 4.2.

Estimated effect on national emissions

Emissions from land conversion from peatland to cropland are reported in the agriculture chapter for N_2O, while the LULUCF chapter covers CO_2 emissions. In 2020, the area of new cultivation of peatland was about the same as in 2019, but in 2021 the restrictions reduced the area of new cultivation and the related emissions of N_2O and CO_2. Since 2021 is the first year where the regulation was effective the whole year, the area of new cultivated peatland in this year was used when estimating the future effect of the measure.

Since the restrictions were enforced in June 2019, the effect for 2020 is set to 0. The effect is estimated to increase to 7 ktonnes CO_2 equivalents for the year 2035, based on the prevention of cultivation of 180 ha per year. The effect of the restrictions is increasing over time because the emissions from each hectare of drained peatlands continue for decades after the drainage have happened.

Brief description [e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
Several support schemes. Differs between regions. No-autumn tillage implemented in 2003 will be strengthened in 2023. Environmentally friendly spreading of manure implemented in 2012.	2003, 2012	Ministry of Agriculture and Food	13	13	13	13
Various requirements and support schemes differentiated between livestock category and pasture category.	1990	Ministry of Agriculture and Food	NE	NE	NE	NE
Several support schemes, of which storage of manure is mostly related to climate mitigation	2017	Ministry of Agriculture and Food	NE	NE	NE	NE
National support scheme	2013	Ministry of Agriculture and Food	NE	NE	NE	NE
Project to develop and maintain tools to quantify greenhouse gas emissions from farms	2017	Ministry of Agriculture and Food	NE	NE	NE	NE
Develop knowledge which, among others, will contribute to reduced emissions on farm level	2013	Ministry of Agriculture and Food	NE	NE	NE	NE
Support scheme for delivery of manure. The goal is to increase the utilization of livestock manure to biogas production.	2015	Ministry of Agriculture and Food	0.9	0.9	0.9	0.9
Avoid conversion of peatland into cropland	2020	Ministry of Agriculture and Food	0	2	5	7

Box 4.10 Policies for agricultural soils' quality, health and carbon retention

Policies for carbon storage include actions to reduce land take/soil sealing, and action to halt and reverse soil degradation. In 2020, a working group mandated by the Norwegian Agriculture Agency issued the National Soil Programme. Activities in this programme align with policy development for soils in the EU, including under Horizon Europe where soils are subject of one of five so-called "missions". The National Soil Programme include activities to advance practices, know-how and incentives to advance soil ecosystems, soil quality and soil health.

In the letter of intent with the agricultural organisations from 2019, there is a combined ambition to reduce emissions and enhance removals in the agricultural sector. Policy developments for removals in agricultural soils that have been taken or that are due, include:

- National target to limit the land take of agricultural land to max. 300 ha per year (corresponding to max 0.03 per cent of total utilized agricultural area) was reached in 2021, and more ambitious targets and strategies are due.
- Various grant schemes for research on soil health and for practices that promote carbon sequestration in soils is included in the annual Agricultural Agreement under regional agri-environmental programmes.
- System to monitor status and changes in soils and track progress with efforts that are taken, are established from 2023.
- Soil carbon sequestration is part of the funding portfolio of Bionova, a new funding instrument to incentivize emission reductions, increased removals, and a more circular bio-economy.

4.3.10 Land Use, Land Use Change and Forestry

4.3.10.1 Introduction

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. Boreal forests grow slowly, hence the mitigation effects must be considered in a very long timescale.

Box 4.11 Bionova

The government has decided to establish Bionova. Bionova is a new funding instrument for reaching Norway's climate goals for 2030 and the goal of being a low-emission society in 2050 by contributing to reduced greenhouse gas emissions and increased soil carbon sequestration and storage as well as value creation through a transition to a more circular bioeconomy based on renewable biological resources from land and sea. Bionova will contribute to reducing greenhouse gas emissions and increased removals and carbon sinks at farm level.

4.3.10.2 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 entered 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.

The municipalities are the main spatial planning authorities under the Planning and Building Act, but the central government determines the overall framework through regulations, government expectations for regional and municipal planning and central government planning guidelines. 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 adopt measures and policies to reduce greenhouse gas emission. These should include measures and policies to reduce deforestation and to increase carbon sinks in forests and other land. Central government guidelines on spatial planning emphasise that spatial planning processes should be used to promote the development of compact towns and urban areas, and that the potential for densification, transformation and re-use of areas and buildings should be used before new areas are developed. Spatial planning in accordance with these principles will generally lead to lower GHG emissions from land use change compared to spatial planning that allows for extensive development of virgin land.

The methods and projections for managed forests are relatively well developed, although uncertainties are present, and the models are subject to continuous improvements. As for other types of land use and land use change, it is challenging to estimate the GHG effects of existing and possible new policies and measures. The government has requested relevant agencies to analyse the potential for GHG reductions from land use and land use change further.

4.3.10.3 Higher seedling densities in existing areas of forest land

Using higher seedling densities for forest regeneration increases the growing stock and CO_2 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 no effect by 2030. However, in the longer term, it has greater potential, estimated to be around 2 million tons of CO_2 in 2100.The total potential is not yet reached. Based on statistics, about 50 per cent of the total regeneration area has been covered by this scheme since it was implemented in 2016 and the remaining potential is approximately 1 mill tonnes CO_2.

4.3.10.4 Genetical improvement, plant breeding

Tree breeding involves using of the genetic variation in forest trees to produce seeds that are more robust and provide higher yields than non-improved seed from ordinary forest stands. High-quality seeds have been produced in seed orchards, making it possible to develop forests where the tree survival rate is high, timber quality is better and volume growth is 10–15 per cent larger. If more effective tree breeding techniques are used, it may be possible to increase the growth in volume by 20 per cent 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. In 2016, a grant scheme was launched to support plant breeding.

Estimated effect on national emissions

Given these assumptions, it is estimated that the potential for CO_2 removals could be approximately 0,15 mill. tonnes CO_2-equivalents for 2035. For 2100, the estimated potential is 1.1 million tonnes CO_2 annually. The most important tree species in Norwegian forestry is Norway spruce (≈50 per cent of the growing stock and 93 per cent of the planted seedlings). More than 90 per cent of the spruce trees that are planted annually originate from improved seeds.

4.3.10.5 Fertilization of forest as a climate mitigation measure

On forest land where growth is inhibited by the availability of nitrogen, using nitrogen fertiliser will increase both diameter and height growth, and increase annual CO_2 removals for the next ten years. 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.

Estimated effect on national emissions

It is estimated that fertilization of 5 000–10 000 hectares of forest is an acceptable amount of fertilization for biodiversity and the environment. The estimates show that the activity may give additional CO_2 removals of 0.14–0.27 mill. tonnes annually.

4.3.10.6 Afforestation

From 2015 to 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. The government has tasked the agencies to finalize a potential grant scheme for afforestation within a certain set of criteria that aims to ensure that no significant harm will be done to biodiversity.

Estimated effect on national emissions
The effect of afforestation depends on the amount planted, where the impact in the short term is meagre. However, the long-term effect can be substantial. 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.

4.3.10.7 Tending of juvenile stands
Tending of young stands is necessary to select the most adapted tree-species and optimize growth. Correct spacing between the most adapted tree species lead to improved tree stability with straight stems that provide high quality lumber. The need for tending is stipulated to 40 000 ha per year, but the area treated is only about half of the area (20 000 ha per year).

Estimated effect on national emissions
By doubling the area treated each year it is possible to increase removals by 0–0,5 million tons CO_2 equivalents by 2030 and 1.5–3.3 million tons CO_2 by 2100 (estimate from the former Government's Climate Action Plan for 2021–2030 — Meld. St. 13 (2020–2021) Report to the Storting (white paper))[10]. Tending as a climate measure is under consideration as a new climate measure in Norwegian forestry.

[10] *https://www.regjeringen.no/en/dokumenter/meld.-st.-13-20202021/id2827405/*

4.3.10.8 Measures to reduce damage from root-rot
Norway spruce grows well on soil with a high site index but is vulnerable to root-rot (*hetrobasidion annosum*). Twenty per cent of Norwegian spruce trees are infested with fungi and in 2019 it was estimated 500 000 m^3 of sawlogs was damaged. Damaged trees typically have reduced growth and CO_2 from infested trees will gradually be emitted to the atmosphere. It is important to prevent spreading of fungi to uninfected areas by treatment of stumps with Root-stop™ or urea when harvesting spruce in spring, summer, and autumn season.

Estimated effect on national emissions
Measures to reduce damage from root-rot have no effect in the short term. The measure can contribute with increased removals in 1 million tons CO_2-equivalents per year by 2100 and is under consideration for implementation.

4.3.10.9 Regeneration with proper tree-species
The Norwegian Forestry Act requires preparation for regeneration to a certain number of trees pr area unit within 3 years after harvesting. The Act is not precise in terms of what tree species that can be accounted for. The former Government's Climate Action Plan for 2021–2030 — Meld. St. 13 (2020–2021) suggests that only tree species that best can utilize the growing potential on the particular site can be accounted for.

Estimated effect on national emissions
This measure in under consideration and can increase removals by 0.1 million tons CO_2 equivalents by 2030 and 1.3 million tons CO_2 equivalents by 2100.

4.3.10.10 Threshold for tree-stand age by harvesting
If tree stands are cut too early, they will not be able to utilize their full potentials for carbon removals. The Government considers implementing a threshold

age for harvesting that will be in line with the requirements under the Norwegian PEFC standards.

Estimated effect on national emissions
This measure can increase removals by 0.3 million tons CO_2 equivalents by 2025.

4.3.10.11 Reduced emissions from peatlands and bogs

Peatland bogs and mires are important carbon stocks. There is a general prohibition against the cultivation of peatland and mires in Norway. The prohibition came into force in 2021. Farmers may apply for exceptions from the prohibition provided that certain conditions are met.

Estimated effect on national emissions
Emissions from land conversion from peatland to cropland are reported in the agriculture chapter for N_2O (chapter 4.3.10.8), while the LULUCF chapter covers CO_2 emissions. For CO_2 alone, the projected effect can reach a little less than 80 000 tonnes by 2035, based on the prevention of cultivation of 180 ha per year. The effect of the restrictions is increasing over time because the emissions from each hectare of drained peatlands continue for decades after the drainage have happened.

4.3.10.12 New policies and measures

The Solberg government presented its Climate Action Plan for 2021–2030 — Meld. St. 13 (2020–2021) to the Parliament in 2021. Several of the new measures presented in that White Paper are under consideration for implementation by the Støre government. The Støre government's climate status and plan was presented to the Parliament in October 2022 and outlines the government's climate policies. For forestry, it is important for the government to continue and consider enhancing existing mitigation measures in the forest sector to increase removals. The Government will prioritize measures with a positive mitigation effect and a positive or acceptable effect for the environment. The Government will consider new mitigation measures in managed forest land that offer a high potential for enhancing CO_2 removals and are easy to implement. This applies specifically to improving practices for tending young-growth stands and treatment of stumps to control root rot on Norway spruce. Furthermore, the government is considering to introduce requirements in the Forestry Act relating to minimum ages for logging in line with the requirements in the Norwegian PEFC Forest Standard, as well as considering to facilitate afforestation of new areas as a mitigation measure on the basis of clear environmental criteria.

Table 4.15	Summary polices and measures, LULUCF

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Higher seedling densities in existing areas of forest land *	LULUCF	CO_2	Enhancing production in existing forests	Economic	Implemented
Genetical improvement, plant breeding *	LULUCF	CO_2	Enhanced forest management	Economic	Implemented
Fertilization of forests as a climate mitigation measure *	LULUCF	CO_2, CH_4, N_2O	Enhancing production in existing forests	Economic	Implemented
Afforestation	LULUCF	CO_2	Enhancing production in existing forests	Economic	Planned
Tending of juvenile stands	LULUCF	CO_2	Enhancing production in existing forests	Economic	Planned
Measures to reduce damage from root-rot	LULUCF	CO_2	Enhancing production in existing forests	Economic	Planned
Regeneration with proper tree-species	LULUCF	CO_2	Enhancing production in existing forests	Regulatory	Planned
Threshold for tree-stand age by harvesting	LULUCF	CO_2	Enhancing production in existing forests	Regulatory	Planned
Reduced emissions from peatlands and bogs *	LULUCF	CO_2	Conservation of carbon in existing forests, prevention of drainage or rewetting of wetlands	Regulatory	Implemented

For note and footnotes, see under table 4.2.

4.3.11 Waste

4.3.11.1 Introduction

The main goal of the Norwegian waste policy is that waste is to cause the least possible harm to humans and the environment. The quantity of waste generated is to be considerably lower than the rate of economic growth, whilst rates for the preparing for reuse and recycling should rise. 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 the ban on depositing biodegradable waste in landfills and requirements regarding extraction of landfill gas (see below).
- Extended producer responsibility for specific waste fractions.
- The tax on waste incineration (described under 4.3.2)

In general, targets set in EU waste directives, such as EU-targets for preparing for reuse and recycling of municipal waste, also apply for Norway owing to the EEA agreement.

4.3.11.2 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 33 730 tonnes, corresponding to 2 per cent of the total greenhouse gas emissions in Norway. Landfill gas emissions have been reduced by about 52 per cent from 2000 to 2020 and by more than 50 per cent from 1990 to 2020. The reduction is mainly due

Brief description [e]	Start year of imple-mentation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
Increase the number of plants to an optimum level from a climate perspective to enhance net carbon sequestration	2016	Ministry of Agriculture and Food	0	0	0	0
Genetically improvement means to single out robust plants which can improve growth and quality.	2016	Ministry of Agriculture and Food	0	50	100	150
Fertilization can sustain or improve carbon sequestration where nitrogen scarcity in existing forest areas limits plant growth.	2016	Ministry of Agriculture and Food	0	270	270	270
Planting trees on new areas to increase the carbon uptake		Ministry of Climate and Environment	NA	0	0	0
Tending of young stands is to select the most adapted tree species and optimize growth.		Ministry of Agriculture and Food	NA	0	500	500
Treating stumbs after harvest to reduce the spread of tree rot to increase growth.		Ministry of Agriculture and Food	NA	0	0	0
Regeneration with the tree species that gives the highest growth		Ministry of Agriculture and Food	NA	0	100	100
Regulate the minimum harvesting age		Ministry of Agriculture and Food	NA	300	300	300
Avoid conversion of peatland into cropland	2020	Ministry of Agriculture and Food	4	41	60	78

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 19 400 tonnes CH_4 in 2010. In 2020, extracted methane from landfills amounted to almost 6 150 tonnes CH_4. The reduction is primarily due to the prohibition of depositing organic waste. In Norway, in 2020, 3 per cent of the landfill gas production was utilized to generate electricity. 56 per cent is flared, and 33 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 153 kt CO_2 equivalents in 2020, 119 kt CO_2 equivalents in 2025, 94 kt CO_2 equivalents in 2030 and 76 kt CO_2 equivalents in 2035. The downward trend is due to the prohibition regulation which has reduced amounts of organic waste deposited and thus potential emissions.

4.3.11.3 Ban on depositing biodegradable waste in landfills

In 2002, Norwegian authorities introduced a ban on depositing easily degradable organic waste in landfills. This prohibition was replaced in 2009 by a ban on the depositing of all biodegradable waste in landfills. Since the introduction of these regulatory measures, the annual amount of biodegradable waste deposited in landfills has been reduced by 99.6 per cent in the period between 1990 and 2020. Meanwhile, the amount of all waste generated increased by more than 65 per cent in the same timeframe. Due to the decomposing process, CH_4 production from landfills will continue for several decades after the waste has been disposed of. Nevertheless, the prohibition on depositing biodegradable waste in landfills will reduce CH_4 emissions over time, as the amount of deposited biodegradable waste is reduced.

Estimated effect on national emissions

To estimate the effect of the ban of depositing biodegradable 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 to estimate the effect of the prohibition of all biodegradable waste.

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 26 per cent of national potential methane emissions from landfills. This value has been kept constant during the period 2002–2030 to estimate the mitigation impact of the regulation. This impact has been estimated to 461 kt CO_2 equivalents in 2020, 595 kt CO_2 equivalents in 2025, 699 kt CO_2 equivalents in 2030 and 780 kt CO_2 equivalents in 2035.

4.3.11.4 Other measures in the waste sector

4.3.11.4.1 Extended producer responsibility

The systems of extended producer responsibility is based on requirements regarding waste regulation and to some degree on tax incentives. EPR is important to ensure that waste is collected and sent to approved treatment and for fulfil national or EEA-wide targets for recycling. Extended producer responsibility schemes have been made for packaging, electronic waste, tires and PCB-infected insulation of windows.

4.3.11.4.2 Agreement on reduction of food waste

In 2017 the government concluded an agreement on the reduction of edible food waste together with relevant stakeholders representing the entire food value. The parties to the agreement have committed to reduce edible food waste by 50 per cent before 2030. The initial results indicate that the levels of edible food waste in Norway have been reduced by nearly 10 per cent in the period between 2015 and 2020.

4.3.11.4.3 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.

When it comes to EU-targets for preparing for reuse and recycling of municipal waste, a revision made this year of the national waste regulation introduces a new requirement, applicable as of 2023, to separate biowaste (i.e. food, park and garden waste) and plastic waste at source. Furthermore, the new regulation requires that bio- and plastic waste separated at source is sent to recycling.

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.

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, 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).

Table 4.16 Summary policies and measures, waste.

Name of policy or measure [a]	Sector(s) affected [b]	GHG(s) affected	Objective and/or activity affected	Type of instrument [c]	Status of implementation [d]
Requirement to collect landfill gas *	Waste	CH_4	Reduce emissions from landfills	Regulatory	Implemented
Ban of depositing biodegradable waste in landfills *	Waste	CH_4	Reduce emissions from landfills	Regulatory	Implemented
Other measures in the waste sector *	Waste	CO_2, CH_4, N_2O	Reduce emissions, increase recycling and reduce the quantities of waste	Regulatory, fiscal, voluntary	Implemented

For note and footnotes, see under table 4.2

4.4 Policies and measures no longer in place

Arrangement to reduce emissions in the processing industry, 2004 and 2009. See description in chapter 4.3.8.

Agreement with the aluminium industry. See description in chapter 4.3.8.

Agreement on SF_6 reductions from use and production of GIS. See description in chapter 4.3.8

SF_6 reduction, production of magnesium. See description in NC7.

Tax on final disposal of waste. See description in chapter 4.3.2.3

Grants for biogas projects. See chapter 4.2.9.8 in BR4.

Discount in the pilotage readiness fee. See chapter 4.2.7.5 in BR4.

Brief description [e]	Start year of imple-mentation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)			
			2020	2025 [f]	2030 [f]	2035 [f]
All landfills with biodegradable waste must have a system for extracting landfill gas	2002	Ministry of Climate and Environment, Ministry of Agriculture and Food (National government)	153	119	94	76
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	2002	Ministry of Climate and Environment, Ministry of Agriculture and Food (National government)	461	595	699	780
Agreements primarily to ensure that waste is collected and sent to approved treatment. Waste regulations for a number of waste fractions and a tax on beverage packaging. Tax on incineration up to 2010 and for landfills up to 2015.	1995	Ministry of Finance and Ministry of Climate and Environment	NE	NE	NE	NE

5 PROJECTIONS AND TOTAL EFFECT OF POLICIES AND MEASURES

5.1 Introduction

This chapter presents projections of greenhouse gas emissions in Norway for the years 2025, 2030 and 2035. 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 2022. The previously reported projections were in the fourth Biennial report (BR4).

5.2 The 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 2022-level and that the observed EU ETS prices for future delivery at that time are applied. The 2022-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 without accompanying policy proposals, and policy initiatives that have yet to be operationalised in the form of regulations, parliament resolutions or binding agreements, etc., are not incorporated into the projections.

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 this National Communication were presented in the national budget for 2023.

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 from the national budget for 2023.
- Implemented and adopted policies and measures by summer 2022 are maintained, including the scope and rates of the taxes on emissions of GHGs.
- The EU ETS price is assumed to increase from an average of NOK 700 for 2022 to about NOK 1 000 per tonne of CO_2 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 majority of CO_2 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 100 per cent of new car sales in 2025. 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 13 per cent in real terms from 2023 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.

Table 5.1	Information on updated greenhouse gas projections under a "with measures" scenario.

	Base year (1990)
Sector[d,e]	
Energy	18 785
Transport	10 056
Industry/industrial processes	15 377
Agriculture	4 812
Forestry/LULUCF	-10 542
Waste management/waste	2 403
Other (specify)	
Gas	
CO_2 emissions including net CO_2 from LULUCF	24 148
CO_2 emissions excluding net CO_2 from LULUCF	35 097
CH_4 emissions including CH_4 from LULUCF	6 405
CH_4 emissions excluding CH_4 from LULUCF	6 236
N_2O emissions including N_2O from LULUCF	4 343
N_2O emissions excluding N_2O from LULUCF	4 106
HFCs	0
PFCs	3 895
SF_6	2 099
NF_3	
Other (specify)	
Total with LULUCF[f]	40 890
Total without LULUCF	51 432

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

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.
[a] In accordance with paragraph 25 of these guidelines, at a minimum Parties shall report a 'with measures' projection and they may also report 'without measures' and 'with additional measures' projections. If a Party chooses to report a 'without measures' and/or 'with additional measures' projection, it is to use table 3 and/or 4 below, respectively. If a Party does not choose to report a 'without measures' or 'with additional measures' projection, then it should not include table 3 or 4 in its national communication.
[b] Emissions and removals reported in these columns should be as reported in the most recent annual inventory submission available and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in accordance with section IV of these guidelines. Where the sectoral breakdown differs from that reported in the GHG inventory, Parties should explain in their national communication how the inventory sectors relate to the sectors reported in this table.
[c] Parties may include indirect CO_2 emissions in historical GHG emissions and in GHG emission projections and shall indicate this in a custom footnote below.
[d] Parties should include projections on a quantitative basis starting from the most recent inventory year and for subsequent years that end in either a zero or a five, extending at least 15 years from the most recent inventory year.
[e] The most recent inventory year.
[f] A year that ends in either a zero or a five following the most recent inventory year, extending at least 15 years from the most recent inventory year.
[g] In accordance with paragraph 31 of these guidelines, projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories as used in the GHG inventories. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 14 of these guidelines; namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry/industrial processes and product use, agriculture, forestry/LULUCF, waste management/waste, other sectors and cross-cutting.
[h] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes and product use, agriculture, forestry/LULUCF, waste management/waste and other sectors (i.e. cross-cutting), as appropriate.
[i] Parties may choose to report total emissions with or without LULUCF, as appropriate.
* Indirect CO_2 emissions are included in the historical GHG emissions and in the GHG emission projections.

GHG emissions and removals[b] (kt CO_2 equivalents)								GHG emission projections (kt CO_2 equivalents)		
1990	1995	2000	2005	2010	2015	2019	2020	2025	2030	2035
18 785	21 142	23 098	23 912	25 647	24 648	23 203	22 258	19 778	15 937	13 438
10 056	10 999	11 951	12 998	14 041	14 343	12 724	11 929	10 628	8 591	6 735
15 377	12 436	13 220	11 669	9 102	9 317	9 259	9 224	8 749	8 469	8 166
4 812	4 749	4 586	4 569	4 361	4 538	4 518	4 510	4 599	4 711	4 733
-10 542	-15 444	-18 641	-20 329	-23 716	-13 101	-16 436	-20 332	-15 876	-16 540	-13 605
2 403	2 306	2 066	1 797	1 788	1 642	1 382	1 351	1 005	865	758
24 148	22 655	23 085	22 585	21 536	32 049	25 903	20 418	20 829	14 344	12 777
35 097	38 508	42 149	43 342	45 691	45 590	42 785	41 197	37 111	31 294	26 805
6 405	6 588	6 351	5 919	5 757	5 403	4 922	4 899	4 622	4 440	4 266
6 236	6 420	6 176	5 741	5 576	5 219	4 735	4 712	4 452	4 271	4 091
4 343	3 952	4 067	4 312	2 729	2 759	2 648	2 579	2 610	2 636	2 639
4 106	3 712	3 819	4 062	2 471	2 502	2 390	2 319	2 373	2 395	2 391
0	98	369	549	894	963	934	810	587	364	329
3 895	2 314	1 518	955	238	146	175	161	173	175	173
2 099	580	891	297	69	68	68	74	63	74	42
40 890	36 188	36 281	34 616	31 223	41 387	34 650	28 940	28 883	22 032	20 225
51 432	51 631	54 922	54 945	54 939	54 488	51 086	49 273	44 759	38 572	33 830

Table 5.2 Greenhouse gas emissions in Norway by EU-ETS and ESR. Mill tonnes CO_2 equivalents

	1990	2005	2021	2025	2030	2035
GHG emissions in Norway	51.4	54.9	49.1	44.8	38.6	33.8
EU-ETS emissions	23.2	27.7	23.8	22.2	19.0	16.6
– Oil and gas extraction	7.2	12.9	11.5	10.8	8.0	6.3
– Manufacturing industries and mining	15.3	13.7	10.7	10.2	9.8	9.1
– Other sources[1]	0.7	1.1	1.5	1.2	1.2	1.2
ESR emissions	28.2	27.2	25.4	22.6	19.5	17.2
– Transport[2]	12.0	15.0	15.4	13.5	10.9	8.9
Of this. road traffic	7.4	9.5	8.7	7.1	5.3	3.9
– Agriculture	4.8	4.6	4.6	4.6	4.7	4.7
– Other sources[3]	11.4	7.6	5.4	4.8	3.9	3.6
LULUCF	-10.5	-20.3	-14.0	-15.9	-16.5	-13.6
Emissions including LULUCF	40.9	34.6	35.1	28.9	22.1	20.2
Mainland Norway	43.2	40.9	37.0	33.3	30.0	27.1

[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.

Box 5.2 Climate policy

Projections of environmentally harmful emissions to air were last presented in the national budget for 2021, and were based on the level of policy measures from the summer of 2020. Climate policy has been tightened since then:

- The general rate of CO_2 tax on mineral products (petrol, mineral oil, natural gas and LPG) has been increased from NOK 571 per tonne of CO_2 in 2020 to NOK 766 per tonne of CO_2 in 2022. The tax on HFC and PFC has been increased correspondingly. In addition, a tax on waste incineration has been introduced, and the tax exemption for natural gas and LPG used in the greenhouse industry has been abolished.
- The CO_2-component in the one-off registration tax for passenger cars and vans has been increased. Simultaneously, the road usage tax has been reduced.
- The government is co-funding two full scale CCS projects, capturing and storing a total of 0.8 mill. tonnes of CO_2 annually.
- The government has introduced a requirement stating that public acquisitions of passenger cars are to be limited to zero emission vehicles. A ban on fossil fuels used in temporary heating for buildings under construction has also been implemented.
- Enova has received considerably funds. A governance agreement for the period 2021–2024 attaches even more weight to climate and technological development than the previous agreement. Supported initiatives include, inter alia, zero- and low-emission solutions for shipping and charging/fuelling stations for zero-emission cars.

Greenhouse gas emissions are estimated to decline from 49.1 million tonnes CO_2 equivalents in 2021 to 33.8 million tonnes in 2035, see table 5.1 and table 5.2. Emissions will in such case be close to 15 million tonnes of CO_2 equivalents lower in 2035 than in 2021. A little more than half of the reduction is expected to occur in the ESR sector. About half of this reduction is expected within road traffic – mostly due to a strong increase in the share of zero-emission vehicles.

The projections of emissions (not for LULUCF) use Statistics Norway's general equilibrium model SNOW and table 5.3 lists the key macroeconomic projections underpinning the Norwegian emission projections.

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 has increased significantly in 2022. The price is expected to gradually decrease over the next years. By 2026 it is expected to level off somewhat above the average of the past few years.

In the baseline scenario, the EU ETS price is assumed to increase to NOK 739 by 2025, measured in 2018-prices. In 2035 the price will increase to NOK 1015 measured in 2018-prices.

Table 5.3	Summary of key variables and assumptions used in the projections analysis.

Key underlying assumptions		Historical[b]							Projected		
Assumption	Unit	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Gross domestic product	*billion NOK. Fixed 2015-prices*	1 701.4	2 044.2	2 442.3	2 723.0	2 855.6	3 111.2	3 254.3	3 682.7	3 885.1	4 059.5
Of which mainland Norway	billion NOK. Fixed 2015-prices	1 303.0	1 492.9	1 790.4	2 059.7	2 331.9	2 614.1	2 740.5	3 101.9	3 399.2	3 661.1
Of which petroleum activities and ocean transport	Billion NOK. Fixed 2015-prices	398.3	551.3	651.9	663.4	523.7	497.1	513.8	580.8	485.9	398.4
Consumption	billion NOK. Fixed 2015-prices	609.2	697.5	849.8	1 016.3	1 186.0	1 354.3	1 343.3	1 568.5	1 756.7	1 970.4
Gross fixed capital formation	billion NOK. Fixed 2015-prices	329.6	368.1	477.0	585.0	630.2	741.5	835.6	898.5	961.7	1 031.0
Of which mainland Norway	billion NOK. Fixed 2015-prices	235.0	262.5	349.9	441.1	464.7	540.7	655.0	728.1	817.1	833.1
Of which petroluem activities and ocean transport	billion NOK. Fixed 2015-prices	94.6	105.5	127.1	143.9	165.6	200.8	180.6	170.4	144.6	197.8
Population	Thousands	4 249.8	4 370.0	4 503.4	4 640.2	4 920.3	5 214.0	5 391.4	5 559.8	5 685.5	5 803.5
Number of persons employed	Thousands	2 047.8	2 112.4	2 314.9	2 319.3	2 552.3	2 709.6	2 792.4	2 949.2	2 994.9	3 003.1
Oil price [e]	USD per barrel	23.7	17.0	26.2	55.1	8.3	53.4	43.4			
Gas price	*USD per MMBtu*	2.3	2.3	3.0	5.1	6.9	6.3	3.0			

Sources: Statistics Norway and Ministry of Finance.

[a] Parties should include key underlying assumptions, as appropriate.
[b] Parties should include the historical data used to develop the greenhouse gas emission projections reported.
[c] The most recent inventory year.
[d] A year that ends in either a zero or a five following the most recent inventory year, extending at least 15 years from the most recent inventory year.
[e] Custom footnote. Prices for oil and gas for 2025, 2030 and 2035 are equal to those used in National budget 2023. But since these assumptions are not published in the budget proposal it is not appropriate to publish them here either.

5.2.1 Details of the estimates

The estimate for greenhouse gas emissions in 2030 has been revised downwards by 6.4 million tonnes of CO_2 equivalents (about 14 per cent) compared to the previous projection (2018 white paper on long-term perspectives for the Norwegian economy, presented in NC7/BR3). Most of this reduction relates to lower EU ETS emissions, especially from oil-and gas production. Most of this reduction is due to expected electrificaton of power supply delivered via cables from land. In the non-ETS sector projected emissions are reduced by 1 million tonnes CO_2-equivalents (about 5 per cent). The main part of this downward revision is in road traffic. This is due to increased use of biofuels and a faster development of zero-emission cars than previouisly projected. Since the previous report Statistics Norway has revised historical emissions.

This also impacts future emissions. Seen in isolation, the adjustment adds about 05 million tons to the emission level in the transport sector in 2030.

In 2017, electric vehicles (EVs) accounted for about 23 per cent of new passenger car sales. In 2021 sales increased to about 65 per cent, and the share is expected to increase further in 2022. The projections assume that almost all passenger cars will be non-fossil fuel cars by 2025. In the previous reported projections, the share was expected to increase gradually towards 75 per cent in 2030. The share of zero-emission vans has also been significantly revised upwards since the previous projection. Strong incentives combined with more rapid technology improvements are the main reasons for the adjustments. 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. To some extent 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 in the projection period.

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. 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 more than 80 per cent since 1990. The prohibition against the use of mineral oil in the heating of buildings, which came into force in 2020, means that the heating of homes, public buildings and commercial buildings will have no emissions form use of mineral oil in the future. 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. In the projections, emissions from non-quota energy supply is expected to be reduced by around 20 per cent (about 0,2 million tonnes) by 2035. The reduction is linked partly to the establishment of capture and storage of CO_2 on the waste incineration plant at Klemetsrud in the latter part of this decade.

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.

Projections for the forest and land use sector, carried out by the Norwegian Institute for Bioeconomy (NIBIO), show a continued high net uptake from the sector. Since the peak in 2009, there has been a decline in annual reported net admissions. In the projections, the decline in annual net admissions is estimated to continue over the next decades. From the middle of the century, annual net intake is expected to increase again.

5.2.2 Other emissions

Emissions of long-range air pollutants, nitrogen oxides (NO_X), sulphur dioxide (SO_2), ammonia (NH_3), fine particulate matter ($PM_{2,5}$) and non-methane volatile organic compounds (NMVOC) are regulated under the Gothenburg Protocol. These pollutants are spread across borders via the atmosphere and give rise to, inter alia, acidification, particle concentrations that are detrimental to health, as well as the formation of tropospheric ozone.

Figure 5.1 Emissions of SO_2 and NMVOC within the scope of the Gothenburg Protocol. ktonnes.

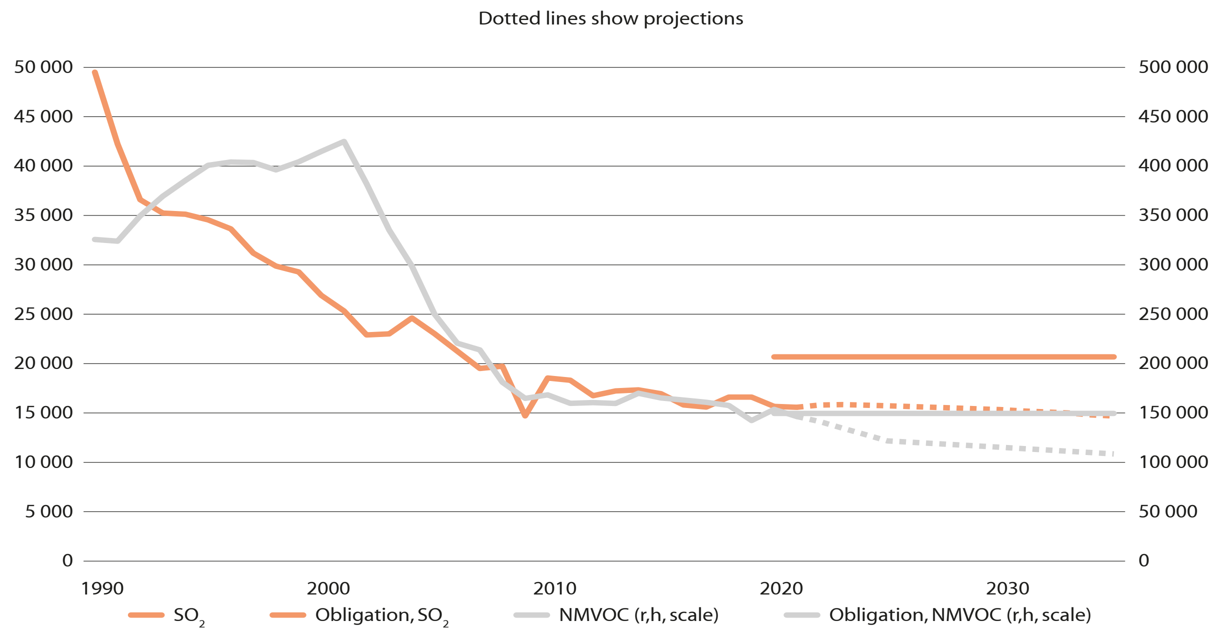


Figure 5.2 Emissions of NO_x and NH_3 within the scope of the Gothenburg Protocol. ktonnes

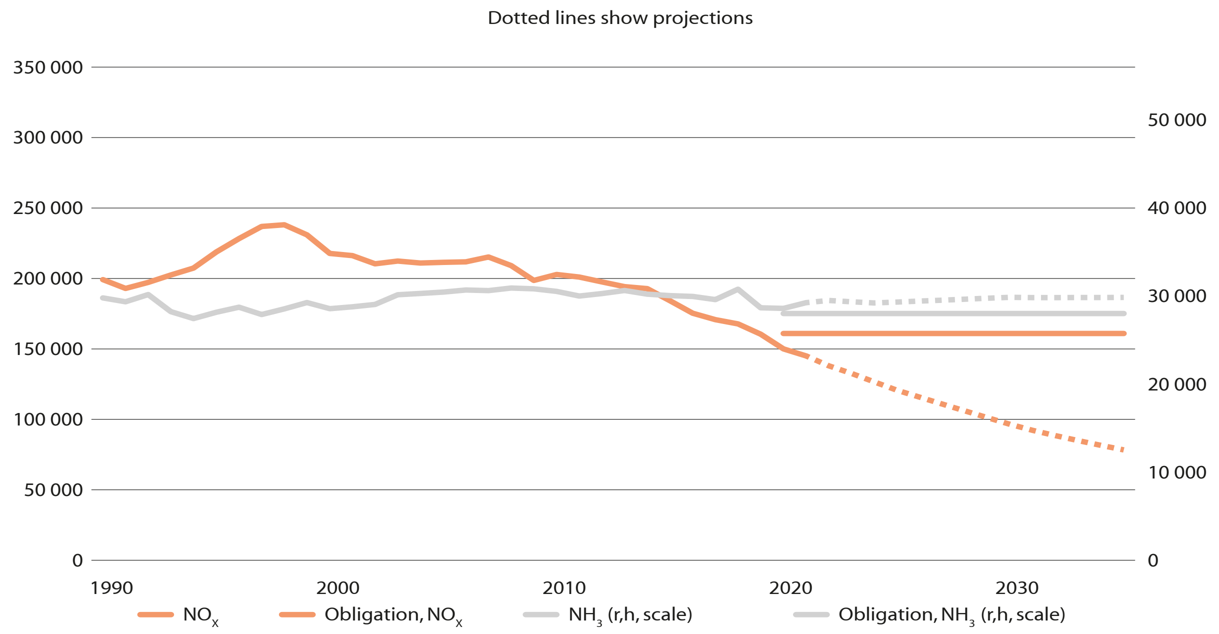
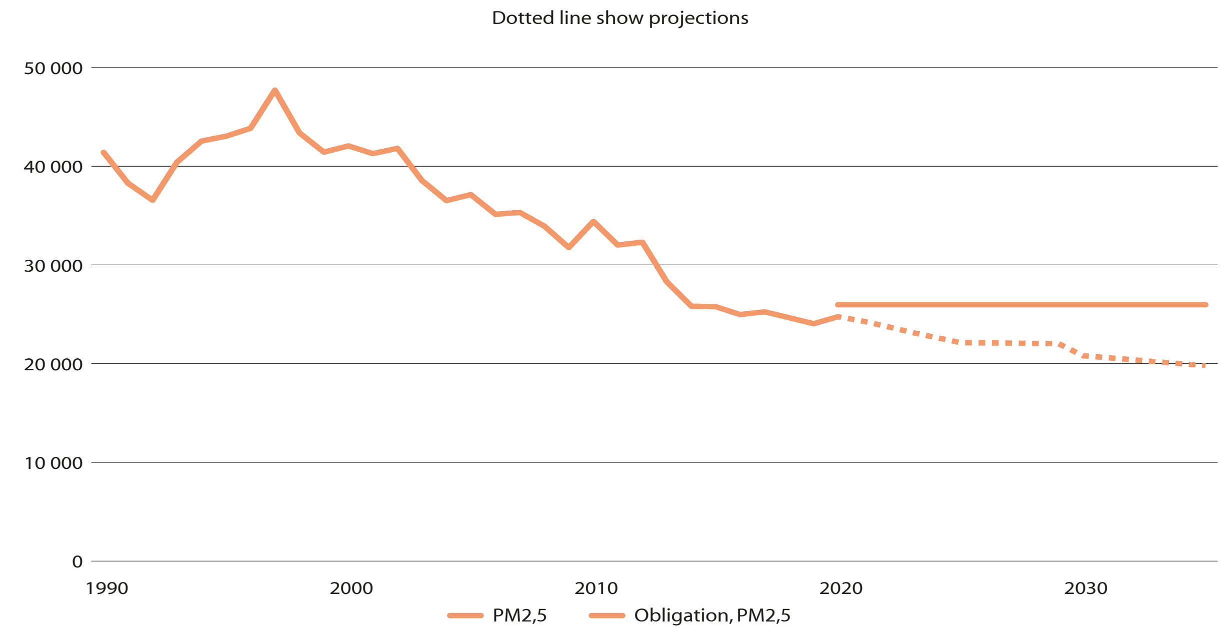


Figure 5.3 Emissions of PM within the scope of the Gothenburg Protocol. ktonnes



[1]The straight lines show the emission commitments under the Gothenburg Protocol.

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

Table 5.4	Emissions of long-range transboundary air pollutants. ktonnes

	1990	2005	2021	2030	2035
NO_x	199.2	211.5	145.2	96.5	78.3
SO_2	49.5	23.0	15.9	15.3	14.7
NMVOC	325.7	250.2	148.0	115.3	108.5
NH_3	29.8	30.5	29.4	29.9	29.9
PM 2.5	41.4	37.1	24.1	20.8	19.8

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

Norway has under the Gothenburg Protocol committed to reducing NO_X emissions by 23 per cent by 2020, relative to the emission level in 2005. In the current account this means an emissions cap for 2020 in excess of 156 000 tonnes. Consequently, NO_X emissions are estimated to be well below the commitment in 2020.

Since 1990, nitrogen oxide (NO_X) emissions have declined by 27 per cent, as a result of the exhaust gas requirements having been tightened in several rounds. Domestic shipping emissions have declined considerably since 2007 as the result of, inter alia, measures funded with support from the Business Sector's NO_x Fund and the gradual phase-out of older engines with high emissions. NO_X emissions are projected to decline to 78 300 tonnes in 2035. The estimated decline has to do with lower road traffic emissions as the result of stricter exhaust gas requirements, especially for heavy goods vehicles, and a steep increase in the number of zero- and low-emission vehicles. The use of biofuels may result in higher NO_X emissions. Emissions from oil and gas activities are expected to decline somewhat in the projection period.

In 2015, non-methane volatile organic compounds (NMVOC) emissions were l 60 per cent lower than in 2001, which was the year emissions peaked. The reduced NMVOC emissions are primarily the result of lower emissions from the loading and storage of crude oil offshore. The commitment under the Gothenburg Protocol calls for emissions in 2020 to be less than 149 600 tonnes. Emissions were marginally higher than the commitment in 2020, but further reductions bring emissions below the commitment. Emissions are projected to decline to 108 500 in 2035.

Sulphur dioxide (SO_2) emissions have declined by almost 70 per cent since 1990. Since 2007, emissions have been lower than the commitment in the first Gothenburg period, which was for a maximum of 22 000 tonnes. In 2020, emissions were 15 700 tonnes. The projections estimate a continued modest decline in SO_2 emissions. Emissions are well below the Gothenburg commitment for 2020 of 21 700 tonnes.

The emissions account for ammonia (NH_3) has previously indicated that Norway was meeting its commitment in the first Gothenburg period of 23 000 tonnes. In 2013, emission figures back to 1990 were revised upwards by 10–20 per cent as the result of a new calculation method for emissions from livestock manure. In 2020, emissions were 28 600 tonnes. Emissions are estimated to remain relatively stable at slightly below 30 000 tonnes towards 2035, whilst the Gothenburg commitment for 2020, which is based on emissions in 2005, is 28 000 tonnes. Thus, projections indicate that Norway emissions may remain somewhat above commitments. Upon the revision of the Gothenburg Protocol in 2012, Norway committed to reducing fine particulate matter ($PM_{2,5}$) emissions by 30 per cent in 2020, compared to the level in 2005. In the current emissions account, this corresponds to an annual emissions cap of about 28 000 tonnes from 2020. From 1990 emissions have fallen by about 40 per cent to 24 800 tonnes in 2020. This was well below commitments. Projections indicate that emissions will decline further by about 20 per cent within 2035.

5.2.3 Fuel sold to ships and aircraft engaged in international transport

Table 5.5 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 marine bunkers were increased for the years 2013 onwards, particularly for the latest years. The projections of emissions from international marine and aviation are mainly a prolongation of the historical trends. The CO_2 emissions from use of international bunker in aviation are, using expert judgement, projected to increase from 2019 by 1.7 per cent per annum. That is half of the average annual growth during the period 1990–2019. The projection was made using 2019 as base year as the activity was strongly reduced in 2020 due to the pandemic. Emissions from fuel sold to ships are projected to decrease by 1.4 per cent per annum, half of the annual decrease 1990–2020) during the projection period.

Compared with the previous biennial report, the emissions have been adjusted upwards because of the revised consumption date for marine bunkers.

Table 5.5 Emissions (CO_2, CH_4 and N_2O) from international bunker. Mill tonnes CO_2 equivalents

	1990	2000	2010	2020	2025	2030	2035
Total international bunkers	2.9	3.7	3.0	1.5	2.8	2.9	3.0
Aviation	0.7	0.9	1.3	0.5	1.9	2.1	2.2
Marine	2.4	2.9	1.7	1.0	1.0	0.9	0.9

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

5.3 Uncertainty

The projections illustrate 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 2021, the population growth in Norway has been 27 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.[11] 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.

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.

5.4.1 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

[11] Greaker, M. og O. Rosnes (2015): Robuste norske klimamålsetninger. Samfunnsøkonomen nr. 1-2015, pp. 67–77

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 2018 with respect to trends, but the trends are calibrated to start at the emission level in 2020. Adjustments were made for sectors particularly affected by the pandemic. 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.

5.4.1.4.1 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.

5.4.1.4.2 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

5.4.1.4.3 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).

5.4.1.4.4 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.

5.4.1.4.5 Emissions of N_2O, PFCs and SF_6 from industrial processes and product use

Projections of N_2O emissions from nitric acid production are based on information about the N_2O 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 per cent per annum from 2017. This efficiency rate is lower than in the years 2010–2017. The assumed emissions of N_2O per tonne nitric acid produced in the newest production line is based on information from the plant. N_2O 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 (CF_4 and C_2F_6) 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.

HFC emissions: Emission projections of HFCs are based on the HFC emission inventory and current regulations.

5.5 Projections of the LULUCF sector

5.5.1 Method and assumptions

New projections of removals and emissions from the LULUCF sector were published by the Norwegian Institute of Bioeconomy Research (NIBIO) in October 2022. The projections cover removals and emissions of all greenhouse gases in the LULUCF sector from 2021 to 2100 based on the Climate Convention 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 per cent of the forest area.

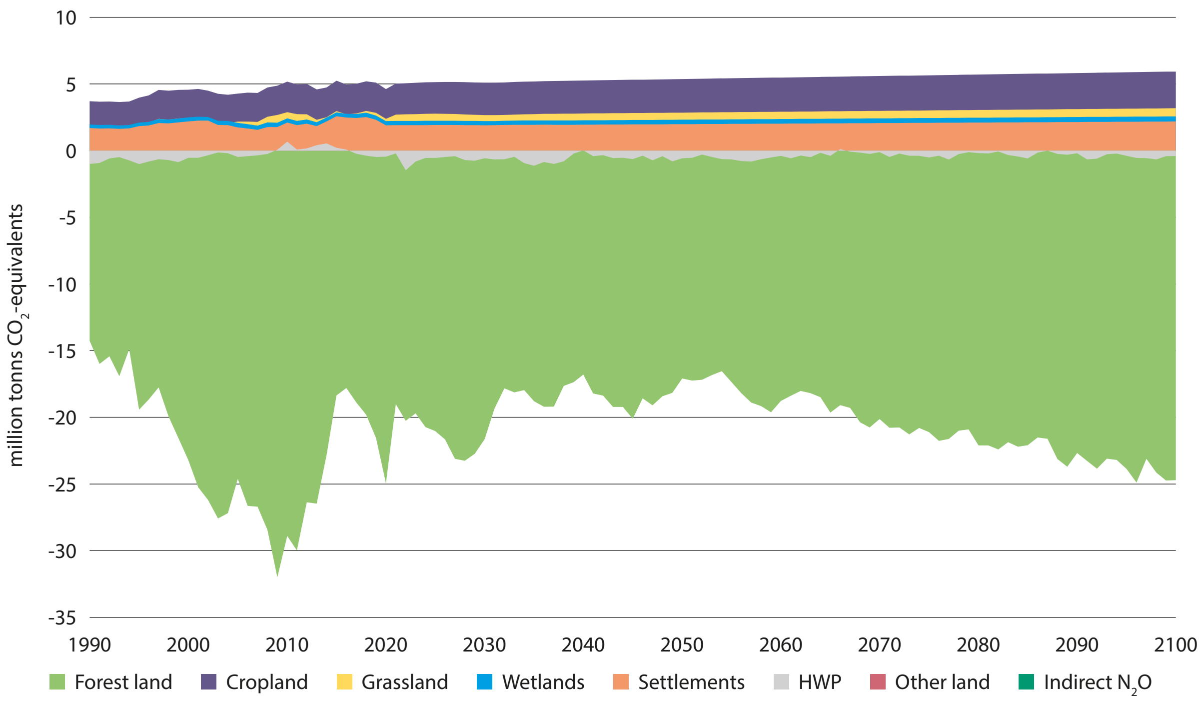
The Norwegian Institute of Bioeconomy Research (NIBIO) based the projections on the best available and most updated data and models. The reference period was from 2006 to 2020. The projection is based on the SiTree model, updated numbers from The National Forest Inventory (NFI) database and the RCP 4.5 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 2022).

5.5.2 Projections

Figure 5.4 shows net removals and emissions of greenhouse gases from 1990 to 2020 (historical data) and projections until 2100 for all categories in accordance with the reporting to the UNFCCC. The categories include emissions from areas in transition to the category and areas remaining in their category (i.e. was the same category in 1990, or changed category more than 20 years ago).

Figure 5.4 Total net emissions from all categories.



The categories include emissions from areas in transition to the category 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.

Table 5.6 Net removals (mill tonnes CO_2 eq) in the LULUCF sector (historic and projections.)

	1990	2005	2010	2020	2025	2030	2035
LULUCF	-10.5	-20.3	-23.7	-20.3	-15.9	-16.5	-13.6

Source: Norwegian Institute of Bioeconomy Research

The total net removals of the LULUCF-sector for the historic period 1990–2020 and projections for 2030 are given in table 5.6.

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 a skewed age class structure of the Norwegian forest with 43 per cent mature stands. Due to ageing forests and higher harvesting rates, the annual increment and removals will inevitably decline between 2030 and 2050. 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 due to the implementation of new forest management measures, a more normal age class structure, and better growing conditions due to global warming. However, the projections do not directly model the increased risk of damages from climate change, as the input data on damages are from the historical reference period.

5.5.3 Sensitivity analyses for LULUCF

The Norwegian Institute of Bioeconomy Research (NIBIO) has carried out a sensitivity analysis of some of the most important parametres for the LULUCF sinks and sources. More specifically, they have analysed the effects of climate change (climate scenario RCP8.5, as well as an average between RCP 4.5 and RCP 8.5, and different climate models for scenario RCP 4.5), effects of land-use change (deforestation and land-use change from forest land and wetlands on organic soil to other land-use categories), and soil carbon change in forest land remaining forest land (soil model parameters for litter with different climate models).

Their analysis shows that the estimated net removals in the LULUCF sector will be fairly unaffected by differences in the selected climate scenarios until 2050. Most of the land-use categories are expected to remain in the "cool temperate moist" climate zone (at least until 2050). NIBIO has not analysed the sensitivity of forest developement between climate change scenarios for the period after 2050 due to uncertainties related to the effects of natural disturbances caused by future climate extrems.

The analysis of soil carbon change in forest land remaining forest land, related to variations in litter input parameters combined with different climate models for RCP 4.5. This resulted in mean annual net removals for the period 2021–2050 of 5358 kt CO_2 with a mean deviation corresponding to +74% to -50%, reflecting an uncertainty range in mean annual removals of 2 664 – 9 309 kt CO_2.

As for deforestation, applying a high deforestation rate of 11.3 kha per year (upper 95 per cent conf. int.) may result in an increase of GHG emissions of approximately 1 633 kt and 2 878 kt CO_2-eqv. per year in 2030 and 2050, respectively. Applying a low deforestation rate of 1.5 kha per year (lower 95 per cent conf. int.) may result in a reduction of GHG emissions of approximately 1 412 and 2 467 kt CO_2-eqv. per year in 2030 and 2050, respectively.

Furthermore, NIBIO created a scenario in which future land-use change related to drainage and removal of organic soil in forests and peatlands is halted. This would encompass approximately 1.2 kha per year and would lead to a reduction of GHG emissions of 251 and 552 kt CO_2-eqv. per year in 2030 and 2050, respectively.

5.6 Main differences in projections between current and previous report

Differences between the current projections and the projections in BR4 are due to changes and corrections in the historical inventory, to the actual trend since the previous base year differing from the projections, and to reappraisals of future trends in activity and technology.

Since BR4, Statistics Norway has made several changes in the emission inventory. Corrections in energy data led to increased emissions in the latest years, but reduced emissions earlier in the time series. Revised methods for venting in the oil and gas industry gave reduced emissions in the latest years, while revised methods for agriculture and wastewater led to increased emissions throughout the period. A reallocation of emissions in petrochemical industries from *Energy* to *Industrial processes* did not affect total emissions, but is the cause of most of the changes in these sectors for 1990–2010. Net changes excluding LULUCF were small and variable, with a net increase of 0,2 Mt in the last common year (2017).

The actual emissions in 2020, which is the base year for the current projections, were 1,7 Mt lower than projected in the BR4. This shift includes corrections and methodological changes as discussed above, but the main differences are due to actual changes from the expected trends. This is mainly due to lower than projected emissions from the petroleum sector. Reduced activity due to the pandemic particularly affected air transport.

Reappraisals of future trends include increased use of electric vehicles (transport) and further reductions in the petroleum sector, among others due to higher expectations to electrification of offshore installations. Some use of CCS and other technological advances were also included.

For LULUCF, several methodological changes in the national greenhouse gas inventory have led to changes also in the projection. For instance, the climate models have been changed from static to dynamic. Using a dynamic climate model has resulted in somewhat lower removals of carbon in litter in managed forests, due to higher decomposition rates. In addition, the reference period is changed from 2010–2017 in the previous projection to 2006–2020 in the newest projection. The latter reference period entails higher logging intensity in managed forests, and hence a decrease in carbon removals. The trend is similar to the 2019-projections, but the removals in managed forests are generally lower.

The total effect is that emissions excluding LULUCF are projected to be 6.4 million tonnes CO_2 equivalents lower in 2030 than in the BR4. Including LULUCF, the projected emissions in 2030 are 2.6 million tonnes CO_2 equivalents lower than in the BR4.

Table 5.7 Changes in GHG emissions compared with BR4 by sector. Mill. tonnes CO_2 equivalents

Sector	1990	2000	2010	2020[a]	2025[b]	2030	2035[b]
Energy	-0.9	-1.2	-1.6	-2.9		-6.8	
Transport	0.0	-0.2	-0.3	-0.0		-0.7	
Industry/industrial processes	0.9	1.1	0.9	0.9		0.7	
Agriculture	0.1	0.1	0.1	-0.0		0.2	
Forestry/LULUCF	-0.6	5.8	2.7	1.3		3.9	
Waste management/waste	0.2	0.2	0.3	0.3		0.1	
Total with LULUCF	-0.4	5.9	2.2	-0.4		-2.6	
Total without LULUCF	0.2	0.1	-0.5	-1.7		-6.4	

[a]) Comparisons for 2020 show the effects of both changes in the historical inventory and differences between the actual trend and projected trends in the BR4

[b]) Comparisons for 2025 and 2035 are excluded, as these years were not included in the BR4 report.

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

5.7 Assessment of aggregate effects of policies and measures

There are considerable methodological difficulties in calculating the effect of policies and measures ex post, including establishing a hypothetical baseline and obtaining relevant data. There is also uncertainty related to such estimates. Nevertheless, effects are estimated for a number of policies and measures. According to the estimates, the historical GHG emissions (without LULUCF) in 2020 would have been about 24.3 million tonnes of CO_2 equivalents higher than observed, if these policies and measures had not been implemented. Similarly, projected GHG emissions (without LULUCF) would be about 34.9 million tonnes higher in 2030 (see Table 5.8 and Figure 5.3).

To arrive at a total the estimated effects of each significant policy and measure are aggregated. The estimated and expected effects of the individual policies which are addressed in chapter 4 are based on studies by various agencies and ministries. Structural policy changes, which might have an indirect impact on emissions, are not estimated. As 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 emissions in Norway.

Table 5.8 Effects of policies and measures that have been implemented. Total in ktonnes of CO_2 equivalents

	2020	2025	2030	2035
Cross sectoral	2 259.0	3 711.3	3 928.8	3 962.3
Petroleum activity	7 151.0	11 167.0	10 159.0	8 143.0
CCS	0.0	400.0	800.0	800.0
Energy and transformation	540.0	580.0	595.0	545.0
Transport	4 139.0	5 822.0	7 573.0	9 324.0
Industry	9 573.0	10 391.0	10 652.0	10 652.0
Agriculture	13.9	15.9	18.9	20.9
LULUCF	4.0	361.0	430.0	498.0
Waste	614.0	714.0	793.0	856.0
Total	24 293.9	33 162.2	34 949.7	34 801.2

Table 5.9 Effects of policies and measures that have been implemented. CO_2 in ktonnes

	2020	2025	2030	2035
Cross sectoral	1 659.0	3 111.3	3 328.8	3 362.3
Petroleum activity	7 151.0	11 167.0	10 159.0	8 143.0
CCS	0.0	400.0	800.0	800.0
Energy and transformation	540.0	580.0	595.0	545.0
Transport	4 139.0	5 822.0	7 573.0	9 324.0
Industry	700.0	700.0	700.0	700.0
LULUCF	4.0	361.0	430.0	498.0
Total	14 193.0	22 141.3	23 585.8	23 372.3

Table 5.10	**Effects of policies and measures that have been implemented. CH_4 in ktonnes CO_2 equivalents**

	2020	2025	2030	2035
Waste	614.0	714.0	793.0	856.0
Total	614.0	714.0	793.0	856.0

Table 5.11	**Effects of policies and measures that have been implemented. N_2O in ktonnes CO_2 equivalents**

	2020	2025	2030	2025
Industry	2 833.0	2 985.0	2 985.0	2 985.0
Agriculture *	13.9	15.9	18.9	20.9
Total	2 846.9	3 000.9	3 003.9	3 005.9

* The effect also includes minor emissions of CH_4 and CO_2.

Table 5.12	**Effects of policies and measures that have been implemented. HFCs in ktonnes CO_2 equivalents**

	2020	2025	2030	2035
Cross sectoral	600.0	600.0	600.0	600.0
Industry	154.0	377.0	600.0	635.0
Total	754.0	977.0	1 200.0	1 235.0

Table 5.13	**Effects of policies and measures that have been implemented. PFCs in ktonnes CO_2 equivalents**

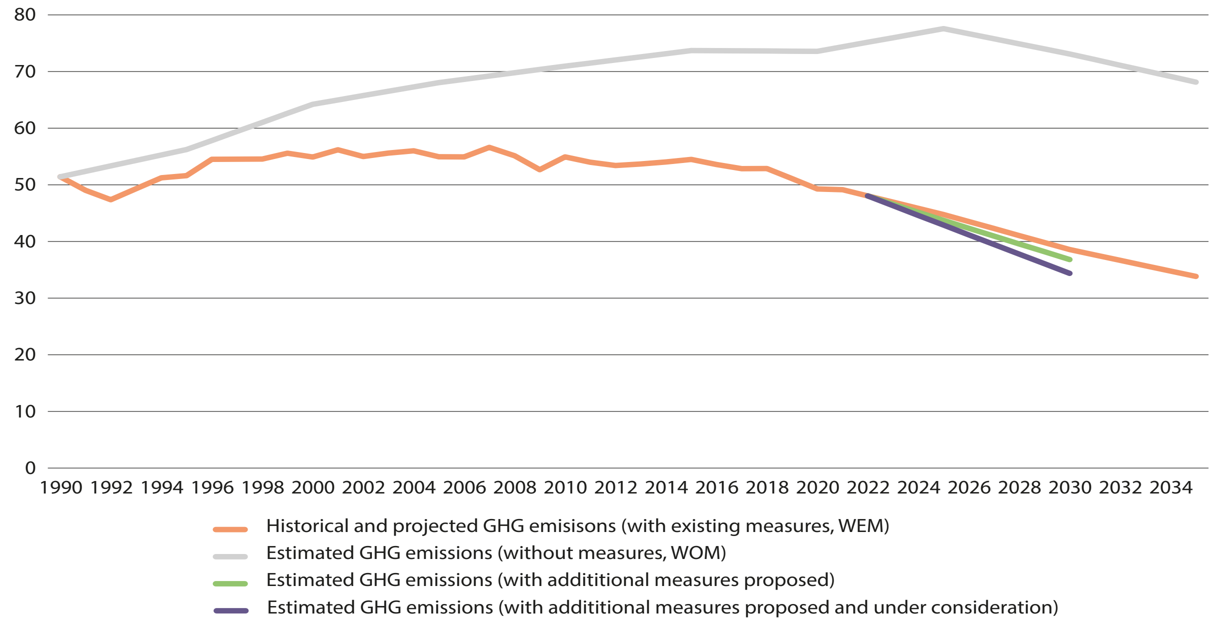
	2020	2025	2030	2035
Industry	5 830.0	6 260.0	6 300.0	6 240.0
Total	5 830.0	6 260.0	6 300.0	6 240.0

Table 5.14	**Effects of policies and measures that have been implemented. SF_6 in ktonnes CO_2 equivalents**

	2020	2025	2030	2035
Industry	56.0	69.0	67.0	92.0
Total	56.0	69.0	67.0	92.0

Figure 5.5 shows the historical GHG emissions without LULUCF for 1990–2020 together with the projections in the with existing measures (WEM) scenario. The projections in the without measures (WOM) scenario are without LULUCF and are based on two data sources. The effects for 1995, 2000, 2005, 2010 and 2015 are from the estimates in the seventh National Communication. The effects for 2020, 2025, 2030 and 2035 are from the estimates of this National Communication (see table 5.8).

Figure 5.5 Actual and projected emissions with and without measures (mill. tonnes CO_2 equivalents)



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

Figure 5.5 also shows the potential emission reduction that can come as a result of proposed climate measures and policies and measures that are under consideration, see box 4.2. It is estimated that measures proposed in the budget in aggregate can reduce the ESR emissions by 9.3–9.9 million tonnes of CO_2 equivalents in the period 2021–2030. The potential effect for 2025 and 2030 are about 1 and 1.7 million tonnes CO_2 equivalents respectively and is illustrated by the green line in the figure. A further 10.4 to 11 million tonnes of CO_2 equivalents in the period 2021–2030 can come from policies and measures that are under consideration. The potential effect for 2025 and 2030 are about 0.8 and 2.4 million tonnes CO_2 equivalents respectively and the incremental effect of this is illustrated by the purple line in the figure. Estimates have only been considered up to 2030.

5.8 Supplementarity relating to mechanisms under Articles 6, 12 and 17, of the Kyoto Protocol

Section 5.7 indicates that the emissions level in 2020 would have been about 26 million tonnes of CO_2 equivalents higher than actual emissions in the absence of domestic policies and measures taken to mitigate climate change, or about 50 per cent of the 1990 emission level. The estimates are uncertain but could still be conservative as not all policies and measures are quantified. The estimates illustrate that the use of Kyoto mechanisms has been supplemental to domestic action.

By way of comparison, the gap between emissions and the commitment under Article 3.1 was 3.3 million tonnes/year for KP 1, and 9.2 Mt/year for KP 2. Such a gap also illustrates that it is possible to assume a more ambitious target with access to mechanisms than what could have been possible without.

6 VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

6.1 Summary

The Norwegian economy, environment and society are vulnerable to climate change. The Government has conducted several actions, in compliance with the requirements of UNFCCC, to prepare for climate change.

In 2010, the Official Norwegian Report[12] NOU 2010: 10 *Adapting to a changing climate* was published. In this report, a committee appointed by the Government assessed Norway's vulnerability to the effects of climate change and the need to adapt. The NOU incorporates many of the aspects described in the Intergovernmental Panel on Climate Change (IPCC) Technical Guidelines for Assessing Climate Change Impacts and Adaptations and the United Nations Environment Programme (UNEP) Handbook on Methods for Climate Change Impacts Assessment and Adaptation Strategies. Following publication of the NOU, a white paper on climate change adaptation, Meld. St. 33 (2012–2013) *Climate change adaptation in Norway*, was prepared and adopted by the Norwegian Parliament. The white paper outlines actions to be taken at various governmental levels and within sectors in order to adapt to a changing climate. In 2022, the Government announced that it will start working on a new report to the Storting (white paper) on adaptation to climate change, due to be submitted in 2023.

Since the release of Norway's 7th National Communication in 2018, Norway has passed several milestones in its work related to climate change adaptation, and important progress has been made on local to national administrative levels and across different sectors. An NOU concerning climate risk and the Norwegian economy has been published, and central government planning guidelines on how to integrate climate change adaptation into municipal planning activities has been developed. Capacity building has been strengthened through networks, cooperation and other activities related to climate change adaptation. Climate change adaptation is also integrated into strategies and action plans within and across relevant sectors, such as in the recently adopted white paper Meld. St. 9 (2020–2021) *Mennesker, muligheter og norske interesser i nord* (translates to "People, opportunities, and Norwegian interests in the Arctic", with an English abstract available)[13]. Moreover, the Norwegian Parliament adopted a Climate Change Act in 2017, which includes reporting requirements related to adaptation to climate change. The Office of the Auditor General (OAG) of Norway recently assessed the work of the government authorities in adapting infrastructure

[12] The Norwegian Government or a ministry may appoint committee and work groups to report on different aspects of society. A report may either be published as a Norwegian Official Report Reports (in Norwegian: «Norges offentlige utredninger», abbreviated NOU) or as a regular report.

[13] Abstract available in English: The Norwegian Government's Arctic policy. People, opportunities and Norwegian interests in the Arctic – abstract.

and built-up areas to a changing climate, revealing that the Norwegian government authorities do not have the necessary overview of the risks of natural disasters in a future climate.[14]

This chapter provides an overview of observed and projected climate change in Norway, the expected impacts of these changes and related risks and vulnerabilities. Furthermore, the framework for climate change adaptation work is described, including the legal framework, policies and strategies. Adaptation actions are presented in the final part of the chapter. Norway's climate change-related support to developing countries is described in chapter 7.

6.2 Climate modelling, projections and scenarios

6.2.1 Climate change on the Norwegian mainland

6.2.1.1 Introduction

Norway is a sub-Arctic country with a long and convoluted coastline combined with a long mountain chain facing a relatively warm ocean surface to the south, west and north. This results in large geographical contrasts in the present climatic conditions as well as in the projections of future climate change. These contrasts are found both from coastal to inland and mountainous regions, for ocean and land areas from the southwest to the north and – even more so – from the Norwegian mainland to the Arctic islands (Svalbard and Jan Mayen). Climate change in Norwegian waters and in the Norwegian Arctic are described in sections 6.2.2 *Climate change in Norwegian waters* and 6.5.2 *Climate change in the Norwegian Arctic*, respectively.

[14] The Office of the Auditor General of Norway (2022): The Office of the Auditor General's investigation into government authorities' effort to adapt infrastructure and built-up areas to a changing climate, Document 3:6 (2021–2022).

In Norway, comprehensive studies of regional climate development in a scenario of global warming were initiated in 1997 through the *RegClim* project, and from 2007 to 2011, continued in the *NorClim* project. In later years, several research projects have contributed to continuing these activities, and from it was established in 2013, the Norwegian Centre for Climate Services (NCCS) has taken on a responsibility for regular assessments of climate projections for Norway.

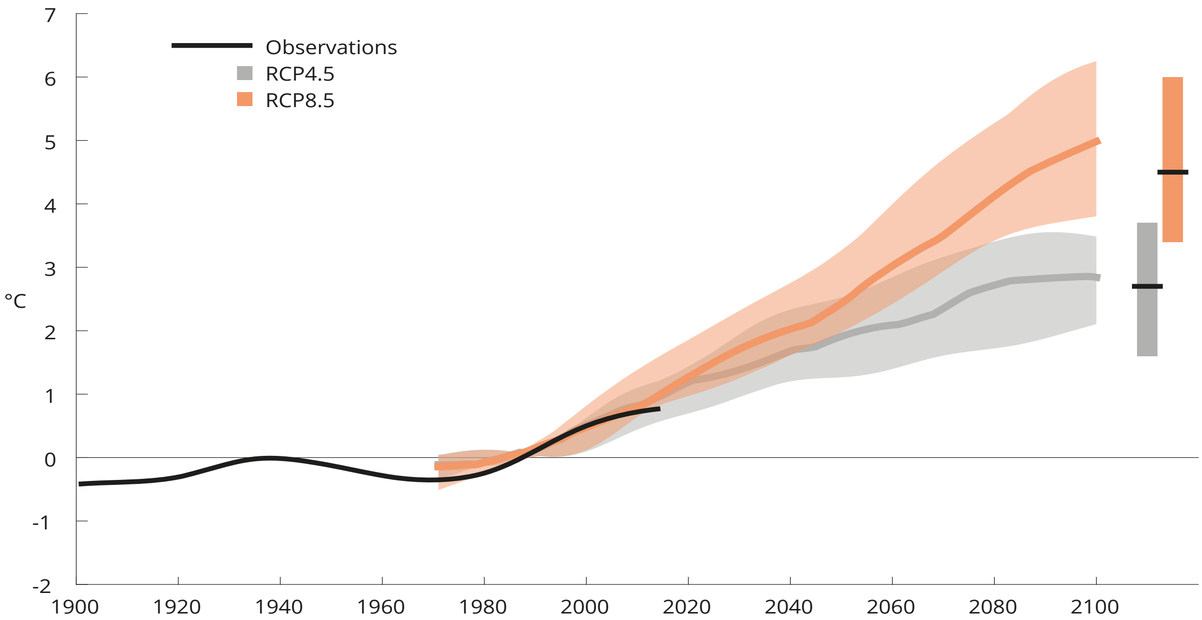
In 2015, NCCS published an updated report describing projections of climate change for the Norwegian mainland from a recent time period (1971–2000) and up to two scenario periods (2031–2060 and 2071–2100).[15] The projections are based on statistical and dynamic downscaling of global climate model results from IPCCs Fifth Assessment Report (2013/2014). During the same year, NCCS – in collaboration with the Norwegian Mapping Authority (NMA) – also published a report on projected sea level changes along the Norwegian coast.[16] It used the same database for downscaling, but from the period 1986–2005 to 2081–2100.

Both reports provided results for three different emission scenarios: the low emission scenario RCP2.6, the intermediate emission scenario RCP4.5 and the high emission scenario RCP8.5. Of the three, graphics are shown for RCP4.5 and RCP8.5, while the text describes the resulting climate changes following RCP8.5, in line with

[15] NCCS (2015): Klima i Norge 2100: Kunnskapsgrunnlag for klimatilpasning oppdatert i 2015 [I. Hanssen-Bauer, E.J. Førland, I. Haddeland, H. Hisdal, S. Mayer, A. Nesje, J.E.Ø. Nilsen, S. Sandven, A.B. Sandø, A. Sorteberg, B. Ådlandsvik (eds.)], the Norwegian Centre for Climate Services (NCCS) report no. 2/2015. A condensed English version of NCCS report no. 2/2015 was published in 2017 as NCCS report no. 1/2017.

[16] NCCS (2015): Sea Level Change for Norway: Past and Present Observations and Projections to 2100 [M.J.R. Simpson, J.E.Ø. Nilsen, O.R. Ravndal, K. Breili, H. Sande, H.P. Kierulf, H. Steffen, E. Jansen, M. Carson, O. Vestøl], the Norwegian Centre for Climate Services (NCCS) report no. 1/2015.

Figure 6.1 Annual temperature for Norway as deviation (in °C) from the mean of the reference period 1971–2000.



Black curve shows observations (1900–2014), while blue and red curves show median values for the ensemble of ten RCM simulations for emission scenarios RCP4.5 and RCP8.5, respectively. All curves are smoothed by low-pass filtering. Shading indicates spread between low and high climate simulation (10th and 90th percentile). The box plots on the right show values averaged over 2071–2100 for both scenarios.

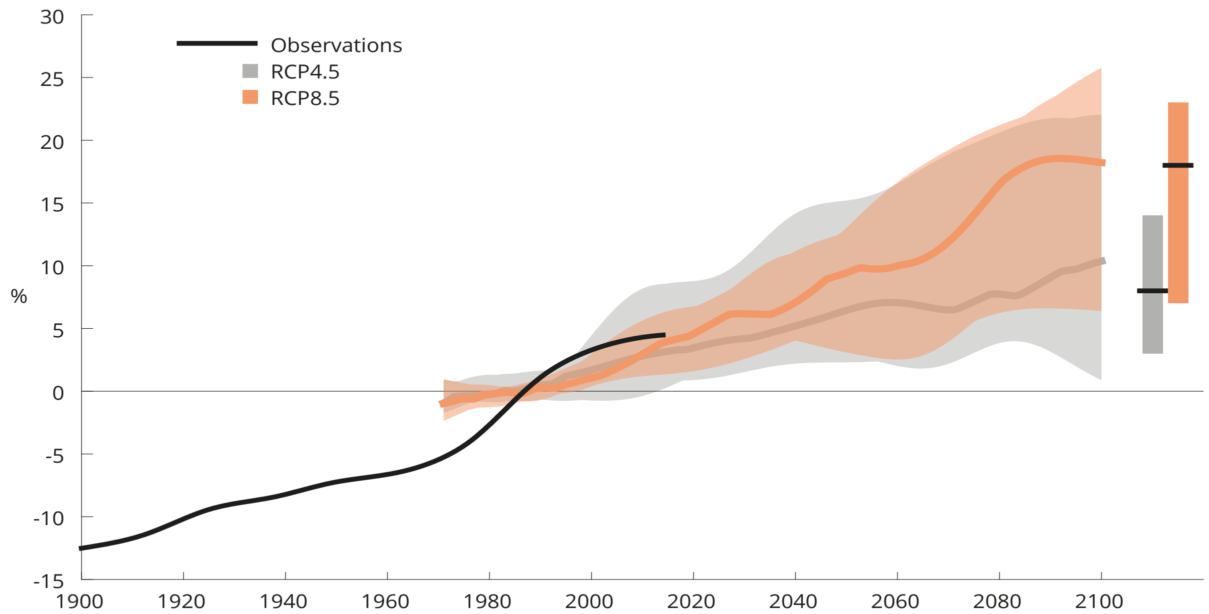
the national guidelines that assessment of climate change impact is to be based on a precautionary approach. However, if future global greenhouse gas emissions are reduced significantly (e.g., following RCP2.6), projections show that the expected changes in climate parameters will be significantly smaller.

6.2.1.2 Air temperature

The projections indicate warming in all parts of Norway and during all seasons.[4] The annual mean temperature for Norway (Figure 6.1) is estimated to increase by 4.5 (3.3–6.4) °C towards the end of this century under the high emission scenario RCP8.5. For the Norwegian mainland, the greatest change in annual mean temperature is estimated for the northern parts of Norway, where the warming is 6,1 °C by the end of the century. For Western Norway, the estimated warming is lower, with a median value close to the global average estimate of 3,7 °C.

A general trend is that the projected warming is stronger for the winter (DJF) than for the summer (JJA) season. This trend is more pronounced inland than along the coast, more pronounced in the north than in the south and more pronounced for RCP8.5 than for RCP4.5.

Figure 6.2 Annual precipitation over Norway as deviation (in per cent) from the reference period 1971–2000.



Black curve represents observations (1900–2014), while blue and red curves show median values for the ensemble of ten RCM simulations for emission scenarios RCP4.5 and RCP8.5, respectively. All curves are smoothed. Shading indicates the spread between low and high climate simulation (10th and 90th percentile). The box plots on the right show values averaged over 2071–2100 for both scenarios.

6.2.1.3 Growing season

The growing season, defined as the number of days with an average temperature above 5 °C, is expected to become considerably longer over the course of this century.[4] Calculations show a one to two-month increase in large parts of the inland areas and a two to three-months increase in coastal areas and in a zone between the coast and the inland region.

The total area (not only area used for agricultural purposes) with a growing season longer than six months is projected to increase from about 37 000 km^2 in the reference period (1971–2000) to 165.000 km^2 by the end of the century (2071–2100).

6.2.1.4 Days with zero crossings

Days with zero crossings are days where the 2 m minimum temperature is below 0 °C and the 2 m maximum temperature exceeds 0 °C.[17]

The number of days with zero crossings is projected to increase in cold regions and seasons, while decreasing in mild regions and seasons.[4] More frequent zero-crossings are projected for inland regions in winter and for Finnmark County in spring, indicating more frequent icing of the snowpack and the need for winter road maintenance.

[17] Nilsen I.B., I. Hanssen-Bauer, O.E. Tveito, W.K. Wong (2021): Projected changes in days with zero-crossings for Norway, International Journal of Climatology, 41, 2173–2188.

6.2.1.5 Precipitation

Amounts of annual precipitation averaged over the Norwegian mainland is projected to increase by 18 per cent towards the end of this century (Figure 6.2).[4] The projections indicate increases in all seasons, except a small projected decrease in summer precipitation in the southernmost part of the country.

Heavy rainfall is defined as the 99.5th percentile for 24-hour precipitation, i.e. the amount of rainfall that is expected to be exceeded approximately twice a year on an annual basis. The projections indicate an increase of days with heavy rainfall for all season and all regions. For the Norwegian mainland, an 89 per cent increase is projected by the end of this century, with the largest increase in the winter season.

However, due to the large variation between projections, it cannot be ruled out that the number of days with heavy rainfall will more than double by the end of the century. In addition, it is expected that the actual amount of rainfall on such days will increase with approximately 10 to 20 per cent. This also applies to all seasons and regions.

In general, such increases in both amount and frequency, are even higher when assessing intense short-duration rainfall (up to 3 hours).

6.2.1.6 Wind speed

The projections from climate models indicate small changes in average, as well for high, wind speeds throughout Norway towards the end of this century.[4] However, some model results indicate that adverse wind conditions may become more frequent.

6.2.1.7 Runoff, floods and droughts

The annual runoff from the Norwegian mainland is estimated to increase, but to a lesser degree than annual precipitation as evapotranspiration also will increase.[4] The largest relative changes are expected in the winter (large increase due to increased precipitation that falls as rain) and in the summer (large decrease caused by earlier snowmelt in mountainous regions and higher evapotranspiration losses).

In general, trends towards a later snow accumulation and an earlier snowmelt have already been observed. These observed changes are expected to continue in the future. For the high emission scenario RCP8.5, the snow season can become one to more than six months shorter.

Future changes in flood magnitudes have been analysed for 115 rivers in Norway.[18] The results show that the magnitude of change strongly depends on the emission scenario, but the direction of change is the same. We can expect rain flood magnitudes to increase and snowmelt flood magnitudes to decrease. In many areas, this is also associated with a change in seasonality. More frequent and intense rainfall events may in the future give special challenges in small steep rivers and urban areas all over the country.

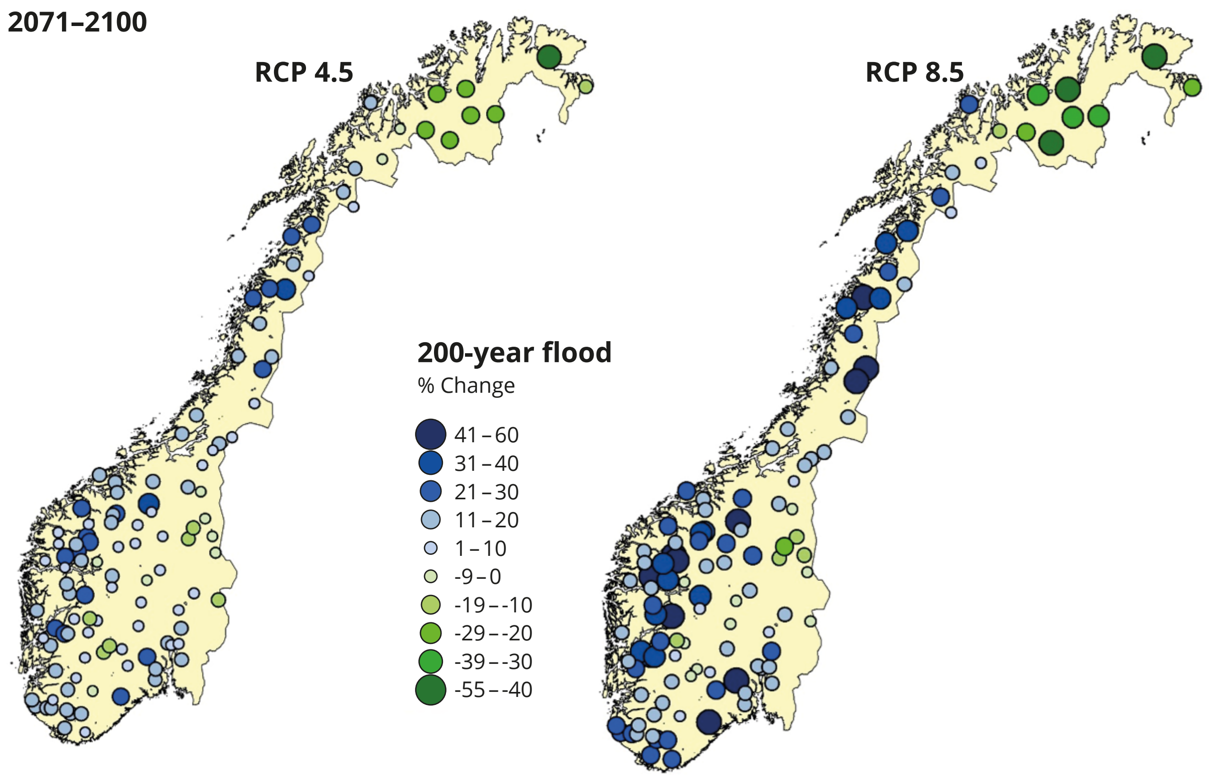
Higher temperatures causing earlier snowmelt and higher evaporation losses during the summer season may lead to reduced river flow, more severe soil moisture deficits and lower groundwater levels even in regions where summer precipitation is expected to increase. This will result in more severe summer droughts.

6.2.1.8 Landslides and avalanches

Landslides are separated into earth slides (including flood slides), rockslides and quick clay slides. Avalanches are – depending on the water content in the snow – separated into dry and wet snow avalanches and slush slides.

[18] Lawrence, D. (2016): Klimaendring og framtidige flommer i Norge, the Norwegian Water Resources and Energy Directorate (NVE) report no. 81-2016.

Figure 6.3	Relative change (in per cent) in the 200-year flood from the reference period 1971–2000 to the end of the century period 2071–2100.



Left and right panels show projections following the intermediate emission scenario RCP4.5 and the high emission scenario RCP8.5, respectively. Green indicates a reduction and blue an increase in flood magnitude.

Landslides and avalanches mostly occur in steep terrain (except quick clay slides), but weather is one of the main triggering factors, and hence, climate change will affect their frequency. In particular, we can expect more wet snow avalanches and earth, flood and slush slides.[4]

6.2.1.9 Glaciers

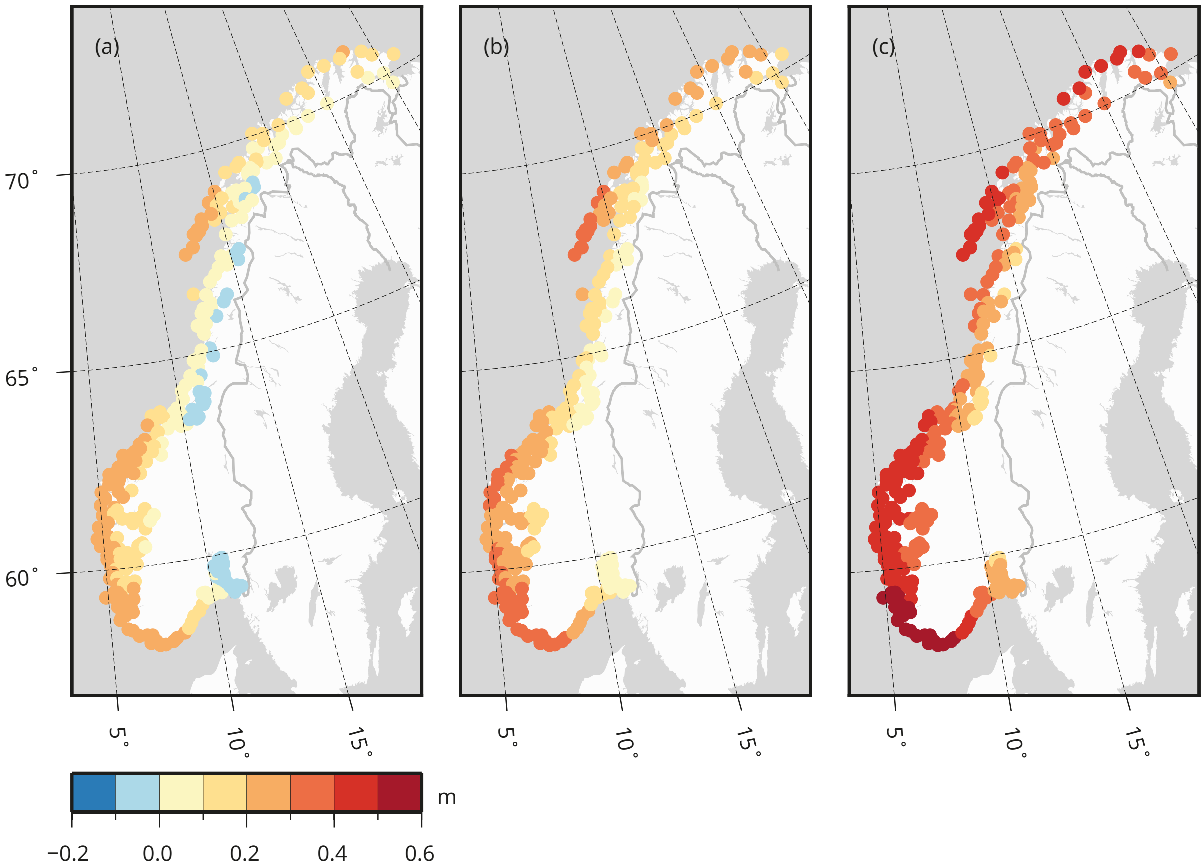
Expected climate change under the high emission scenario RCP8.5 will have a large impact on the area and volume of glaciers in Norway towards the end of the century.[4]

For larger glaciers, a reduction of up to 2/3 of the area and volume currently covered is expected, such that remaining glaciers will be significantly smaller and only found at higher altitudes. The smaller glaciers will disappear (completely melt).

6.2.1.10 Sea level rise and storm surges

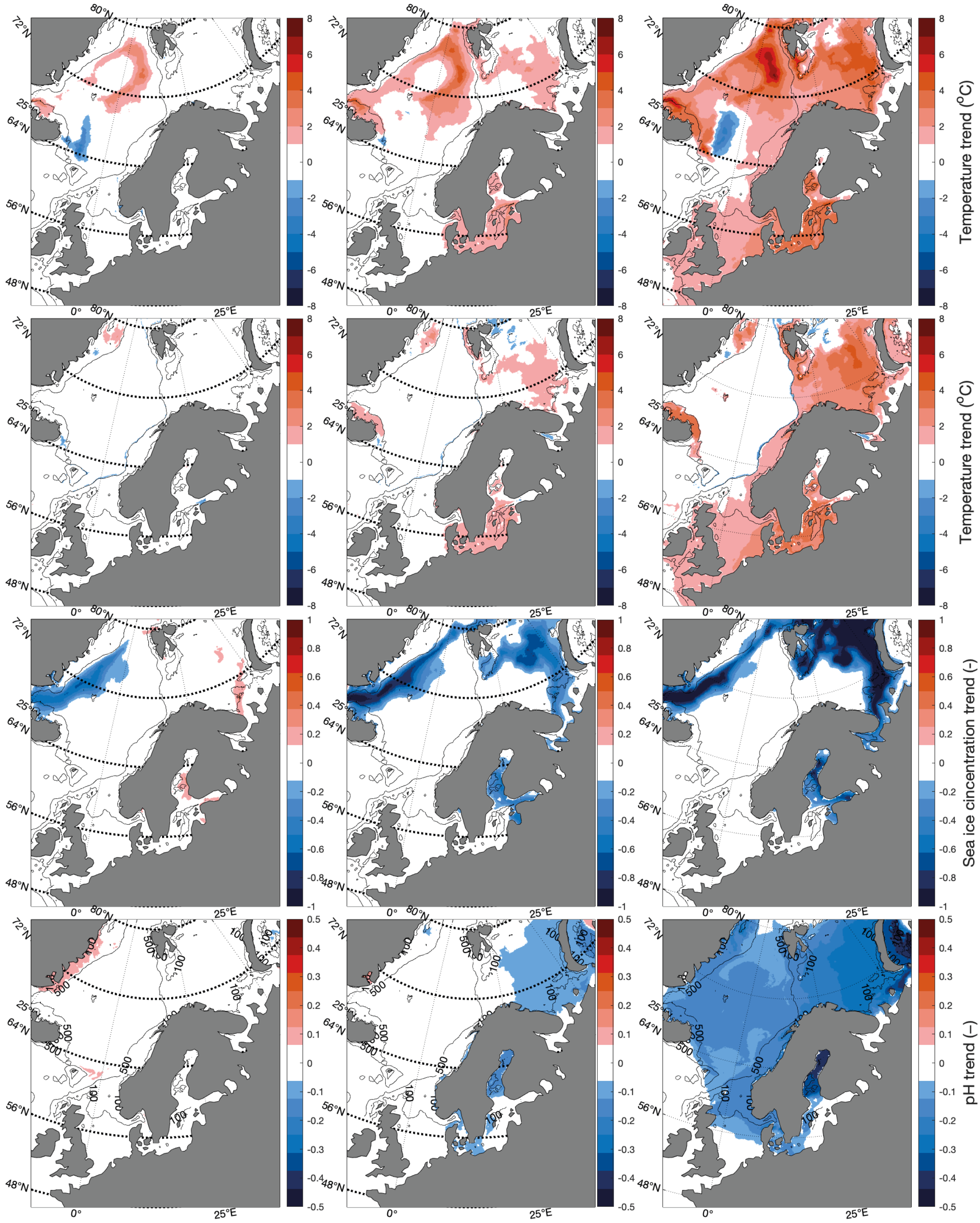
Regional sea level projections based on IPCC AR5 show that, for all emission scenarios, the majority of Norway will likely experience a sea level rise over this century (Figure 6.4).[5] For the high emission scenario RCP8.5, the model average projected sea level for 2081–2100 is between 0.15 and 0.55 m, depending on location. Geographic differences in projected sea level largely reflect differences in land uplift. By the end of this century, the spread of projections shows rates of relative sea level rise may approach or exceed 1 cm per year.

Figure 6.4 Projections (model average) of changes in relative sea level in Norway from 1986–2005 to 2081–2100 for a) the low emission scenario RCP2.6, b) the intermedia emission scenario RCP4.5 and c) the high emission scenario RCP8.5.



Future sea level rise will cause an increase in the height of extreme sea level events (e.g. storm surges). Owing to this, coastal areas already exposed to storm surges will experience a large increase in the frequency of inundation. Climate change can also cause changes to the nature of storm surges themselves, for example, due to changes in storminess and/or waves. Projections of storm surge changes are in general of low confidence, but the projections available suggest a weak increase in future storm surge heights along the Norwegian coast.

Figure 6.5 Spatial distribution of trends in March temperature (in °C) at the ocean (first row) surface and (second row) bottom, (third row) March sea ice concentration (in proper fractions), and (fourth row) annual means of pH at intermediate ocean depths (-) for (left column) SSP1-2.6, (middle column) SSP2-4.5, and (right column) SSP5-8.5 during the period 2015–2100.



6.2.2 Climate change in Norwegian waters

6.2.2.1 Introduction

In 2022, the Institute of Marine Research (IMR) and the Norwegian Institute for Water Research (NIVA) published two reports describing projections of climate change for Norwegian waters over the 21st century. These covered the Norwegian sea (the Barents, Norwegian and North seas)[19] and coastal[20] regions, respectively.

The projections are based on dynamical and statistical downscaling of global climate model results from IPCCs Sixth Assessment Report (2021/2022), providing results for three different emission scenarios: the low emission scenario SSP1-2.6, the intermediate emission scenario SSP2-4.5 and the high emission scenario SSP5-8.5. The three scenarios follow rather divergent paths with regards to emissions and radiation impulses, with corresponding peaks at very different times.

6.2.2.2 Ocean sea temperature and acidification

The two first rows of panels in Figure 6.5 show the spatial trends in temperature at the ocean surface and bottom in March for the three emission scenarios SSP1-2.6, SSP2-4.5, and SSP5-8.5 during the period 2015–2100.[10] While the ocean temperature trends are relatively modest in SSP1-2.6, they reach values of around 4 °C at the surface in the north-eastern parts of the Barents Sea and even higher in the Greenland Sea close to the West Spitsbergen Current in SSP5-8.5.

This warming is reflected in the sea ice extent, which is almost completely gone in SSP5-8.5 by the end of the century (third row and third column panel in Figure 6.5). Correspondingly, the largest negative trends in pH are also found in the Barents Sea region, with about -0.3 (-) at intermediate depths in its eastern parts (fourth row of panels in Figure 6.5).

6.2.2.3 Coastal sea temperature and acidification

Trends in temperature and pH for the Norwegian coastal region generally reflect those of the Norwegian ocean regions; that is, distinct warming and acidification over the 21st century, with higher trends for higher emissions scenarios.[11]

In particular, temperatures are expected to increase across all regions (first column of panels in Figure 6.6). Warming varies between 1 °C in SSP1-2.6 and 4 °C in SSP5-8.5.

pH will decrease overall, with the largest drop possibly occurring in Southern Norway (second column of panels in Figure 6.6). While there is relatively little change across regions, there are large differences across scenarios. The SSP5-8.5 scenario would lead to dangerously low values by 2100 that would be detrimental for many marine species.

Coastal oxygen values remain relatively high across all regions, although there is a decreasing trend in dissolved oxygen (third column of panels in Figure 6.6). This reflects trends seen in global climate assessments.[21]

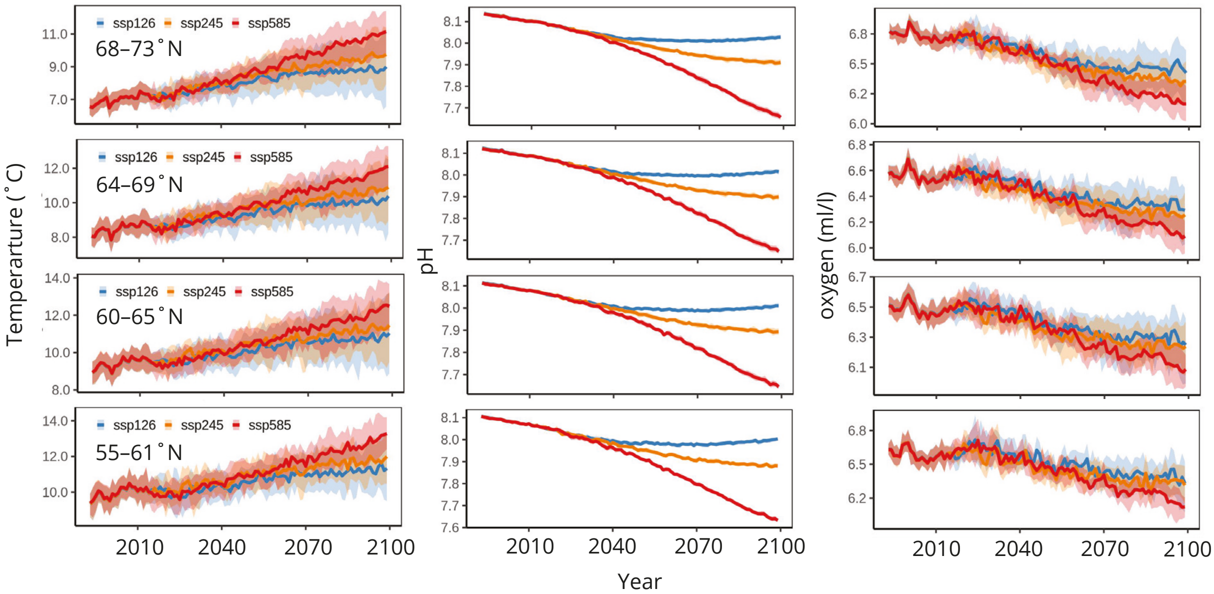
---

[19] IMR (2022): Risikoanalyse for de norske havområdene om direkte og indirekte virkninger av klimaendringer på marine økosystemer under ulike utslippsscenarier. Risikorapport hav og klima. [A.B. Sandø, M.D. Skogen, R. Hordoir, S.S. Hjøllo, C. Hansen], the Institute of Marine Research (IMR) report 2022-41).

[20] NIVA (2022): Klimapåvirkning på viktige kystvannsarter [T. Kristiansen, K.Ø. Kvile, M. Aune, J. Jensen, R.G.J. Bellerby, S.F. Skjellum, G. Hairabedian], the Norwegian Environmental Agency report M-2344 by the Norwegian Institute for Water Research (NIVA).

[21] IPCC (2022): Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp.

Figure 6.6 Projections of (left column) temperature (in °C), (middle column) pH (right column) and oxygen (in ml/L) averaged for four regions within the 24 nm zone – the Northern (68-73°N), Middle (64-69°N), Western (60-65°N), and Southern (55-61°N) Norway.



Thick lines show annual averaged values for each of the three emission scenarios SSP1-2.6, SSP2-4.5 and SSP5-8.5, while shaded colours indicate the 95th percentile uncertainty across the global climate models.

6.3 Vulnerability to climate change and expected impacts on society and nature

6.3.1 Introduction

According to the committee that conducted the vulnerability assessment in NOU 2010: 10 *Adapting to a changing climate*, Norway is in a good position to adapt to climate change. Future vulnerability, however, will depend on the extent to which climate change considerations are incorporated into planning and decision-making processes in all areas and all levels of society. The committee considered that the degree of vulnerability varies between different areas of society. Climate affects all areas of society, but in different ways, to different extents and at different timescales. In the committee's assessment of the various areas of society, vulnerability has been considered based on how exposed the area is and its adaptive capacity. Exposure to climate change was assessed based on climate projections, other research results and contributions from people involved in the sectors. Adaptive capacity was evaluated in the light of the sector's organisational structure, resources, knowledge base and priorities. The interaction between these factors was also an important part of the assessment. The review showed that vulnerability is not just dependent on the exposure to climate change; it is also very closely linked to the adaptive capacities in various areas.

The committee concluded that the natural environment, infrastructure and buildings – in particular water and sewage – are especially vulnerable to climate change in Norway. The impact varies between regions and types of terrain. The nature of the exposure varies between the coast and the interior, between Northern Norway and Southern

Norway, and between steep, mountainous areas and low-lying, flat areas.

The committee considered the north and alpine areas to be especially vulnerable to climate change. Part of the Sámi population in the north derives its livelihood from natural resources, and Sámi culture is, therefore, vulnerable to the impact of climate change on nature.

In 2019, existing knowledge on consequences of climate change in Norway was compiled, documenting important developments in since the NOU was published in 2010.[22] Among the conclusions, the report finds that:

- knowledge on *how* the climate in Norway is expected to change, has been improved since 2010, through the establishment of the Norwegian Climate service centre in 2013;
- climate change in other countries will possibly impact many sectors in Norway;
- the Norwegian society's capacity to adapt has been strengthened since 2010, through changes in laws and regulations, a great increase in production of knowledge, guidance, coordination and, to some extent, resources;
- despite an increase in the production of knowledge, there are still challenges related to translating knowledge into useful information for local level practitioners; and
- national authorities' work on adaptation has increased significantly since 2010, but the efforts are varying across different sectors.

Climate change may intensify existing problems and create new ones. On the other hand, opportunities for business development and advantages for local communities may also emerge.

Climate change is expected to have a major impact on ecosystems and increase the overall strain on the environment. The environment is affected in various ways by human activities through land and resource utilization, transport and pollution. These activities and climate change affect ecosystems separately and in combination, and in some cases, they are mutually reinforcing. The vulnerability of an ecosystem is a result of the integral impact of the numerous stress factors.

Ecosystems adapt continuously to climate variability. This takes place, among others, through changes in the distribution of species and through natural selection over generations. One challenge of a changing climate is that changes may manifest themselves faster than ecosystems and species are able to adapt. Adaptation through natural selection is particularly challenging for species with small populations and a low genetic variation. In addition, fragmentation and changes in land use may create barriers that prevent species from migrating to new areas.

Certain local communities that are not currently at risk for landslides, avalanches and floods, may face these risks in the future, but in general, climate change may enhance existing challenges. To some extent, these recurring themes take on different guises in different sectors, but they challenge adaptive capacity across sector boundaries.

The municipalities are Norway's local administrative level and have the overall responsibility for development planning and provision of services within their geographical catchment areas. Many municipal responsibilities will be affected by climate change, and plans and decisions adopted by municipalities today will have consequences for many decades.

[22] Vestlandsforsking & Cicero (2018): Oppdatering av kunnskap om konsekvenser av klimaendringer i Norge (translates to «An update of knowledge on consequences of climate change in Norway», albeit in Norwegian only), [C. Aall (red.)], CICERO report no. 2018:14.

6.3.2 Nature and ecosystems

6.3.2.1 Terrestrial ecosystems

The Norwegian Red List for Species 2021 shows that climate change is negatively affecting 211 of the 2752 threatened species in Norway. The Norwegian Red List for Ecosystems and Habitat Types from 2018 lists climate change as a negative factor for 35 of the 75 threatened nature types. *Alpine and tundra ecosystems* are regarded as particularly vulnerable to climate change. Climate change causes the tree line and vegetation zones to creep upwards, which in turn affects species in the mountains. For alpine species, there is a risk that there will no longer be any suitable natural habitats to migrate to and that some species will become extinct. This applies for example to the Arctic fox, wild reindeer and alpine plants. Competition from new species will also pose a threat, such as the red fox, which migrates to alpine areas and competes with the Arctic fox. The tree line moving ever higher reduces the number of continuous alpine areas, which will particularly affect the alpine species dependent on large, continuous alpine areas, such as wild reindeer. This will happen at the same time as pressure increases in alpine areas owing to land use and other human activity. Red listed species that are threatened in Norway because they are at their northerly distribution limits, may, however, become less threatened.

The growing season is expected to become longer and warmer. An assessment from 2022 on the impacts of climate change on the *forest ecosystems* in Norway shows that, in the short term, this may result in faster growth and primary production, a rise in the proportion of trees that prefer a warmer climate and changes in the species composition of forests with broadleaf species replacing pine and spruce in the south.[23] Rising temperatures may also result in the northward and upward spread of forest. Climate change is, however, also expected to result in increased damage by factors such as storms, pest outbreaks, droughts and forest fires. Such factors can pose serious threats to forest health, vitality and productivity, and by the end of the century, such negative effects of climate change may supersede the positive effects on forest growth and productivity.

Some *cultural landscape systems,* such as species-rich hay meadows and grazed grasslands, are vulnerable to increased production. Many cultural landscapes are already threatened by re-growth due to abandonment, and increased growth will accelerate this process.

In Norway, *wetlands*, especially bogs, have also been exposed to major human encroachment, such as drainage for agricultural purposes, forestry, harvesting of firewood and peat moss, as well as other developments. Climate change represents a new factor that is threatening wetlands, in addition to other threats. This applies in particular to Southern and Eastern Norway, where one expects higher temperature and less precipitation in summer, and to certain types of wetlands, such as palsa mires, which may melt in a warmer climate. Increased precipitation in other parts of the country may lead to an increase in wetland areas.

Conditions for invasive *alien* species also change with climate change. At present, many invasive alien species are not able to survive the cold winter conditions in large parts of Norway. With the milder winters expected in the future, more of the harmful species will be able to survive and spread.

[23] VKM (2022): Impacts of climate change on the forest ecosystem: Scientific Opinion of the Panel on Alien Organisms and Trade in Endangered species (CITES) of the Norwegian Scientific Committee for Food and Environment (VKM) [K. Kausrudet al.], VKM report no. 2022:15.

6.3.2.2 Fresh water ecosystems

The effects of climate change on the freshwater ecosystem are many and complex, and they will have impact on production, biomass, life cycles and species composition. Together with an increase in extreme precipitation events and flooding, this will result in more runoff, transport of particulate matter and leaching of nutrients and other pollutants. Higher erosion rates along riverbanks and runoff of particulate matter and nutrients from farmland may become a greater problem, and such tendencies have already been registered in smaller rivers in Eastern Norway. Particulate matter and pollutants are transported downstream to coastal waters, adding to the overall environmental pressure on marine ecosystems.

The ice-free season will be longer, the water temperature will increase and the thermal vertical stratification in the lakes will increase. In parts of Norway, prolonged periods of summer drought and low stream flow are expected. For vulnerable fish species, such as salmon, trout and Arctic char and grayling, temperatures exceeding 20–25 °C could be critical. Regulated rivers with low residual flows may be particularly exposed.

Climate change-induced alterations in habitats may force fish and other aquatic organisms to adapt by moving to other parts of the watercourses where water quantity, quality and temperature remain suitable. The high number of man-made barriers can prevent this migration, representing an obstacle to this adaptation approach.

6.3.2.3 Marine ecosystems

In *marine and coastal waters*, climate change will result in higher temperatures, and a higher CO_2 content in sea water will lead to ocean acidification (Figure 6.6). Warmer waters can hold less oxygen, which combined impacts marine species habitat suitability. This in turn may cause serious impacts on marine ecosystems. In addition to an increase in mean global ocean temperature, the frequency of extreme temperature events – a phenomenon called marine heat waves – are expected to increase further depending on developments in greenhouse gas emissions.[24] Marine heatwaves have many measurable negative effects on marine habitats, e.g. harmful algae blooms, mass deaths among seabirds and fish species found hundreds of miles from their traditional habitats.

A large proportion of CO_2 of anthropogenic origin is absorbed by the oceans, where it reacts with water to form carbonic acid. Ocean acidification will result in changes in the seas' ability to precipitate calcium carbonate, on which calciferous organisms depend. This problem increases at great depths with high pressure and low temperatures. It implies that Norwegian waters and especially the Polar Regions are particularly exposed and will be impacted before more temperate regions. Calciferous organisms include coralline algae, phytoplankton, zooplankton, crustaceans, molluscs and corals.

There are many cold-water coral reefs in Norwegian waters, including the world's largest known cold-water coral reef complex, *The Røst Reef*.[25] Coral reefs are among the most species-rich ecosystems and are a vital habitat for many types of fish. Ocean acidification has negative impacts on these ecosystems, and by the end of this century, cold water coral reefs and associated ecosystems in Norwegian waters exposed to corrosive waters will be threatened[26] and are expected to show signs of erosion. Phytoplankton, such as calciferous flagellates, form the basis of marine ecosys-

[24] PlanMiljø (2021): Marine heatwaves in Northen Sea areas: Occurrence, effects, and expected frequencies [E. Borgman, M.F. Pedersen, P.A.U. Stæhr], the Norwegian Environment Agency report M-2239 by PlanMiljø.

[25] Sunnset, B. H. (2015): Omringet av koraller, Mareano.

[26] Fransner, F., et al. (2022): Acidification of the Nordic Seas, Biogeosciences, 19, 979–1012.

tems, and the zooplankton that graze on them, are essential food for many fish species. As plankton species with calcareous skeletons may not survive in more acidic seawater, the acidification can have major impacts on many trophic levels.

Higher temperatures can result in a more northwards distribution of a number of species, such as kelp and mackerel that are temperature limited. Owing to its great depths, the Norwegian Sea is a key area for the production of copepods (zooplankton). They represent an important food source for fish larvae and juveniles of the large boreal fish stocks, such as herring and cod. In the North Sea, abundance of the copepod *Calanus finmarchicus* have dropped drastically as the sea temperature has risen over the last decades;[27] at the same time, the quantities of a plankton species that prefers higher temperatures, have increased, e.g. *Pseudocalanus*. However, this species is less nutritious. A decline in *C. finmarchicus* and an increase in plankton species that spawn later in the season, may result in a mismatch between spring-spawning fish and their prey. The presence of plankton exerts a strong impact on fish recruitment and can – in a year of mismatch –have cascading effects on the rest of the marine food web. This includes effects on seabird breeding success and the presence of herring and marine mammals. A study has shown that seabirds, unlike many other marine animals at lower trophic levels, have not shifted their breeding season in response to climate change.[28] Thus, a warmer ocean can result in breeding failure in seabirds. Detailed consequences to the ecosystems and particular species are, however, yet to be well known.

Along with a more northwards distribution of copepods, the southern boundary for boreal fish species is expected to move northwards. Species such as cod, haddock, herring and mackerel may have their migration patterns disturbed and experience changes in their habitat suitability. However, it is expected that, in the 21st century, several temperate and subtropical fish species, such as sardine, anchovy, European bass and tuna, may become common in the North Sea. In the Arctic, fish species such as Arctic char and polar cod may disappear from parts of the Barents Sea since they primarily feed on the Arctic zooplankton whose natural habitat is along the ice edge.

Overall, it is very uncertain how the changes will affect species composition, fish stocks and total production in marine ecosystems.

Seabirds along the coast are subject to a range of different pressures, many of which are caused by intended or unintended human activity: oil pollution; competition with fisheries; climate change (including increasing sea temperatures); marine litter; persistent organic pollutants; introduced predators; habitat degradation; and disturbance by people. Many seabird populations have shown a dramatic decline in recent years. Moreover, a number of seabirds are specialised feeders, which makes them particularly sensitive to climate change and changes in the availability of prey species such as sandeels, herring and capelin.

[27] Beaugrand, G., et al. (2003): Plankton effect on cod recruitment in the North Sea, Nature, 426, 661-664; Beaugrand, G., and R. R. Kirby (2010): Climate, plankton and cod, Global Change Biology, 16, 4, 1268-1280.

[28] Keogan, K., et al. (2018): Global phenological insensitivity to shifting ocean temperatures among seabirds, Nature Climate Change, 8, 313–318.

Box 6.1 Analysis of crisis scenarios: Storm in the Inner Oslofjord

Storms can cause major damage to forests. DSB has in its risk picture for 2014, *Storm in the Inner Oslofjord*, this as a scenario. This scenario was updated in 2021 with an *analysis of preparedness* and capacities to respond to a storm in the same area, and based on a real event the same year. The purpose of the preparedness analysis was to examine how well equipped society is with current preparedness to handle large tree falls (windfall of timber) during a strong storm in the Inner Oslofjord. The main question in the analysis was: to what extent do we have preparedness to protect society's and forestry's values against upcoming storms with large tree falls?

Storms with several wind strengths were analysed. A strong storm of 32 m/s was chosen as the "design scenario", i.e. the storm force society should be prepared to handle. Although there is rarely a strong storm in this area, it is not an unlikely scenario – this is shown by the gusts that hit Eastern Norway on 19 November 2021. It is therefore important to consider what steps can be taken to reduce the consequences of such a storm. Estimations showed that a strong storm in this area will lead to extensive tree falls on roads, power lines and buildings. It is estimated that more than 10 million trees will fall, of which 340 000 trees hit buildings and infrastructure. In the event of such an extensive tree fall, there will be a shortage of trained personnel with the right equipment and expertise. Climate change can increase the likelihood of such events in the future since more frequent and powerful storms and precipitation are expected in the future and because they are also expected in new locations.

6.3.3 Human life and health

6.3.3.1 Civil protection and emergency planning

The exact scope, severity and pace of future climate change impacts are difficult to predict; still, climate change will affect societal safety. Specific examples of this include:

- Increasing frequency and severity of extreme weather events, such as storms, floods and droughts, will threaten human lives and health, material assets and vital societal functions.
- Both changed extreme weather events and a gradual change in the average climate will increase the vulnerability of critical infrastructure.

Global effects of climate change can have an indirect impact on societal safety in Norway. For example, intensifying droughts or floods can result in food insecurity, economic collapse and human suffering, which in turn may lead to cross-border migration and the spread of harmful organisms. Climate change will thus challenge society's ordinary emergency management capacity.

6.3.3.2 Health

A warmer climate may affect public health directly and indirectly in a number of ways. The main effect will be the intensified health risks posed by today's climate.

The quality of drinking and recreational water may become poorer, increasing the risk of waterborne infections. In general terms, the impacts can be split into two categories: impacts on the raw water and water treatment plants; and impacts on the distribution infrastructure. Challenges related to the maintenance backlog of the water supply infrastructure in Norway may pose increased health risks. Vector, food and water-borne infections are among the commonest infections in Norway and are considered to be particularly sensitive to climate change.

The prevalence of communicable diseases may increase as conditions become more suitable for infective agents such as ticks and mosquitoes. A longer and more intense pollen season may aggravate the symptoms of people who suffer from allergic diseases. Climate-related changes in exposure to indoor and outdoor air pollution may affect the risk of developing asthma and allergies. A warmer climate, on the other hand, may also have positive consequences for asthmatics by reducing the negative effects of cold air and respiratory infections.

Heat waves (five days or more with a maximum temperature of 28 °C or more, and the minimum temperature is not lower than 16 °C) increase the health risks. Extreme temperatures increase the risks of cardiovascular disease and lung disease. Elderly, young children and people with certain diseases are the groups most prone to suffer under extreme heat.

The climate changes pose several mental health risks: For example, the direct effects of acute events and disasters leading to trauma, shock and possible long-term effects are obvious. Reduced air quality and increased temperatures may be associated with anxiety, increased incidence of schizophrenia, more aggression and impaired cognitive function. Poorer air quality due to warming can have negative consequences for cognitive function, lead to reduced quality of life and also impair cognitive development in children

The connection between societal inequality and climate changes is complex: Certain social groups are more vulnerable to crises, and this is the case with the climate crisis as well. Already marginalized or exposed and vulnerable groups, for example those with the lowest socio-economic background and/or with an underlying illness, will be hardest hit.[29] Although, economic inequality in Norway is low compared to other countries, societal inequality has increased since the 1980s. As in several other countries, climate changes may lead to reduced access to healthy affordable food and water in Norway, as well as increased energy prices. Vulnerable societal groups will suffer the most from these.

Climate change coincides with unsustainable use of natural resources, destruction of habitats, increased urbanisation and social inequality. Transitioning toward equitable, low-carbon societies may have multiple benefits for health and wellbeing. Benefits for health and wellbeing can be gained from wide-spread, equitable access to affordable renewable energy; active transport; green buildings and nature-based solutions, such as green and blue urban infrastructure, and by transitioning to a low-carbon, wellbeing-oriented and equity-oriented economy consistent with the aims of the Sustainable Development Goals.[30] Compound weather and climate events refer to a combination of drivers and/or hazards that contributes to societal and environmental risk. This compound events represent a severe threat: Droughts may occur simultaneously with heat waves, which increase the risk of wildfires, which again increase air pollution. The four events all have negative health effects. The compound events must be taken into considerations in future risk assessments.[31]

---

29 Islam, S.N., J. Winkel (2017): Climate Change and Social Inequality, Department of Economic & Social Affairs (DESA) Working Paper No. 152.

30 IPCC (2022): Health, Wellbeing, and the Changing Structure of Communities. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1041–1170.

31 See e.g. Zscheischler, J., et al. (2018): Future climate risk from compound events, Nature Climate Change, 8, 469–477.

Climate change may also have indirect impacts on health if, for example, medical transport services are blocked by disruptions to transport or other critical infrastructure due to extreme weather events. However, climate change is not expected to cause any great changes in *mortality* in Norway.

6.3.3.3 Infrastructure and buildings

Infrastructure is affected by climate, and through direct exposure to the weather, the infrastructure will be exposed to climate change such as increased precipitation, temperature and frequencies of natural hazards. The vulnerability of infrastructures varies, but the need for maintenance will be a major common challenge in connection with climate change.

In snow rich climates, knowledge of the weight from snow on building is very important for the design of buildings. Changes in the snow load due to climate change might lead to adjustments of the national standards on snow load.

At the same time, different types of infrastructure are mutually dependent, further increasing their vulnerability. For example, power supply is essential for the functioning of all the other socially important infrastructures, and a functioning telecommunications network is necessary for a stable power supply. In the event of any disruption in power supply, there is a dependency on the transport system and a functioning telecommunication system to perform efficient repairs and restoration of the supply. This mutual dependency increases vulnerability to climate change, making society even more vulnerable.

Vulnerability to climate change varies between different infrastructure areas. According to NOU 2010: 10 *Adapting to a changing climate*, the power supply has a relatively high adaptive capacity, which counters the fact that the sector is highly exposed to climate change. The overall vulnerability is, therefore, relatively low. Careful spatial planning and sustainable urban drainage systems, where the focus is to manage stormwater locally, as close to the source as possible, remain a key strategy to avoid damage to buildings and infrastructure due to excessive runoff. The adaptive capacity of the water utility sector is, in the opinion of the NOU committee, low, and the vulnerability is correspondingly high. The assessments of the transport sector and buildings provide a more complex picture of adaptive capacity and vulnerability.

A backlog in maintenance is a shared challenge for large portions of the infrastructure and buildings. Climate change will increase the need for water sensitive spatial planning, continuous maintenance and increase the challenges related to the maintenance backlog, which is particularly true for transport, buildings, water supply and urban wastewater services.

Increased precipitation, exposure to moisture and changes in the wind patterns are the key climate variables that determine a building's vulnerability. Moisture problems resulting from more frequent and more intense precipitation will be the greatest threat in a changed climate. The effect of moisture is reinforced by rising sea levels, increased and more intense precipitation and increased floods, landslides and avalanches in a changed climate.

The risk of rot in exterior wood constructions above ground is dependent to a great extent on local climate conditions. More parts of the country will be exposed owing to climate change. Health effects due to moisture and subsequent increased mould growth pose health risks: Moisture and mould in indoor environments increases the risk of worsening and/or development of a number of allergies and respiratory disorders. The health impact appears to be of both allergic and non-allergic nature

Longer periods of drought in the warmer season can lower the infiltration capacity through the soil surface. This will increase runoff when exposed to intense precipitation. Drought conditions will also dry out grasses and trees, which will become more flammable and again be a treat to buildings.

Milder winters can lead to more episodes of freezing and thawing, which again will lower the infiltration capacity due to more ice on the frozen ground.

More extreme events, such as storm surges, landslides, avalanches and floods, will entail a risk to buildings in exposed locations. Some locations that are already exposed may become even more exposed, and new locations may become exposed. Rising sea levels in combination with storm surges will increase the risk of floods in coastal settlements

6.3.3.4 Transport

The challenges related to the maintenance backlog will intensify with climate change. Road and railway transport are exposed to natural hazards. Greater probability of floods, landslides and avalanches entails a traffic safety hazard and may increase the frequency of disruptions. Greater precipitation volumes will result in an increased strain on drainage systems. Rising sea levels and storm surges may create problems linked to wave erosion and overflow, which may result in erosion damage and traffic disruptions. This is especially relevant for sub-sea tunnels. Furthermore, increased amounts of water will expose road fill and bridge foundations to more strain and erosion.

The maritime infrastructure – in the form of waterways, navigation guidance (aids to navigation), harbours and the infrastructure in harbours (quays, etc.) – is vital for sea transport. This infrastructure is exposed to changes in sea levels, increased ocean acidification, storm surge levels and generally harsher weather effects. Climate change will increase the strain and weathering on maritime infrastructure.

All Norwegian airports will be affected to varying degrees and in different ways by climate change. Climate affects both air traffic and the physical infrastructure. Many Norwegian airports are located near the coast on flat or reclaimed land near the sea or open water, making them vulnerable to impacts from higher sea levels, storms and storm surges. In addition, increased humidity and more frequent days with zero crossings (c.f. section 6.2.1.4 *Days with zero crossings*) will cause challenging conditions. Safety zones, lighting facilities and buildings at several airports could be exposed to erosion and will be vulnerable to climate change. Increased precipitation can make draining of runoff water more important and demanding, which will demand more efficient infrastructure. More frequent temperature variations around 0 °C will be an additional challenge in some places with regards to controlling the friction conditions on runways and taxiways. It will also lead to increased use of de-icing fluids.

6.3.3.5 Water and wastewater systems

Without climate change adaptation and proper maintenance, climate change will increase the risk of disruptions in drinking water and urban wastewater treatment services. A disruption in the water supply will quickly affect private households and the business community, and a disruption of wastewater treatment services can have serious consequences for human health and the environment.

Many drinking water and wastewater treatment plants are located near rivers and along the coast. The location could potentially cause disruption due to risk of floods, flood slides, rising sea levels and storm surges.

Heavy rain can create problems for existing storm water drainage systems and increase the risk of drinking water pipes becoming immersed in contaminated water.

Higher temperatures combined with greater precipitation and runoff intensity may have negative effects on raw water quality. More erosion from the catchment areas may lead to an increased prevalence of infectious matter, environmental toxins, nutrients and organic matter in the raw water.

Fluctuating temperatures above and below 0 °C may cause unstable ground and lead to more disruptions to underground water and wastewater pipes.

6.3.3.6 Urban storm water

In this context, storm water refers to runoff due to precipitation or meltwater in urban areas. Climate projections indicate a higher frequency of more intense precipitation events in Norway and potentially more storm water runoff and consequently more urban flooding. This may cause serious damage to buildings and other infrastructure. NOU 2010: 10 *Adapting to a changing climate* stresses that climate change, with higher total precipitation and more frequent intense precipitation events, will make urban storm water management more imminent. NOU 2015: 16 *Storm water runoff in towns and cities – As problem and a resource* underlines this.

Urban areas contain a high proportion of impermeable surfaces, such as car parks, roads, yards and pavements, which prevent storm water from infiltrating naturally into the ground. Urban storm water has traditionally been channelled through dual wastewater treatment systems or in separate storm water drains that may discharge directly into nearby river systems. Today storm water management also involves other measures such as green infrastructure.

Failure to manage storm water properly is already resulting in several incidents of damage. During intense rainfall, the volume of storm water entering the sewer system may exceed the system's capacity, leading to mixed sewage and stormwater overflows. The overflows consist of untreated wastewater and discharge directly to the sea or a water course. The discharges can contaminate beaches and drinking water and pose a risk to public health and the environment. Excessive volumes of storm water can also flood buildings, cause damage to infrastructure and contaminate drinking water, resulting in substantial costs and possibly threatening life and health.

6.3.3.7 Power supply

Norway's power supply is primarily based on renewable energy, dominated by hydropower, making it directly impacted by climate change. Climate change will lead to increased precipitation but also increased evapotranspiration due to increased temperatures. Even if the magnitude of the increase is very uncertain, the hydropower production potential is expected to increase.

River flow is expected to increase more in winter and could be reduced in summer because of earlier snowmelt and increased evapotranspiration. A detailed study of climate change effects on the hydropower system in the Glomma river basin indicates increased hydropower generation capacity in the autumn and winter.[32] In rivers with glacier runoff, the hydropower production potential in summer is expected to increase towards the middle of the century and decrease again towards

[32] NVE (2017): Klimaendringer i Glommavassdraget – Påvirkning på kraftverk og produksjonssystemet [C.S. Beisland, V.J. Koestler, B. Longva, E.V. Øyslebø], the Norwegian Water Resources and Energy Directorate (NVE) report no. 29-2017.

2100. The runoff river hydropower plants will benefit the most from the river flow becoming more evenly distributed over the year. Still, some years will have more drought. This will result in lower production of electricity.

The power supply system is designed to withstand climate and natural disasters. However, hydropower structures may be challenged in case of extreme floods. Floods are expected to increase in most parts of Norway, causing possible extra strain on many hydropower dams.[33] the Norwegian Water Resources and Energy Directorate (NVE) has made a vulnerability assessment of the exposed dams, showing that 45 per cent of the dams in the highest consequence classes (2, 3 and 4) may be vulnerable to increased floods in the future.[34] NVE recommends that all dam owners take account of future increased floods when planning new or upgrading existing dams. NVE has done a portfolio risk assessment to be able to follow up the safety of the dams with the highest risk. Weather conditions are a major cause of the faults and disruptions that occur in the distribution system, including regional and national grids, e.g. caused by trees falling over and cutting the power lines. Expected increases in extreme weather events will increase the risk of damage at various types of power supply infrastructure unless appropriate climate change adaptation measures are implemented.

6.3.3.8 Cultural heritage

Rising sea levels, increased storm surges and increased coastal erosion are a threat to coastal settlement and cultural heritage objects in vulnerable areas. More precipitation and increased moisture will lead to more rot and fungal growth in historic buildings. All building materials are exposed to degradation over time, and climate conditions are crucial to how fast this will take place. Most materials break down faster in a warmer and more humid climate.

In addition to the gradual changes that take place over a long period of time, climate change will cause more extremes, more storm water, landslides, erosion and more floods that can cause acute damage to historical buildings and other cultural monuments.

The growth season for plants and trees is extended when the climate gets warmer and wetter, creating greater challenges for owners and managers of cultural monuments and landscapes.

6.3.4 Businesses and other industries

6.3.4.1 Introduction

Climate change in Norway will have a direct impact on industries that base their activities on natural resources, such as agriculture, forestry, reindeer husbandry, fishing and aquaculture. Other businesses and industries may be indirectly affected by vulnerabilities in other sectors, such as interrupted power supply or through value chains that stretch both nationally and internationally.[35] Utilising the opportunities that may emerge will also require adaptive measures to enable these opportunities to be realised.

[33] NVE (2016): Klimaendring og framtidige flommer i Norge [D. Lawrence], the Norwegian Water Resources and Energy Directorate (NVE) report no. 81-2016.

[34] NVE (2016): Klimaendringer og damsikkerhet – Analyse av dammers sårbarhet for økte flommer 2021 [G.H. Midttømme, L.A.H. Haugsrud], the Norwegian Water Resources and Energy Directorate (NVE) report no. 17-2021.

[35] See EY (2018): Utredning om konsekvenser av klimaendringer for Norge av klimaendringer i andre land [N. Prytz, F.S. Nordbø, J.D.R. Higham, H. Thornam], EY Rapport, 100 s. Executive summary in English: Consequences for Norway of transnational climate impacts and Nibio, Vista Analyse, Ruralis. 2022. Klimaendring utfordrer det norske matsystemet. English title: Climate change challenges the norwegian food system.

6.3.4.2 Agriculture, forestry and reindeer husbandry

In areas where lower summer precipitation does not produce a soil moisture deficit, the combination of a longer growing season and higher CO_2 content in the air will allow the forest to grow more quickly. In addition, the productive forests will expand both to higher altitudes and northwards throughout the country. There will be significant regional differences, with forests in Southern and Eastern Norway potentially facing drought stress and, during a transition period, it appears that the growing season in the interior of Finnmark and Troms County may become somewhat shorter.

The largest threat to the continued health and vitality of Norwegian forests will be increasing attacks by native pests, as well as non-native organisms that may be able to establish viable populations in Norway as a result of climate change.

Without ground frost for much of the year and with less snow cover, operating conditions will become more difficult using existing technology. Forest roads could be exposed to erosion and landslides due to surface water, clogged gutters and the water taking new paths.

The main pattern in climate projections for Norwegian agriculture is higher temperatures and precipitation. Increases in rainfall may cause problems to field operations, like thinning and harvesting. Increase in evapotranspiration as a result of higher summer temperatures may, however, also cause drought in certain periods. In addition to such changes in abiotic factors, new pests and diseases may arise that reduce productivity in plant production as well as animal husbandry.

Climate change may also result in more damage caused by freeze–thaw cycles, changes in wind patterns, heightened fire risk due to drought and increased erosion as a result of more precipitation, with a risk of nutrients being washed out of the soil, causing environmental stresses. Climate change also has impact on the conditions for reindeer husbandry.

The impact of climate change on reindeer husbandry is already noticeable, and based on the climate forecasts, it will increase sharply towards 2100 as a result of, for example, rising temperatures, more precipitation and a longer growing season. In recent years, grazing crisis has occurred more often, which not only affects animal welfare but also leads to extra work for the reindeer herder and increased costs associated with additional feeding as a result of locked pastures.

6.3.4.3 Fisheries and aquaculture

The Norwegian fisheries and aquaculture generate significant export revenues, and Norway is one of the world's leading exporters of fish and seafood products. There is uncertainty linked to various aspects of climate change and the potential consequences for the marine environment. The fishing fleet has very high adaptive capacity since the ocean-going fishing fleet has an extensive range. The traditional coastal fleet, on the other hand, may be more exposed to climate change owing to its more limited range or potential change of target species.

Climate change along the Norwegian coastline will reflect the changes that are expected to occur in the open sea. Coastal areas and the continental shelf are important spawning grounds for many fish stocks on which climate change may have an impact. Several of the coastal cod stocks have declined significantly over the past decades. A number of factors are probably involved in this, one of which may be climate change. A plan for rebuilding coastal cod stocks has already been adopted. A combination of higher water temperature, eutrophication and sediment deposition explains the loss of sugar kelp forests (important as a nursery area for coastal cod and other species) from many areas along the Skagerrak coast and the south-western coast of Norway.[36,37]

Climate change will have a number of impacts on wild stocks of anadromous salmonids at different stages of their life cycle. A higher water temperature may result in changes in the numbers and distribution of important prey species for anadromous salmonids in coastal waters and the open sea and of disease organisms and parasites, such as sea lice. On the other hand, higher precipitation will increase water flow in rivers and the freshwater content in the coastal zone. This may improve conditions for juvenile salmonids in rivers and reduce the impacts of salmon lice. It is important to maintain the genetic diversity in the wild salmon populations, among other ways by reducing the genetic interaction between farmed salmon and wild salmon, as this makes the species and the various populations more robust for changes in the living environment brought about by climate change. Higher precipitation will also result in more runoff from land, which may lead to sediment deposition and pollution and subsequently to more frequent algal blooms, sometimes of toxic algae.

Higher sea temperatures may cause a shift in the distribution of marine organisms, with populations making a general migration northwards. The overall productivity of the boreal species of fish is expected to increase in the northernmost fishing areas, while the productivity of the Arctic species is expected to decline in the same areas.

Overall, climate change over the remainder of the 21st century may increase fish resources in Norwegian waters. There are, however, two factors that may counteract these predictions. One of them is associated with natural climate variability, which may dominate over anthropogenic climate change and result in a somewhat colder marine climate. The other major uncertainty factor is ocean acidification, a process taking place simultaneously with, and to some extent independently of, climate change. Acidification creates a more hostile environment for calcifying organisms.

Temperature is of vital importance to the aquaculture industry, as it affects factors such as growth rates, algal blooming and disease. In the long term, an increase in sea temperature, therefore, has the potential to result in significant structural changes in terms of the species farmed, the best production areas and siting structure, as well as the occurrence of diseases. Emerging technologies open up for more offshore aquaculture.

The nature of the risk from marine infectious agents (pathogens) will change. The extent to which this will lead to larger problems, as opposed to different problems, remains unclear.

6.3.4.4 Petroleum production

Oil and gas production on the Norwegian continental shelf is significantly affected by the weather and offshore conditions. The technologies used in Norway for both production and support functions are, therefore, designed to withstand significant weather-related impact. Norwegian oil and gas activities are expected to have a continuous natural decline after 2030.

6.3.4.5 Climate risk and the Norwegian economy

NOU 2018: 17 *Climate risk and the Norwegian economy* states that Norway is a market economy with a large public sector and that the interrelationship between the public and the private sector implies that there is no sharp distinction between climate risk in the two sectors. The commission points to

[36] Filbee-Dexter, K., et al. (2020): Marine heatwaves and the collapse of marginal North Atlantic kelp forests, Scientific Reports, 10, 13388.

[37] NIVA (2020): Increased light attenuation in Norwegian coastal waters – A literature review, the Norwegian Institute for Water Research (NIVA), Report sno. 7551-2020.

several factors related to the climate risk that can affect the Norwegian economy, among others, that global factors are important to Norway and that climate change will curb worldwide economic growth. Further, the commission consider it likely that moderate climate change will have more of an impact on the composition of Norwegian production than on its level.

6.3.4.6 Insurance

More frequent weather-related and natural damage will both change the risk pattern and stimulate demand for insurance. Climate change will result in a greater need for various insurance policies, among other things, related to health, primary industries, buildings and equipment.

6.4 Adaptation measures

6.4.1 Domestic adaptation policies and strategies

In 2007, an inter-ministerial working group was appointed to promote coordination and dialogue in the national climate adaptation work. The working group was supported by a programme-secretariat that was established in DSB. A committee consisting of experts from government agencies, research institutes and civil society published an NOU on Norway's vulnerability and adaptive needs in 2010.[38] The objective of the report was to facilitate sustainable development through increased knowledge of the significance of climate change for Norway and to provide advice regarding how the authorities and other parties best can proceed to prevent negative impacts from these changes on people, society and the environment.

The Ministry of Climate and Environment has the overall responsibility for the Norwegian climate policy, including climate change adaptation.

The Norwegian Environment Agency supports the Ministry of Climate and Environment in its work on climate change adaptation as the coordinating agency. The agency assists the ministry in following up the white paper Meld. St. 33 (2012–2013) *Climate change adaptation in Norway* and in policy-making on climate change adaptation.

6.4.1.1 The national climate change adaptation strategy

Following the NOU, the Norwegian Parliament adopted the first white paper on climate change adaptation in 2013 (Meld. St 33 (2012–2013) *Climate change adaptation in Norway*), outlining national policies and guidance for adaptation in Norway. The paper provides an overview of the implications of climate change for Norway and sets out a framework to facilitate the development of adaptation strategies and identification of effective adaptation measures across sectors and administrative levels. The white paper upholds that everyone – individuals, business and industry and the authorities – is responsible for assessing and addressing the impacts of climate change on their areas of competence. This means that government agencies and local and regional authorities carry a responsibility for climate change adaptation within their field.

Several actions, measures and principles are presented in the white paper, among other things, that the knowledge for climate change adaptation will be strengthened through closer monitoring of climate change, continued expansion of climate change research and the development of a national centre for climate services.

Further, that knowledge about impacts and consequences of climate change, and adaptation needs

[38] Ministry of Climate and Environment (2010): NOU 2010: 10 Adapting to a changing climate: Norway's vulnerability and the need to adapt to the impacts of climate change.

in Norway will be updated regularly. Updates will be considered when substantial new knowledge is available, particularly related to the assessment reports of the Intergovernmental Panel on Climate Change (IPCC).

It is also stated in the white paper, that as a precautionary approach, assessments of impacts of climate change should be based on figures from the high end of the range of national climate projections. However, when decisions are made in individual cases, climate change considerations and underlying assumptions about the degree of climate change must be weighed against other considerations of the public interest, the lifetime of the development in question and its importance to society.

Moreover, the white paper emphasises the role of the municipalities related to climate change. pointing to the local character of climate change impacts, that puts the municipalities in the front line in dealing with climate change. As a follow-up of actions identified in the strategy, a committee has evaluated legislation related to stormwater, and central government planning guidelines on climate change adaptation came into force in 2018.

The action-points in the strategy has been followed up over the past ten years, and the government has started developing a new strategy for climate change adaptation.

6.4.1.2 Climate change adaptation in other policy documents

In accordance with the principle of responsibility, the issue of climate change adaptation is addressed in several sectoral policy documents published recently. Among these are:

- the Norwegian Official Report NOU (2015: 16) *Overvann i byer og tettsteder — Som problem og ressurs* (translates to "Storm water runoff in towns and cities — As problem and a resource", albeit in Norwegian only);
- the Norwegian Official Report NOU (2022: 3) *På trygg grunn* (translates to "On safe ground", albeit in Norwegian only);
- the white paper Meld. St. 15 (2011–2012) *Hvordan leve med farene, om flom og skred* (translates to "How to live with the hazards – floods and landslides", albeit in Norwegian only);
- the white paper Meld. St. 14 (2015–2016) *Nature for life – Norway's national biodiversity action plan*;
- the white paper Meld. St. 18 (2015–2016) *Friluftsliv – natur som kilde til helse og livskvalitet* (translates to "Outdoor recreation – nature as a source of improved health and life quality", albeit in Norwegian only);
- the white paper Meld. St. 6 (2016–2017) *Verdier I vekst – konkurransedyktig skog- og trenæring* (translates to "Values in growth – a competitive forestry and timber industry", albeit in Norwegian only);
- the white paper Meld. St. 11 (2016–2017) *Endring og utvikling – en fremtidsrettet jordbruksproduksjon* (translates to "Change and development – a future-oriented agricultural production", albeit in Norwegian only);
- the white paper Meld. St. 32 (2016–2017) *Reindrift. Lang tradisjon, unike muligheter* (translates to "Reindeer husbandry. Old tradition – unique opportunities", albeit in Norwegian only);
- the white paper Meld. St. 33 (2016–2017) *National transport plan 2018–2029* (English summary);
- the white paper Meld. St. 19 (2018–2019) *Gode liv i eit trygt samfunn* (translates to "Good lives in a safe society", albeit in Norwegian only);
- the white paper Meld. St. 5 (2020–2021) *Samfunnssikkerhet i en utrygg verden* (translates to "Civil protection in an insecure world", albeit in Norwegian only);
- the white paper Meld. St. 9 (2020–2021) *Mennesker, muligheter og norske interesser i nord* (translates to "People, opportunities and Norwegian interests in the Arctic", with an abstract available in English);

- the white paper Meld. St. 13 (2020–2021) *Klimaplan for 2021–2030* (translates to "Climate plan for 2021–2030", albeit in Norwegian only);
- the white paper Meld. St. 40 (2020–2021) *Mål med mening — Norges handlingsplan for å nå bærekraftsmålene innen 2030* (translates to: "Goals with a purpose – Norway's action plan to achieving the Sustainable Development Goals", albeit in Norwegian only); and
- the white paper Meld. St. 16 (2021–2022) *Samisk språk, kultur og samfunnsliv* (translates to "Sami language, culture and community life", albeit in Norwegian and Sami only).

Several agencies have prepared strategies and action plans addressing climate change adaptation. See further descriptions of concrete actions under section 6.4.4 *Implementations and actions*.

6.4.1.3 Legislation relevant to climate change adaptation

Climate change adaptation concerns basic social structures, and a number of laws are therefore relevant, including rules on land use planning, contingency legislation, waterway legislation, legislation regulating various types of infrastructure, natural property legislation etc.

Planning is a core tool in the work to meet the challenges related to consequences of climate change. The Planning and Building Act provides the framework for planning in Norway. This framework includes tools and requirements for local, regional and national planning. One such tool is the Central Government Planning Guidelines, which define certain areas of national interest to be implemented in local and regional planning. In 2018, the government adopted new planning guidelines (in Norwegian: "Statlige planretningslinjer for klima- og energiplanlegging og klimatilpasning") to promote climate change adaption in local and regional planning. An online tool to support the implementation of the guidelines has been developed.

Another tool is the national expectations regarding regional and municipal planning, issued every 4th year by the Ministry of Local Government and Regional Development. The Planning and Building Act is based on the principle of sustainable development.

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

Pursuant to the Act of 25 June 2010 No. 45 relating to the Municipal Preparedness Duty, Civil Protection Measures and the Norwegian Civil Defence (Civil Protection Act), municipalities have a duty to identify the adverse events that could occur in their municipality, assess the likelihood of these events occurring and assess how they could affect their municipality. The results of this work must also be assessed and compared in a comprehensive risk and vulnerability analysis. Municipalities must draw up contingency plans based on this analysis, have a municipal crisis team and carry out exercises and other skills enhancing measures to ensure they are able to handle adverse events.

In June 2017, the Norwegian Parliament adopted a Climate Change Act, which establishes by law Norway's emission reduction target for 2030 and 2050. The act will have an overarching function in addition to existing environmental legislation. According to the act, the government shall submit to the Parliament updated information on how Norway prepares for and adapts to climate change.

Within the different sectors, several laws are relevant – though to varying extents – to the climate change adaptation work. Relevant legislation includes, inter alia:

- the act on Health and Social Preparedness;
- the act relating to food production and food services;
- the act relating to municipal health and care services;
- the act relating to ports and navigable waters;
- the act relating to the control of communicable diseases;
- the Aquaculture Act;
- the Forestry Act;
- the Land Act;
- the Marine Resources Act;
- the Natural Damage Insurance Act;
- the Natural Damage Compensation Act;
- the Nature Diversity Act;
- the Pollution Act;
- the Public Health Act;
- the Railway Act;
- the Road Act;
- the Svalbard Environmental Act; and
- the Water Resources Act.

6.4.2 Monitoring, reporting and evaluation

The Norwegian Climate and Environment Ministry is responsible for the overall reporting of the climate change policy in Norway, including reporting on adaptation progress. The national Climate Change Act commits the government to providing annual reports to the parliament on the status regarding adaptation. A national system for monitoring, reporting and evaluation (MRE) for climate change adaptation has not yet been implemented but is under way as a follow-up of Norway's action plan on the sustainability goals: the white paper Meld. St. 40 (2020–2021) *Mål med mening* (translates to "Goals with a purpose", albeit in Norwegian only).

The member states of the United Nations adopted in 2015 the Sendai Framework for Disaster Risk Reduction 2015–2030. According to the framework, climate change adaptation is a central part of United Nations (UN) Member States' commitments to reduce risk and vulnerability. Norway is among the countries that have joined the framework and committed to strengthen resilience for natural hazards and reduce the adverse effects of climate change. A midterm review of the implementation of the Sendai framework will be conducted and reported to UN during the fall of 2022.

6.4.3 Roles and responsibilities

A fundamental principle in Norway's adaptation policy is that the actor responsible for the work also is the actor responsible for the task or function affected by climate change. In consequence, everyone has a responsibility for climate change adaptation: individuals, households, private businesses and the public sector.

6.4.3.1 National level

All government agencies and local and regional authorities carry a responsibility for climate change adaptation within their field. The Norwegian Environment Agency supports the Ministry of Climate and Environment in the work on climate change adaptation and is the coordinating agency. The Environment Agency assists the Ministry in the follow-up of the white paper on climate change adaptation (Meld. St 33 (2012–2013)) and in policymaking. Furthermore, the agency contributes to ensure that the Government's climate change adaptation work is being implemented in the public administration, as well as in society in general. The agency supports the ministry in international climate change adaptation work.

As the coordinating agency for climate change adaptation, the Norwegian Environment Agency works to ensure that actors on local, regional and national level are taking account of and adapting to climate change. As part of the coordination tasks, the agency also gives guidelines and guidance to the county governors in their climate change adaptation work.

The Norwegian Environment Agency works to strengthen climate adaptation efforts in Norway, among other things by increasing the knowledge base for climate adaptation. The agency has a particular responsibility for disseminating and sharing knowledge and experience, contribute to competence and capacity building and facilitate cooperation between different public administration levels, sectors and other stakeholders in the field.

Climate change has implications for natural hazards, and several actors have responsibilities in this regard. DSB supports the Ministry of Justice and Public security in coordinating civil protection and emergency planning efforts in Norway, in order to prevent and limit consequences of natural hazards. The interdisciplinary approach of civil protection ensures that climate change is managed as part of a comprehensive risk approach, emphasizing the interdependencies between different sectors, different types of infrastructures and different levels of planning.

The Ministry of Petroleum and Energy has the responsibility for floods, landslides and avalanches at the national level, with NVE as an executive authority. The directorate is tasked with improving ability to manage flood, landslide and avalanche risk in the Norwegian society. NVE supports the municipalities through mapping programmes, warnings (flood, soil landslides and avalanches), gives advice in the spatial planning processes and offers technical and financial support in the planning and construction of structural protection measures.

A number of other agencies also carry a sector responsibility for climate change adaptation (see further descriptions of actions under 6.5.4 *Implementations and actions*).

6.4.3.2 Regional level

The County Governor work to ensure that decisions of the Norwegian Parliament and Government are implemented correctly and is an important link between municipalities and central government authorities. The County Governor plays an important role in supporting and guiding the municipalities in their adaptation efforts, particularly related to risk and vulnerability analysis and land use planning. The County Governor coordinates the civil protection efforts, both prevention and preparedness, on the regional level. The County Governors have to ensure that climate change has been taken into consideration and followed up, both in planning and risk and vulnerability assessments, and have the authority to make formal objections to decisions made by municipalities in planning and building.

The county municipalities play an important role regarding guidance and coordination in relation to municipal planning, in addition to being the regional planning authority. The county municipalities are responsible for regional development in Norway and plays in this regard a role towards the private sector and their adaptation efforts.

6.4.3.3 Local level

Climate change will affect a number of municipal tasks and areas of responsibility. Therefore, the municipalities are required to apply knowledge about current and future climate change in their planning activities and exercise of authority.

The central government planning guideline outlines expectations to municipal and regional planning regarding climate change adaptation. It stresses the need for coordination and cooperation across sectors and between different governance levels. The purpose of the guideline is to contribute to ensuring that adaptation is taken into account in planning and to ensure that municipalities use a wide range of roles and instruments in their work on climate change adaptation. Climate change considerations are particularly important in long-term planning for the development of municipal services and associated infrastructure.

6.4.4 Implementations and actions

Since Norway's 7th National Communication, important progress has been made in the climate change adaptation work, within and across a range of sectors.

Climate change creates a need for a service that provides information on the current and future climate and play a part in translating climate science into practical adaptation work. NCCS was officially established in 2013, following the white paper on climate change adaptation the same year. Its purpose is to provide a basis for decision-making on climate change adaptation by facilitating climate and hydrological data to users at the national, regional and local levels. The centre consists of the Norwegian Meteorological Institute (MET Norway), NVE, NORCE Norwegian Research Centre (NORCE) and the Bjerknes Centre for Climate Research (BCCR). MET Norway holds the overall responsibility for the centre.

NCCS has published several reports over the last years. In particular, its 2015 synthesis report *Climate in Norway 2100 – a knowledge base for climate adaptation* served the basis for freely available climate and hydrological projections for Norway.[39] Summaries of these projections are available in *Klimaprofilene* (translates to "Climate fact sheets", albeit in Norwegian only) for Norway's 19 previous counties and the main settlement on Svalbard, Longyearbyen.[40] The synthesis report, along with the regional summaries, are currently being updated to account for the latest knowledge in the 6th Assessment Report of IPCC.

The knowledge on climate change impacts and consequences has been developed since the 7th National Communication. In 2019, the existing knowledge on consequences of climate change in Norway was compiled, documenting important developments in since the NOU was published in 2010.[13] In the report *Climate risk in the municipalities,* the Norwegian Environment Agency discusses what kind of climate risk municipalities are exposed to, how the municipalities consider climate risk today, and what tools and methods the municipalities have, to carry out these types of assessments.[41]

A report on transboundary risks points to, among other things, an expected gradual weakening of global productivity, which may cause increased volatility and higher prices on several commodities in the Norwegian market.[42] Such risk is particularly evident within agriculture, a sector that is highly exposed to climate impacts, and Norway is currently importing the majority of its consumption. The report also looks at transboundary risk through trade, agriculture, finance, people, infrastructure and geopolitics. Nordic perspectives on transboundary climate risk have also been gathered and published in a report from 2022.[43] The study was commissioned by the Nordic Council of Ministers.

39 For more information about the report, see section 6.2.1 *Climate change on the Norwegian mainland*.

40 NCCS (2021): Klimaprofiler for fylker – Et kunnskapsgrunnlag for klimatilpasning [H. Hisdal, D.V. Schuler, E.J. Førland, I.B. Nilsen (eds.)], the Norwegian Centre for Climate Services (NCCS) report no. 2/2021.

41 Miljødirektoratet (2021): Klimarisiko i kommunene (translates to «Climate risk in Norwegian municipalities»), M-1959.

42 EY (2018): Utredning om konsekvenser av klimaendringer for Norge av klimaendringer i andre land (executive summary in English: Consequences for Norway of transnational climate impacts) [N. Prytz, F.S. Nordbø, J.D.R. Higham, H. Thornam], EY Rapport, 100 s.

43 Berninger, K., et al. (2022): Nordic Perspectives on Transboundary Climate Risk: Current knowledge and pathways for action.

Box 6.2 Climate risk in value chains: the food system

An analysis of the effect of climate change and related hazards on the Norwegian food system, which includes trans-border and cross-sectoral effects, concludes that the Norwegian food system is a robust system with great ability to adapt to changes both in conditions internationally and in crops nationally. However, we must expect that also the Norwegian food system may be brought to a serious test.

The report describes the primary effects of climate change on terrestrial and marine food production and how the value chains and systems respond to hazards triggered by climate change. Based on the analysis of climate related risks and the robustness of the national food system, methodological issues for climate-related sectoral risk-assessments are discussed.

The analysis was conducted by the Norwegian Institute of Bioeconomy Research (NIBIO), Vista Analyse and Ruralis and was published in 2022.

In 2017, a Commission appointed by Royal Decree was tasked to assess climate-related risk factors and their significance for the Norwegian economy and propose measures for improved management of such risk. Their assessment was published in NOU 2018: 17 *Climate risk and the Norwegian economy*.

The commission recommended a reporting framework for maintaining and accumulating knowledge of climate risk faced by the Norwegian economy, as well as set of general climate risk management principles for both the private and the public sector. The commission further recommended that a proper understanding of climate risk should be better integrated into decision-making processes in both the private and the public sector, with expanded use of scenario analyses as a key measure. They proposed measures to improve the ability of the market to address climate risk, including improved awareness of the link between prevention and the risk of damage.

The commission underlined that there is considerable uncertainty with regards to international developments, and that this means that the range of potential outcomes for the Norwegian economy is very wide. Over the long time-horizon adopted in the report, the risk outlook will be dominated by the indirect physical risk associated with how climate change affects other countries.

Furthermore, in the wake of the white paper on climate change adaptation, the Government appointed a committee to evaluate the current legislation and as appropriate make proposals for amendments to provide a better framework for the municipalities responsible for managing storm water, to deal with the increasing challenges associated with urban floods as a result of climate change. The committee launched their report with proposals for amendments in December 2015 (NOU 2015: 15 *Overvann i byer og tettsteder – som problem og ressurs*; translates to "Storm water runoff in towns and cities – As problem and a resource", albeit in Norwegian only). The official report on urban storm water and proposed and implemented changes in related legislation is further described in the section 6.4.4.5.3. *Urban storm water management.*

In the white paper on climate change adaptation, the need to better integrate adaptation to climate change into the municipal responsibilities in order to enable the municipalities to ensure resilient and sustainable communities also in the future, is emphasised.

Central government planning guidelines on adaptation were developed in 2018, and an online tool describing *how* municipalities and counties can incorporate climate change adaptation work into their planning activities was published in 2019.

In addition, a circular published by the Ministry of Climate and the Environment in 2016 provides guidelines for the use of formal objections in climate and environment related issues (T-2/16 Nasjonale og vesentlige regionale interesser på miljøområdet – klargjøring av miljøforvaltningens innsigelsespraksis; translates to "National and regional environmental interests – clarification of the environmental administration's objection practice", albeit in Norwegian only). The circular includes requirements regarding climate change adaptation.

Even more recent, an analysis of the effect of climate change and climate-related hazards on the Norwegian food system has given new insight into the risks related to and robustness of the national food system (see Box 6.2).[44]

Further, important barriers to adaptation at the local and regional level has been identified and published in a new report[45].

6.4.4.1 Research

The Ministry of Climate and Environment has identified Norway's key knowledge needs related to environment and climate, also addressing specific knowledge needs related to the effects and risk of climate change, as well as climate change adaptation. The Ministry's priorities are presented in the strategy *Klima- og miljødepartementets kunnskapsstrategi 2021–2024* (translates to "The knowledge strategy of the Ministry of Climate and Environment 2021–2024", albeit in Norwegian only). Furthermore, increasing understanding of climate change and laying a foundation for successful climate change adaptation is also highlighted in the white paper Meld. St. 4 (2018–2019) *Long-term plan for research and higher education (2019–2028)*.

The Research Council of Norway supports several research projects related to climate change and adaptation. One of these projects (named *SAfeguard BIodiversity and improve Climate Adaptation in catchment areas under pressure: tools and Solution* and abbreviated SABICAS) is focusing on *solutions for safeguarding biodiversity and improve climate adaptation in catchment areas under pressure*. In 2019, the former large-scale programme for climate research (*KLIMAFORSK*) was integrated into a broader Climate and Polar portfolio, where many of the same goals and objectives have been continued, aiming at providing new, future-oriented knowledge of national and international significance, including enhanced knowledge about how society can and should adapt to climate change. As part of this transformation of the climate research portfolio, the Research Council of Norway initiated an evaluation of *KLIMAFORSK* in 2020. One of the recommendations from this evaluation was to increase the share of research focusing on climate adaptation and interactions between mitigation and adaptation.

One major activity addressing climate change adaptation supported by the Research Council of Norway, is *Klima 2050*. *Klima 2050* is a Centre for Research-based Innovation (in Norwegian: "Senter for forskningsdrevet innovasjon", abbreviated SFI). The SFI status enables long-term research in close

[44] NIBIO, Vista Analyse, Ruralis (2022): Klimaendring utfordrer det norske matsystemet (translates to «Climate change challenges the Norwegian food system») [A. Bardalen, I. Pettersen, S.V. Dombu, O. Rosnes, K. Mittenzwei, A. Skulstad], Norsk Institutt for bioøkonomi (NIBIO) Rapport vol. 8 no. 110.

[45] CICERO (2022): Barrierer for klimatilpasning på lokalt og regionalt nivå (translates to «Barriers for climate change adaptation at the local and regional level») [M. Vindegg, I. Christensen, C. Aall, A. Arnslett, A. Tønnesen, M. Klemetsen, A.K. Temesgen, G.K. Hovelsrud, T. Selseng], CICERO Senter for klimaforskning Report 2022:03.

collaboration with trade and industry, as well as other research partners aiming to strengthen Norway's innovation ability and competitiveness within climate adaptation. *Klima 2050* is addressing societal risks associated with climate change and enhanced precipitation, storm water runoff and water induced landslides within the built environment. *Klima 2050* started in 2015 and will last until 2023. *Climate Futures* is another SFI, launched in 2020 for a duration of 8 years, with the aim of developing climate prediction for handling climate risk. *Climate Futures* focuses on how climate forecasts ranging from 10 days to 10 years into the future can be used within shipping, renewable energy, sustainable food production and resilient societies.

For further information about research related to climate change, see chapter 8 *Research and systematic observation*.

6.4.4.2 Information, capacity building and education

the. The Norwegian Environment Agency regularly organises seminars and webinars on adaptation with other stakeholders. Through webinars, the agency reaches local level practitioners across the country, as well as the County Governor, county municipalities, the national authorities, the private sector and research institutions.

Several pilot projects concerning climate change adaptation and related issues have been conducted over the past years. Results from some of these projects have since been translated into online support tools aimed at the local level.

Furthermore, an introductory course on climate change adaptation was developed by the County Governor of Vestfold, Larvik Municipality and the Norwegian Environment Agency in 2015, aimed at the municipalities. The course has since been rolled out in all counties, i.e. all municipalities have been offered participation.

The web-based information portal *klimatilpasning.no* was established in 2008. The portal supports the Norwegian society in preparing for the consequences of climate change. Local level practitioners being the main target group, the website provides tools and information on climate change adaptation from different sectors. An online tool supports municipalities and county municipalities in adhering to the central government planning guidelines on adaptation. A project archive contributes to sharing knowledge from completed projects that have been supported through the grant scheme administered by the Norwegian Environment Agency. The Norwegian Environment Agency develops and maintains the website on behalf of the sectoral authorities.

In 2018, NVE, DSB, the Norwegian Environment Agency and the Norwegian Association of Local and Regional Authorities (KS) organised a national climate change adaptation conference with over 400 participants from municipalities, national authorities, the private sector and research institutions.

6.4.4.3 Financial support to county councils and municipalities

A grant scheme to support regional and local authorities in their climate change adaptation work was established in 2015 by the Ministry of Climate and Environment and is administered by the Norwegian Environment Agency. Support is given to projects designed to strengthen the knowledge base on which municipalities build their climate change adaptation measures. Between 2015 and 2022, a total of approximately 45 million Norwegian kroner were distributed among about 140 different projects. NVE offers technical and financial support in the planning and construction of structural protection measures.

6.4.4.4 Networks and cooperation

13 urban municipalities are collaborating through *The front runner network*, established in 2015 and coordinated by the Norwegian Environment Agency. The network develops knowledge on climate change adaptation at the local level and shares knowledge and competence among the participating cities through joint projects. The network was evaluated in 2019 after the first strategy period. A second strategy period of five years started in 2020.

An improved cross-sectoral cooperation has been established related to natural hazards, including climate change. *Naturfareforum* (translates to "The Natural Hazards Forum", albeit in Norwegian only) was established in 2016 as a follow-up of the collaboration Research and Development (R&D) program *Naturfare, infrastruktur, flom og skred* (translates to "Natural hazards, infrastructures, floods and landslides" and abbreviated NIFS, albeit in Norwegian only). The aim is to improve cooperation between national, regional and local actors in managing natural hazards, including the impact of climate change. *Naturfareforum* works on identifying gaps and the potential for improvement related to the society's management of risk related to natural hazards, and initiate projects or working groups on cross-sectoral issues. The network is organised with a secretariat consisting of DSB, NVE, the Norwegian Public Roads Administration, and a steering committee where a number of directorates and other national level actors, as well as KS and the Norwegian Environment Agency, are represented.

Naturfareforum acts as the national platform for the global Sendai Framework for Disaster Risk Reduction. As part of the work on the *Knowledge Bank*, a platform for collating natural hazard information from all relevant sources a new Section of the Civil Protection Act came into force on 1 May 2021. The legal provision authorises DSB to process confidential personal data on natural and water damage from insurance companies and make them available to municipalities and other relevant public bodies where this is necessary to prevent and reduce the consequences of undesirable incidents. In addition to the public authorities, organisations in both the private and voluntary sector make important contributions to the climate change adaptation work. The Norwegian Association of Local and Regional Authorities support municipalities and county authorities in their work and carry out various capacity building and support activities related to climate change adaptation, including networks.

6.4.4.5 Risk reduction and natural hazard management

6.4.4.5.1 Introduction

Norway is a stable democratic society with low conflict levels and one of the safest countries in the world to live in. However, the country is experiencing serious events that may have disastrous consequences for individuals and major consequences for society. Dangers and threats with severe consequences may originate from a variety of causal factors both nationally and internationally. Some of the most important trends are related to climate change, political, economic, technological and demographic factors. Climate change adaptation is often considered through a sectoral lens. To gain an overall picture of responsibilities for dealing with climate change, it is important to use a different starting point: the types of phenomena and events on which climate change is expected to have an influence. In Norway's case, the main problems are expected to be water-related, in particular flooding, landslides and avalanches, stormwater, sea level rise and storm surges.

Box 6.3 Office of the Auditor General of Norway – an investigation into adaptation efforts

The Office of the Auditor General (OAG) has carried out an investigation into government authorities' effort to adapt infrastructure and built-up areas to a changing climate. OAG has looked at both national and local authorities. OAG's main critique relates to the authorities' lacking overview of where there may be more floods and landslides in the years ahead. The consequences may be that the authorities do not know which buildings must be secured and that new homes are being built in vulnerable areas where there may be an increased risk of floods or landslides. OAG is an audit agency of the Norwegian Parliament. It is the only entity that can provide the Parliament with a comprehensive and independent audit of the Government. The report was published in March 2022.

Box 6.4 Planning and Building Act: Digital risk and vulnerability analysis (DigiRVA)

The Planning and Building Act currently only require that a risk and vulnerability analysis (RVA) should be prepared for development of new areas, with no explicit requirements or guidelines for the use of methods, process or content. DSB has developed guidelines and methodology for RVA analyses in land-use planning but cannot demand municipalities (or consultants) to use these. Thus, such RVA analyses are performed in numerous ways, with varying quality and verifiability.

In NOU 2022: 3 *På trygg grunn* (translates to "On safe ground", albeit in Norwegian only), the development of requirements for RVAs in accordance with the Planning and Building Act has been proposed. This also includes mandatory use of digital tools for this purpose, and DSB is developing a digital RVA solution for this.

6.4.4.5.2 Civil protection and emergency planning

In the white paper Meld. St. 5 (2020–2021) *Samfunnssikkerhet i en usikker verden* (translates to "Social security in an uncertain world", albeit in Norwegian only) climate change is considered one of the major threats for societal safety. Climate change increases the intensity and frequency of extreme weather such as heat waves, torrential rain and strong winds. The distinction between climatic seasons is becoming less clear, for example floods can occur to a greater extent all year round.

There is increasing scientific evidence that as a result of climate change, Norway will experience more and more serious natural disasters in the coming years. Everyone in society have a responsibility for reducing the adverse effects of climate change in accordance with the principles of proximity, similarity, responsibility and collaboration. This requires good arenas for collaboration on challenges and solutions between all actors. Municipalities and County Governors must facilitate such coordination and be driving forces to ensure comprehensive and systematic community safety work regionally and locally.

The white paper states that the Government will actively contribute to the work by the European Union (EU) and UN on societal safety and security and follow up the UN adopted Sendai Framework for Disaster Risk Reduction 2015–2030.

A guideline for Natech incidents has been published. The guideline describes how relevant industry can assess the risk of such incidents. National regulations require enterprises to map natural hazards they may be exposed to, and the subsequent undesirable incidents to which they must establish risk reduction measures

The Norwegian strategy for disaster risk reduction focuses on four priorities for reducing vulnerability and strengthening resilience. These priorities may also represent different stages in planning for disaster risk management (DRM):

- *Knowledge*: Assess risk and vulnerability at national, regional and local level. All relevant sectors and stakeholders should take responsibility for assessing their vulnerability, including both existing and future hazards (changes due to climate change, urbanisation, demographical/social changes, technological/economic development, health etc.).
- *Prevention*: Avoid new risk and vulnerability by ensuring that development does not take place in hazard-prone areas, or by promoting protection measures in cases where such development cannot be avoided. Land-use planning, development of robust infrastructure, ecosystem based DRR, innovative urban design (e.g. creation of 'blue-green' structures), building restrictions, etc., are key instruments to ensure development of resilient local communities.
- *Prevention*: Reduce existing risk and vulnerability through preventive measures in already developed areas, including technical (protective) installations; building enforcement; improvement of infrastructure; sustainable management of agriculture and ecosystems in order to enhance resilience; etc.
- *Preparedness and response*: Manage remaining risks by strengthening disaster preparedness and response at all levels, including monitoring and (early) warning systems; preparedness plans; information to the public; reconstruction programs ("build back better"), etc.

The report *Vital Functions in Society* identifies 14 vital societal functions.[46] The designated vital societal functions are: governance and crisis management; defence; law and order; health and care; emergency services; information and communication technology (ICT) security; nature and the environment; security of food and fuel supply; water and sanitation; financial services; power supply; electronic communication networks and services; transport; and satellite-based services. Climate change will affect most of these vital societal functions. The Government has established a system of status assessments for these functions. Over a four-year period, the ministries will report to Parliament on status for the vital functions for which they are responsible. The status reports will largely be based on a risk and vulnerability assessment. The latest report is from 2016 and it is now being revised.

NMA is finishing work on a digital height and terrain model. The model is largely based on new laser scanning data from survey aircraft and is freely available at the website. This model will help in many aspects of improving understanding of climate change impacts, for example in applications related to flooding, landslides, avalanches, and inundation from storm surges and sea level rise (ref. section 6.4.4.5.5 *Sea level rise*).

6.4.4.5.3 Urban storm water management

Several different authorities are involved in developing a local framework for stormwater management in urban areas. Examples of the most important legislations are the Planning and Building Act and the Pollution Control Act.

With growing cities and increasing precipitation, Norway has experienced an increase in frequency and cost of water damaged buildings and flooding

[46] DSB (2017): Vital functions in society, the Norwegian Directorate for Civil Protection (DSB) report HR 2371.

events in urban areas due to uncontrolled storm water runoff. Recognizing the need for better storm water management, the Government established a committee in 2014 to assess the legal framework for urban storm water management. The committee published an official report in December 2015 (NOU 2015: 16). The report recommends informative, legal and economic policy instruments that integrates with existing Norwegian legislation and governance. Local, regional and national authorities should be responsible for appropriate management frameworks and overall guidance. The committee suggests that early planning provisions for storm water management should be mandatory for both spatial planning and building authorities. The committee advised that the work of NVE is strengthened and extended with regard to urban hydrology. The committee emphasizes that local measures should be subject to risk and vulnerability assessments, cost-benefit analysis and continuous evaluation. Green infrastructure providing local infiltration, local retention and safe transport to a watercourse should replace costly pipework as a means to reduce storm water damage costs and offer environmental benefits. In this way, the committee saw a potential to find solutions that will, in due time, be paid back by reduced storm water damage costs.

The relevant ministries have welcomed the report and are looking into ways of implementing some of the recommended policy instruments. Based on the recommendations in the report, the Planning and Building Act was amended in 2019 to underline the need to take storm water runoff into account in local planning (Bill Prop. 32 L (2018–2019)). In 2022, the Government presented a bill to the Norwegian Parliament, proposing several revisions to the Planning and Building Act (Prop. 125 L (2021–2022)). The purpose is to strengthen storm water management by stating that property owners will be responsible for handling runoff from their respective premises. Furthermore, property owners are required to participate in establishing local facilities for handling storm water runoff, with emphasis on green infrastructure.

To assist in adapting infrastructure and buildings to a wetter climate, NCCS has defined a climate change allowance for heavy rainfall based on projected precipitation amount for the end of this century (2071–2100) relative to the reference under the assumption of a high emission scenario.[47] Initially, the allowance was formulated as "at least 40 per cent increase", independent of storm duration or return period. Later, this allowance was nuanced, now stating up to 50 per cent increase for durations under 1 hour and return periods exceeding 50 years.

6.4.4.5.4 Floods, landslides and avalanches

NVE is tasked with improving the Norwegian society's ability to manage flood and avalanche risk. This includes both the flood, landslides and avalanche hazards of today and the flood and avalanche hazards of the future, which increasingly are affected by climate change. To accomplish the task, NVE conducts and finances mapping of flood, landslide and avalanche hazard, guides and provides input to land use planning in the municipalities, as well as conducts and finances protective measures. Through this process, areas prone to floods, landslide and avalanches are located. These areas are taken into regard in land-use planning, and if there are infrastructure in prone areas, protective measures are considered.

NCCS has defined a climate change allowance for floods. Three classes are distinguished: 1) no change or an expected decrease in flood hazard (0 per cent); 2) an expected moderate increase in flood hazard (20 per cent); and 3) an expected large increase in flood hazard (40 per cent).[47]

[47] Nilsen, I.B., et al. (2022): From climate model output to actionable climate information in Norway, Frontiers in Climate, 4.

The general awareness regarding climate challenges has increased. The climate change effect on floods[8] is now included as climate change allowances in flood hazard maps. Relevant knowledge has been incorporated in guidelines. For example, how to take climate change into consideration in design flood estimates is included in the Dam Safety Guidelines. Particularly sensitive dams have been identified, and protection against flood and landslide hazards is included in the guideline *Flaum og skredfare i arealplanar* (translates to “Floods and landslides in land use plans”, albeit in Norwegian only). In a newly developed cost-benefit tool to assess and prioritize between protective flood and landslide measures, climate change effects are included.

The observed and – in particular – projected climate development calls for measures to protect against floods, erosion and landslides in small, steep, mass-transporting rivers with a large potential for damage. A particular guideline for floods in small rivers has been issued,[48] as well as guidelines and reports on landslide and avalanche mapping and protection.[49,50,51,52]

NVE, as the national hydrological institution, will continue to monitor the effect of climate change on hydrology. A high level of R&D activity on the effect of climate change on hydrology and natural disasters is ongoing and will be maintained. There is a general need to reduce the uncertainty of climate and hydrological projections and to develop methods to quantify the uncertainty, communicate these results and make decisions under increased uncertainty.

6.4.4.5.5 Sea level rise

NMA is responsible for the operation and maintenance of Norway’s sea level observing system. The system provides data on tides, sea level extremes (storm surges), reference levels for use in planning and observed changes in sea level. This information, as well as sea level projections and guidance on how to use these numbers in planning, are available on the webpage www.kartverket.no/sehavniva. Users can also access this information through an interface that allows them to integrate the data into their own applications.

There is also a webtool for inundation mapping, which shows extreme still water levels and projected sea level[53]. The webtool includes statistics on the areas, roads, and buildings affected now and in the future. All the data and maps are freely available. Nationwide, a total area of 517 km^2, 118 000 buildings and 560 km of roads have been identified as at risk of flooding from a 200-year storm surge event at present. These numbers will increase to 767 km^2, 151 000 buildings and 1454 km with projected sea level rise to 2090 (95th percentile of the high emission scenario RCP8.5, as recommended in spatial planning to account for uncertainties in the sea level projections).[54]

---

48 NVE (2015): Veileder for flomberegninger i små uregulerte felt, the Norwegian Water Resources and Energy Directorate (NVE) Veileder 7-2015.

49 NVE (2011): Plan for skredfarekartlegging – Status og prioriteringer innen oversiktskartlegging og detaljert skredfarekartlegging i NVEs regi [E.K. Øydvin et al.], the Norwegian Water Resources and Energy Directorate (NVE) Rapport 14-2011.

50 NGUet al. (2014): Aktsomhetskart jord- og flomskred: Metodeutvikling og landsdekkende modellering [L. Fischer et al.], Geological Survey of Norway (NGU) rapport nr. 2014.019.

51 NVE (2020): Veileder for utredning av sikkerhet mot skred i bratt terreng, *https://veileder-skredfareutredning-bratt-terreng.nve.no/*.

52 NVE (2019): Sikkerhet mot kvikkleireskred, the Norwegian Water Resources and Energy Directorate (NVE) Veileder 1-2019 .

53 Breili, K. et al. (2020): High-accuracy coastal flood mapping for Norway using lidar data, Natural Hazards and Earth System Sciences, 20, 673–694.

54 Numbers based on data sets downloaded from Geonorge on 25 January 2022. *https://kartkatalog.geonorge.no/metadata/stormflo-og-havnivaa--statistikk-over-beroerte-objekter-og-areal/40fa1b55-ac02-4d61-8446-98f40f9f4a03*.

6.4.4.6 Environment, nature and ecosystems

Through various international agreements, Norway has committed to a number of goals and strategies related to management of the natural environment. At the 13th Conference of the Parties (COP) to the Convention on Biological Diversity in 2016, a decision on biodiversity and climate change was adopted, focusing, among other things, on the need for ensuring the integrity of ecosystems when developing Nationally Determined Contributions (NDCs) under the Paris Agreement, as well as the importance of integrating ecosystem-based approaches (also referred to as nature-based solutions) in adaptation measures. . At the 14th COP in 2018, voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction were adopted by the Parties.

Norway is leading a *program* running in the period 2021–2024 *on nature-based solutions* under the Nordic Council. Its purpose is to encourage the Nordic countries to work together and enhance their knowledge base on nature-based solutions, restoration, climate mitigation and blue/green infrastructure.

The Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) is a regional cooperation for the protection and preservation of the marine environment in the North-East Atlantic. OSPAR aims to prevent and eliminate marine pollution and to achieve sustainable management of the OSPAR maritime area.

Marine fish stocks migrate between the economic zones of different states and some into the high seas as well. Such stocks are managed at international level, e.g. by quota negotiations with other countries and by regional fisheries organisations. The International Council for the Exploration of the Sea (ICES) plays an important role in this regard as the main provider of scientific advice. The white paper on climate change adaptation in Norway, Meld. St. 33 (2012–2013) *Climate change adaptation in Norway*, constitutes the national strategy for adaptation measures, including for the natural environment. The white paper on biodiversity, Meld. St. 14 (2015–2016) *Nature for life*, constitutes Norway's national biodiversity action plan. In both white papers, the Government acknowledges that climate change will alter Norway's natural environment and entail a growing risk of losing characteristic species and habitats. Hence, climate change adaptation must be designed to support the capacity of species and ecosystems to adapt to rising temperatures and avoid any increase in the vulnerability of the environment. The white papers point to the importance of the principles that decisions affecting the environment should be based on scientific knowledge of the impacts of environmental pressures and on assessments of the cumulative environmental effects on ecosystems. These principles are stated in the Norwegian Nature Diversity Act (Act no. 100 of 19 June 2009) and must be followed when making any decisions affecting nature.

A primary objective involves protecting the structure and function of the ecosystems. A major tool for this is ecosystem-based management systems (developed on the basis of the Malawi Principles, laid down in the Convention on Biological Diversity). Integrated marine management plans are in place for all Norwegian marine areas (i.e. the Barents Sea and Lofoten, the Norwegian Sea and the North Sea and Skagerrak) and were revised in 2020. The management plans are based on the ecosystem approach. They are set up to protect environmental services at the same time as they facilitate coexistence and coordination between different commercial activities such as offshore oil and gas extraction, maritime transport, fisheries, and other emerging activities such as offshore renewable energy production. The management plans provide a framework for both existing and future commercial activities, while sustaining the structure, function and productivity of the ecosystems.

The Norwegian Environment Agency has a strategy for its sectoral work on climate adaptation: nature management, outdoor recreation, pollution, climate change mitigation and polar areas, in addition to the agency's work on guiding the county governor and the municipalities in considering the environment in their planning according to the planning and building act. The strategy aims to reduce the negative effects of climate change on nature and the environment. A changing climate will influence the use, distribution, levels and effects of harmful substances. It also affects nature and ecosystems and may influence outdoor recreation, an activity which is very important to many people in Norway. The agency will, therefore, ensure that it has sufficient knowledge of how a changing climate influences its areas of responsibilities. The agency is responsible for an extensive number of monitoring programs, and possible effects of climate changes have been integrated in relevant programs. The agency will also work to ensure that the effect of climate change have been assessed when developing new/revised regulations and that it is included in relevant risk-assessments before permissions to pollute are issued. The Norwegian Environment Agency is currently working on updating its climate change adaptation strategy.

A major contribution to the ecosystem-based management of freshwater is the comprehensive and cross-sectoral planning under the Norwegian Water Regulation, which implements the EU Water Framework Directive in Norway. River basin management plans have been updated for the comping period (2022–2027) for all river basin districts and include monitoring programs and measures to reach the environmental objectives. New national guidance has been implemented on how to integrate climate change and adaptation issues when assessing status, monitoring, pressures, objectives and measures in the river basin management plans, making use of the projections from NCCS.

A national cross-sectoral strategy for restoration of rivers 2021–2030 has also been adopted. Synergies with win-win solutions for water environment and nature-based adaptation are central elements in the work. Restoration of rivers and wetlands that can prevent floods and erosion and reopening urban streams to handle run-off water, are examples of restoration measures important for climate adaptation. Removal of obsolete, man-made barriers to the movement of fish and other aquatic species is an important part of the strategy, permitting these species to adapt by moving to other parts of the watercourses where water quantity, quality and temperature remain suitable.

Wetlands are particularly important with regard to climate mitigation and adaptation. Securing and restoring wetlands are regarded as win-win measures, which reduce climate vulnerability, reduce erosion, store carbon and secure the habitat of many species. A number of wetlands are protected, and since 2016, more than 100 mires have been restored as part of a national plan for restoration of wetlands 2016–2020 and revised for 2021–2025, developed by the Norwegian Environmental Agency and the Norwegian Agriculture Agency. The plan aims to meet the governmental goals connected to both climate change mitigation, biodiversity and climate adaptation.

Securing a representative network of land areas through national parks, nature reserves, etc., is important for plants and animals that need to migrate due to climate change. In the existing work on expansion and adjustment of protected areas in Norway, such considerations are being included. Mountainous and Arctic areas are regarded as particularly vulnerable to climate change, at the same time as many species are moving upwards and northwards towards colder climate. Protection of "cold areas" may therefore make the protected areas more climate robust. In Norway, approximately 34 per cent of the mountain areas is protected.[55]

With regard to the cultural landscapes threatened by climate change due to increased growth and regrowth, a number of national and regional environmental programs and measures, which are aimed at securing cultural landscapes, are in place, among other things, a strategy from 2019 on the use of management measures in protected areas. Considerations of climate adaptation are also compulsory when planning for measures concerning the Norwegian World Heritage Sites.

Many invasive alien species will have improved conditions for survival and reproduction owing to climate change in Norway. The Nature Diversity Act has a separate chapter on the importation and introduction into the environment of invasive alien species. In addition, several regulations are in place, which together provide Norway with a comprehensive and coordinated regulatory framework for better control of the invasive alien species. A cross-sectoral strategy has also been developed by 10 of the Ministries, and an action plan for the period 2020–2025 specifies measures to be carried out by the different sectors and measures that they must cooperate on accomplishing.

Guidance about climate change adaptation and nature management towards local and regional level has been developed during the last years and is collated in the web-portal *miljodirektoratet.no/myndigheter*. Among other things, there is a guide on how to address climate change adaptation related to nature and environment sector in municipal planning activities. Nature-based solutions for climate change adaptation have been getting increasing attention in Norway over a number of years. The Central government planning guidelines on adaptation states that nature-based solutions have to be considered when planning for climate adaptation, and if nature-based solutions are not chosen, it must be explained why. Specific guidance on nature-based solutions has also been developed for areal planning.

6.4.4.7 Human life and health

6.4.4.7.1 Human health

The Norwegian Public Health Act is intended to induce societal changes that promote public health and reduces social inequalities in health. Regional and local authorities shall have an overview of their respective states of public health and the factors that may have an effect on them. Regional and local authorities shall undertake the actions necessary to meet their respective public health challenges. Such action may be undertaken in anticipation of emergencies having public health implications.

The scope of the Norwegian Public Health Act includes the mitigation of likely threats to public health from climatic and environmental conditions, potential floods and the seasonal incidence of high pollen concentration in the air. Pre-emptive action is required to meet health threats from the deficiencies in the maintenance of water works. These actions are to be undertaken in accordance with the Norwegian Planning and Building Act. Other relevant health regulations include regulation concerning water supply (in Norwegian: "Vannressursloven"), water intended for human consumption (in Norwegian: "Drikkevannsforskriften") and environmental health (in Norwegian: "Forskrift om miljørettet helsevern").

[55] Miljødirektoratet (2022): Miljøstatus.no.

To various government institutions, the Norwegian Public Health Act has also assigned certain responsibilities concerning health in general, the level of competence in social medicine in local authorities, emergency preparedness, internal quality assurance, supervision and investigation.

The annual white paper of the Norwegian Ministry of Health and Care Services defines the range and scope of the public health activities at national, regional and local levels. Norwegian Directorate of Health provides detailed guidelines on those activities, as well as on the public health issues related to the environment. In 2019, a survey was undertaken in order to determine the competence of local authorities to manage major accidents and crises.[56]

Norway has committed to building climate resilient and sustainable low carbon health systems through the COP 26 health programme. The programmes' main aims are:

- a national analysis of vulnerability and adaptation needs related to climate change and health;
- climate resilient health systems; and
- building sustainable low carbon health systems.

6.4.4.7.2 Outdoor recreation

The Norwegian authorities have stated a goal that everyone shall have the opportunity to take part in outdoor recreation on a daily basis. A white paper on outdoor recreation, Meld. St. 18 (2015–2016) *Friluftsliv – natur som kilde til helse og livskvalitet* (translates to "Outdoor recreation – nature as a source of improved health and life quality", albeit in Norwegian only), was adopted by the Norwegian Parliament in 2016. The white paper mentions consequences that climate change is expected to have on the conditions for outdoor recreation and the need to take climate change adaptation into account in the management of outdoor recreation areas and trails.

6.4.4.8 Infrastructure and buildings

6.4.4.8.1 Transport

The National Transport Plan is submitted to the Norwegian Parliament in the form of a white paper from the Ministry of Transport and Communication every four years. It sets forth the Government's transport goals and strategies in a long-term perspective. The current National Transport Plan (2022–2033) provides principles for integrating climate change and climate change impacts in planning and prioritization processes. In addition, and in accordance with the requirements of the Ministry of Transportation and Communication, the transport agencies developed strategies for civil security in transport, where adaptation to climate change is an integral part[57].

The transport sector is working on adaptation to climate change by intensifying its work on management of natural hazards. Road and railways were included in the R&D programme NIFS,[58] as well as in the follow-up of the programme *Naturfareforum*.[59]

The Civil Aviation Authority in Norway (CAA-N) has in May 2021 revised its Strategy for Civil Protection to align with the revised Strategy for Civil Protection within the Transport Sector from the Ministry of Transport and Communications. The Strategy states that the CAA-N shall contribute to knowledge on climate change and possible

[56] Helsedirektoratet (2019): Overordnede risiko- og sårbarhetsvurderinger for nasjonal beredskap i helse- og omsorgssektoren.

[57] Norwegian Ministry of Transport and Communication (2015): Strategi for samfunnssikkerhet i samferdselssektoren («Strategy for civil security in the communications sector», albeit in Norwegian only) https://www.regjeringen.no/contentassets/88bc393f2779462a9bc39768735e98fd/statsamfsik2015.pdf

[58] NIFS is further described in section 6.4.4 *Implementations and actions*.

[59] *Naturfareforum* is further described in section 6.4.4 *Implementations and Actions*.

consequences for civil aviation through international participation within the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection and through the national participation within the Directorate Group on Climate Adaptation, chaired by the Norwegian Environment Agency.

The transport agencies Avinor, the Norwegian Public Roads Administration and the Norwegian Railway Directorate services are also partners in *Klima 2050*, a centre for research-based innovation related to climate adaptation.[60]

The railway agency Bane NOR is continuing to develop the system for warning during extreme weather events and flooding, expanding the cooperation with NVE using the national warning system for floods, landslides and avalanches. The Norwegian Public Roads Administration is currently working on a similar system.

Maritime transport
In maritime transport, the Norwegian Coastal Administration (NCA) will carry out risk and vulnerability assessments to adjust infrastructure projects to climate change. NCA has implemented a Climate and Environmental Strategy. In addition to its related action plan, the strategy outlines how the NCA must contribute to meet both national goals and international environmental and climate obligations. In addition, the NCA, alongside other agencies and stakeholders, have an important role in planning. In its participation in planning, the NCA stresses the importance of solid assessments related to climate change and the use of land and waters, especially with regards to consequences for maritime infrastructure.

Road transport
The Norwegian Public Roads Administration (NPRA) has had a major restructuring in 2020, which resulted in divided ownership of the road network between national and county roads. The agency is responsible for updating design manuals (for all roads) to incorporate climate change. NPRA is working on further development of natural hazard plans, on improved warning systems and efficient emergency plans for natural hazards. This is done in collaboration with county road authorities. A web portal (*RESPONS*) for merging mapped vulnerability and information from warning systems is being finalised. The collaboration in the national warning system, *varsom.no*, is an important national basis for managing floods, landslides and avalanches.

Railway transport
Bane NOR decided on a new action plan for civil protection, including adaptation plans for climate change during autumn 2016. Bane NOR is continuously revising handbooks, guidelines and standards for both maintenance and construction of new infrastructure to account for the effects of climate change, based on the recommendations given by national guidelines.

Aviation transport
Twenty years ago, Avinor started work on climate adaption. In 2008–2011, safety areas at the sides and ends of runways at several of Avinor's airports were expanded. Climate change projections were decisive for decisions related to the dimensioning of the projects, ensuring critical infrastructure should be able to withstand future storms and increased precipitation. In 2014, Avinor carried out a risk assessment of all its airports, including connected navigation systems and surface access to the airports. In 2022, this risk assessment was updated as a part of a more strategic approach. This assessment identifies several challenges

[60] *Klima 2050* is further described in section 6.4.4 *Implementations and Actions*.

regarding climate change, such as drainage, wind and flooding issues.

The next step is to implement measures regarding climate change in the early stages of the project plans, such as increased drainage capacity and more durable façade materials, choice of more resistant building materials and resolving drainage issues. It is also important to make the existing infrastructure more durable to the future climate changes, and Avinor now starts working on the reinvestment portfolio regarding these matters. The work with more strategic plans has begun, plans that hopefully will prepare Avinor for the future challenges.

Avinor is one of the partners in *Klima 2050* and also works with climate adaptation through ICAO and the Airport Council International (ACI) and.

Aviation is a very risk averse industry, and safety is of paramount importance. The airspace and runways are under continuous surveillance, so if weather and/or surface measurements indicate it, air traffic can be diverted, and the airports can be closed for shorter or longer periods of time. Hence, climate risk is already one of the risk parameters.

6.4.4.8.2 Power supply

The energy sector must adapt to climate change in order to ensure supply reliability. Several policy instruments are in place. These instruments also take into consideration risks related to anticipated future climate change. NVE follows this up through licensing and inspections. Requirements are also set by NVE to electricity utilities in terms of proper contingency planning, available spare parts, transport and communication systems, training etc., to enable an efficient restoration of electricity supply. Furthermore, NVE conducts research and development in the light of anticipated challenges of the energy sector and climate change by participating in national and international programs and projects.

6.4.4.8.3 Cultural heritage

Owners and managers of cultural monuments and cultural environments are facing greater challenges in the future in terms of preserving the cultural heritage in a changing climate. Well maintained buildings and other cultural heritage objects and environments will become increasingly more important in the future.

Due to an increase in glacier melting, collecting and preserving artefacts melting out of the ice has become an important task for the Directorate for Cultural Heritage and the cultural heritage management agencies in affected counties and municipalities, especially in the mountain regions of Norway. The findings give us new knowledge of the use of the mountains and daily life in earlier times.

Adapt Northern Heritage was a project co-sponsored by the Directorate for Cultural Heritage, in cooperation with the Norwegian Institute for Cultural Heritage (NIKU), Historic Environment Scotland, the Cultural Heritage agency of Iceland and several other associated partners. The project ended in 2020. The main goal was to develop good administration of cultural heritage and cultural environments in a changing climate, to gain experience and knowledge, develop management of all administration levels and to minimize loss of cultural heritage values due to climate change. As a result of this project, new guides on risk and vulnerability analysis and new guides on assessing and planning adaptive measures have been developed. These guides are available for both local municipalities and private entrepreneurs.

The Directorate for Cultural Heritage is currently co-sponsoring a project for further developing risk and vulnerability analysis on cultural heritage and climate change. The aim is to develop better tools for use at the local government level.

In 2017, the Directorate for Cultural Heritage started environmental monitoring programmes (in Norwegian: "Miljøovervåkingsprogram", abbreviated MOV) for measuring the impact of climate change on cultural heritage. There are currently three MOV programs especially monitoring impact of climate change on cultural heritage: MOV Mediaeval Buildings, MOV Bryggen (World Heritage) and MOV Røros (World Heritage)

In cooperation with researchers in Australia and USA, the Directorate for Cultural Heritage are developing a new method, *Climate Vulnerability Index* (CVI), as a tool for mapping climate change challenges in World Heritage Sites.

A new climate strategy was adopted by the Directorate for Cultural Heritage in 2021. The strategy has two main pillars: 1) the contribution by the cultural heritage sectors to mitigate climate change; and 2) adapting cultural heritage to climate change. The directorate has launched the online *Best Practices Collection* and *Bank of Knowledge*, where good examples and the latest research on how to adapt to a changing climate are important elements.

The Directorate for Cultural Heritage continues to prioritize funds for climate shells for valuable churches, and the directorate has for several years had a special focus on securing vulnerable archaeological sites.

6.4.4.8.4 Buildings

Impacts of climate change are of vital importance to requirements of the home and construction sector, and a huge effort has been made to increase the knowledgebase. SINTEF Community, a research institute for the sustainable development of buildings, infrastructure and mobility, has conducted a risk and vulnerability assessment and has proposed measures for reducing climate vulnerability and strengthening the adaptive capacity of this sector.

Owing to the increased exposure to humidity and risk of rot in a changing climate, the Norwegian Institute of Wood Technology and Norwegian Forest and Landscape Institute are conducting research aimed at developing new methods of protecting wood against humidity and rot damage. In addition, the Government in 2012 published the white paper Meld. St. 28 (2011–2012) *Gode bygg for eit betre samfunn* (translates to "Good buildings for a better society"). This white paper highlights the need to address climate change impact in the building and construction sector.

Pursuant to the Planning and Building Act, it is mandatory for planning authorities to ensure that risk and vulnerability analyses are carried out. Climate change adaptation is integrated into the act, along with regulations on technical requirement for constructions works (in Norwegian: "Byggteknisk forskrift", abbreviated TEK17). Technical regulations requires that buildings shall withstand the stresses they are exposed to and – to some extent – may be exposed to in the future. Examples are requirements relating to the siting of buildings, moisture protection, indoor climate, outdoor ground infiltration, surface water runoff, structural safety and the selection of suitable products and materials. The Norwegian Building Authority is working on making the technical regulations even more adapted to future climate conditions.

6.4.4.9 Businesses and industries

Stakeholders in the private sector are responsible for considering climate change in their activities and operations. Businesses based on nature and outdoor activities are particularly relevant, but so too are industries depending on international trade. Several activities have been carried out, and reports on the matter have been published in the last years, giving new insight into adaptation efforts and needs in the private sector.

The report *Consequences for Norway of transnational climate impacts* give an overview of transnational climate impacts, which represent risks and opportunities also for the private sector. Further, OAG, which monitors the public sector, has published an investigation into how a selection of companies located in Svalbard are managing climate change challenges.[61] Significant parts of Norwegian operations on Svalbard are organised through companies that the state owns either directly or indirectly, such as Svalbard Airport AS and Kings Bay AS. Climate change adaptation is included in EU's taxonomy as one of six environmental objectives an economic activity can contribute substantially to. The taxonomy regulation has been implemented in the Norwegian sustainable finance act (in Norwegian: "Lov om offentliggjøring av bærekraftsinformasjon i finanssektoren og et rammeverk for bærekraftige investeringer").

6.4.4.9.1 Agriculture and forestry

Adaptation in the agricultural sector is crucial in order to prevent and limit the damages from extreme weather events and more gradual climate changes. Adaptation is also important for utilisation of the potential productivity benefits of climate change. Agriculture and forestry sectors also manage extensive areas, and proper management of these areas can prevent damage to other sectors and interests.

There is a continuous need to provide knowledge and approaches for the agricultural sector. In later years, responses to climate change have been emphasized in programmes for knowledge development and support/extension services. The European Green Deal and efforts following the Farm to Fork Strategy have aims to encourage more climate resilient production systems.

Since 2013, a climate and environment programme has been in place to improve and disseminate know-how concerning environmental and climate problems and solutions in agriculture. It also comprises climate adaptation. The programme grants financial support to projects improving knowledge, studies and information. In 2021, 28 million NOK was allocated to the programme. Recently, there has been allocated a budget of 10 million NOK for further development of the project *Climate Smart Agriculture*, which involves climate advisory service at the farm level.

Norwegian farmers and the food industry, together with the Government, initiate and fund research on climate change issues and adaptation measures through the Agriculture and Food Industry Research Funds (FFL/JA). Among research projects that are set to finish in 2022–2023, one project has focussed on adaptation of Norwegian seed production for gras and clover to a more unstable climate with increased rainfall, whereas another project has investigated climate-adapted production of Norwegian wheat with good baking quality that can contribute to stability and higher self-sufficiency. Finally, a third research project has looked at adaptation strategies for increased Norwegian grain production in a future climate with more rainfall.

Various instruments and support schemes are in place to improve practices in agriculture and address abiotic and biotic stresses that confronts agriculture and livestock. We can distinguish between supportive systems working at a joint level and grants and regulations operating at farm level.

61 The Office of the Auditor General of Norway (2021): Undersøkelse av svalbardselskapenes håndtering av klimautfordringer (translates to «Investigation of how companies in Svalbard manage challenges related to climate change»), Document 3:2 (2021–2022).

Veterinary services within the livestock sector, as well as sanitary measures and services in the cropping sector, are crucial services to limit biotic stresses. Furthermore, continuous use, development and conservation of animal and plant varieties is crucial to provide adequate varieties for future production.

Genetic diversity and plant breeding are important in handling climate change. Economic support is given to increase the conservation and use of the genetic resources in plants, animals and forestry. In Norway, commercial agriculture is performed even far north. The short growing season with low temperatures, great variation in daylight and challenging winters give few comparable nations with similar growth conditions. Grants are given for plant breeding and seed production to ensure production of plant varieties suitable to the Nordic climate.

To limit future reductions in harvest quantity and quality, the existing warning service for pest infestations could be enhanced. This service estimates and communicates the risk of attacks by plant diseases, insects and weeds for important crops in agriculture and horticulture. This is a useful tool for planning measures for crop protection.

At a practical level, there is a combination of regulation and support schemes to provide for adaptation and preparedness to climate change. Fundamentally, there are instruments to maintain the use of agricultural lands and pasture resources, which safeguards them for future use.

Climate changes will affect the production and demand of agricultural commodities on a global scale. This may affect Norway's ability to import food, which means that an important measure to adapt to climate change is to ensure Norway's self-sufficiency. Food security has long been one of four overall goals for the Norwegian agricultural policy. This was continued with the white paper Meld. St. 11 (2016–2017) *Endring og utvikling — En fremtidsrettet jordbruksproduksjon* (translates to "Change and development — Future-oriented agricultural production", albeit in Norwegian only) from the Ministry of Agriculture and Food. The white paper also states a goal of increased production on Norwegian resources.

Food security and increased production on Norwegian resources depends on protection of soil resources. Norway has very little farmland compared to other countries. Only 3 per cent of the land is cultivated soil, one third of which can be used for the production of food grains.

In 2021, about 730 acres of cultivated land was decided used for other purposes than agriculture. In 2015, the Norwegian parliament adopted the Government's strategy for protection of soil resources, stating that no more than 988 acres (4000 dekar) of land/year should be used for other purposes than agriculture. The strategy promotes several measures to reach this goal within 2020. In 2021, the goal was set to 741 acres (3000 dekar).

Surplus rainfall and flooding impose challenges to harvests and field operations in agriculture. There is a support scheme to support investments in drainage systems for agricultural lands. Various support schemes are also in place to limit losses of soil and nutrients from agricultural land through the use of tillage practices, cover crops and other measures that limit exposure of soils over the winter period.

Adaptation is being assessed in the revised regulations for planning and construction of agricultural and forestry roads and in *Standards for agricultural and forestry roads* (both 2015), and a guidance, *Forestry roads and risk of landslides*, has been produced (2011). The guidance deals with the risk of landslides when building forestry roads in steep terrain and how to reduce such risks by correct construction of road and drainage systems. A circular about the regulations is under preparation by the Ministry for Agriculture and Food.

Climate change will have an impact on biological production systems and makes forestry and agriculture vulnerable to both gradual changes in the climate system and to extreme weather events. R&D projects, monitoring programs, international cooperation and dissemination will show how production in agriculture and forestry in Norway will be affected by climate change and how different production methods in different regions of the country can adapt.

Due to changes in the climate, production output in the Norwegian reindeer husbandry may be reduced. As a short-term solution to mitigate the effects of a changing climate, the number of reindeer herders utilizing trucks to transport reindeer between seasonal pastures has increased along with the number of herders practicing supplementary feeding.

6.4.4.9.2 Fisheries and aquaculture

A comprehensive effort aims to produce more knowledge about the role of the oceans in the climate system and consequences of climate change for marine ecosystems and resources.

The Ministry for Fisheries and Coastal Affairs has elaborated a climate strategy from 2013. The goal of the strategy is to maximise the ability of the coastal and fisheries administration to meet the challenges of climate change and to promote reduction of emissions of greenhouse gases from the sector.

Norway has a well-developed fisheries and aquaculture management system. Environmental conditions in the marine environment have always varied, and climate change is one of several causes for variability. It is the nature of the management system to be adaptive and deal with such changes no matter what causes them. Substantial changes in the organisation of the management system or its major decision-making processes are thus not foreseen.

6.4.4.9.3 Insurance and public compensation schemes

Two insurance/compensation schemes cover damages caused by natural accidents: 1) the compulsory private natural damage insurance and 2) the public *Natural Damage Compensation Scheme*. They both reduce the economic risk borne by companies and private households and strengthen society's resilience against natural hazards.

According to the Norwegian Natural Damage Insurance Act, all objects insured against fire risks (mainly buildings with contents) are as a main rule also insured against natural damage. All insurers providing fire cover in Norway must be members of the Norwegian Natural Perils Pool.

The public *Natural Damage Compensation Scheme* provides compensation for the rebuilding of damaged objects and infrastructure that cannot be insured against fire risks. The compensation scheme only applies to privately owned property. As a main rule, compensation is only paid when the applicant is rebuilding the damaged object. When compensation for rebuilding is granted, the applicant can also apply for a grant to "build better", limited to 20 per cent of the grant for rebuilding and a maximum of NOK 30.000. This grant is a subsidy subject to individual assessment in each case.

Both in the compulsory natural damage insurance scheme and the public natural compensation scheme the compensation may be reduced, or refused entirely, when the damage or the extent of the damage is entirely or partly caused by weak construction, or poor maintenance or supervision, or when the injured party can be blamed for not preventing the damage or its extent. If a building has been raised despite a ban on building due to risk of natural damage, compensation from the insurance will not be given.

6.5 The Norwegian Arctic

6.5.1 Introduction

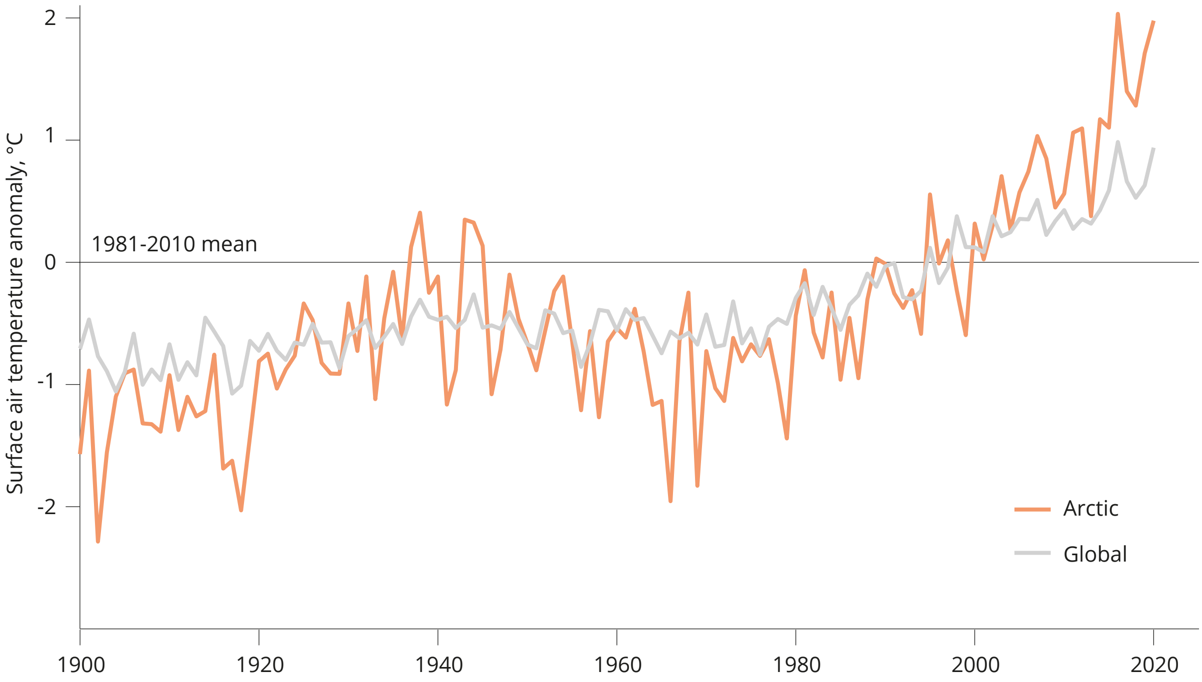
This chapter presents specific challenges to the Arctic region that have not been covered in the previous chapters. The Norwegian Arctic is here defined as the Arctic waters under Norway's jurisdiction in the Barents and Norwegian seas, as well as the Svalbard archipelago and the island of Jan Mayen. Areas with sub-arctic climate in northern parts of mainland Norway is described together with the rest of mainland Norway.

According to the Arctic Monitoring and Assessment Programme (AMAP),[62] the physical drivers of Arctic change continue to change rapidly. Key indicators, such as temperature, precipitation, snow cover, sea ice thickness and extent, as well as permafrost, show rapid and widespread changes under way in the Arctic. An important update is that the increase in Arctic annual mean surface temperature (land and ocean) between 1971 and 2019 was three times higher than the increase in the global average during the same period. This is higher than reported in previous AMAP assessments

AMAP also documents that the Arctic is experiencing an increase in extreme events.[62] New findings include recent increases in the frequency and/or intensity of rapid sea ice loss events in the Arctic Ocean, melt events on the Greenland Ice Sheet and increased boreal forest and tundra wildfires. There has been an increase in extreme high temperatures and a decline in extreme cold events. Cold spells lasting more than 15 days have almost completely disappeared from the Arctic since 2000.

[62] AMAP (2021): Arctic Climate Change Update 2021: Key Trends and Impacts. Summary for Policy-makers, Arctic Monitoring and Assessment Programme (AMAP), Tromsø, Norway, 16 pp.

Figure 6.7 Trends in average (blue line) global and (red line) Arctic surface air temperature (SAT) for the period 1900–2021 relative to the 1981–2010 mean.



6.5.2 Climate change in the Norwegian Arctic

In 2019, NCCS published a report describing projections of climate change in the Svalbard area from a recent time period (1971–2000) and up to two scenario periods (2031–2060 and 2071–2100)[63]. Similar to the report for the Norwegian mainland four years earlier[4], the Svalbard report provided results for three emission scenarios RCP2.6 (low emissions), RCP4.5 (intermediate emissions) and RCP8.5 (high emissions).

Of the three scenarios, the text describes the resulting climate changes following RCP8.5, in line with the national guidelines that assessment of climate change impact is to be based on a precautionary approach. However, if future global greenhouse gas emissions are reduced significantly (e.g. following RCP2.6) projections show that the expected changes in climate parameters will be significantly smaller.

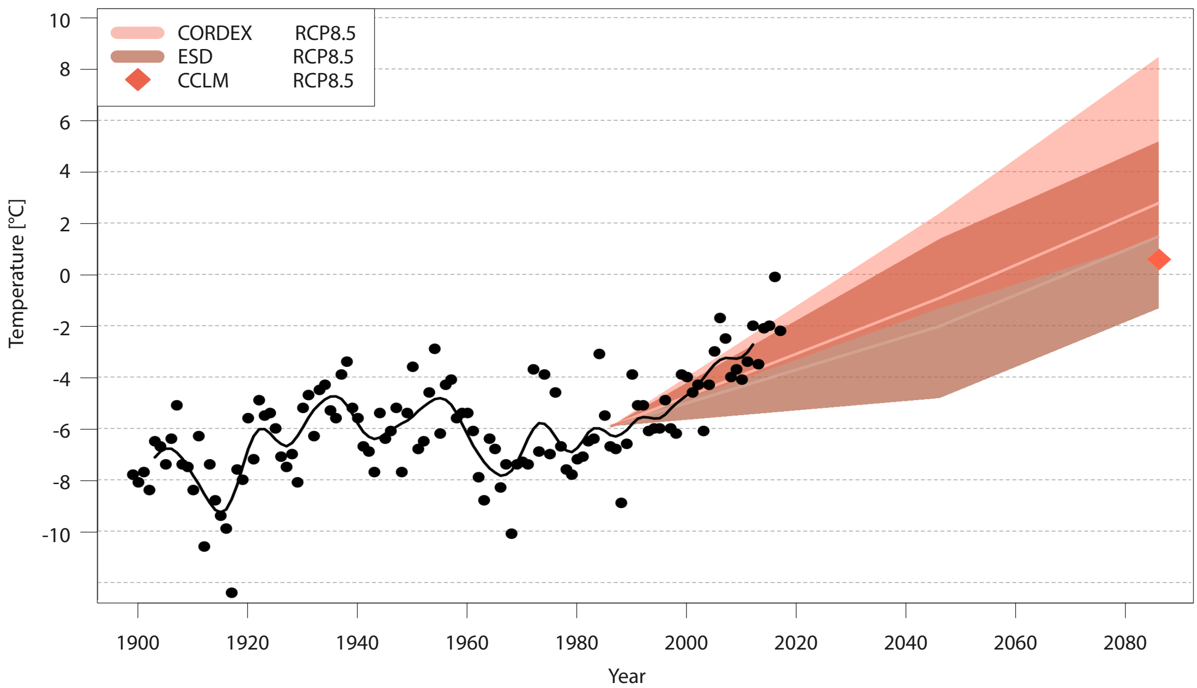
6.5.2.1 Air and sea temperature

Svalbard is presently amongst the areas around the world with fastest warming (Figure 6.8). By the end of the century (2071–2100), the warming is projected to reach 9.8 °C relative to the reference period (1971–2000).[65] This is more than a doubling of the corresponding projected warming for mainland Norway (4.5 °C).[4] The projected warming in winter exceeds that of the other seasons. This is as expected from Arctic amplification.[64]

[63] NCCS (2019): Climate in Svalbard 2100 – a knowledge base for climate adaptation [I.Hanssen-Bauer, E.J.Førland, H.Hisdal, S.Mayer, A.B.Sandø, A.Sorteberg (eds.)], the Norwegian Centre for Climate Services (NCCS) report no. 1/2019.

[64] Nilsen, I.B., et al. (2022): From climate model output to actionable climate information in Norway, Frontiers in Climate, 4.

Figure 6.8 Annual mean temperature for Svalbard Airport near Longyearbyen (in °C).

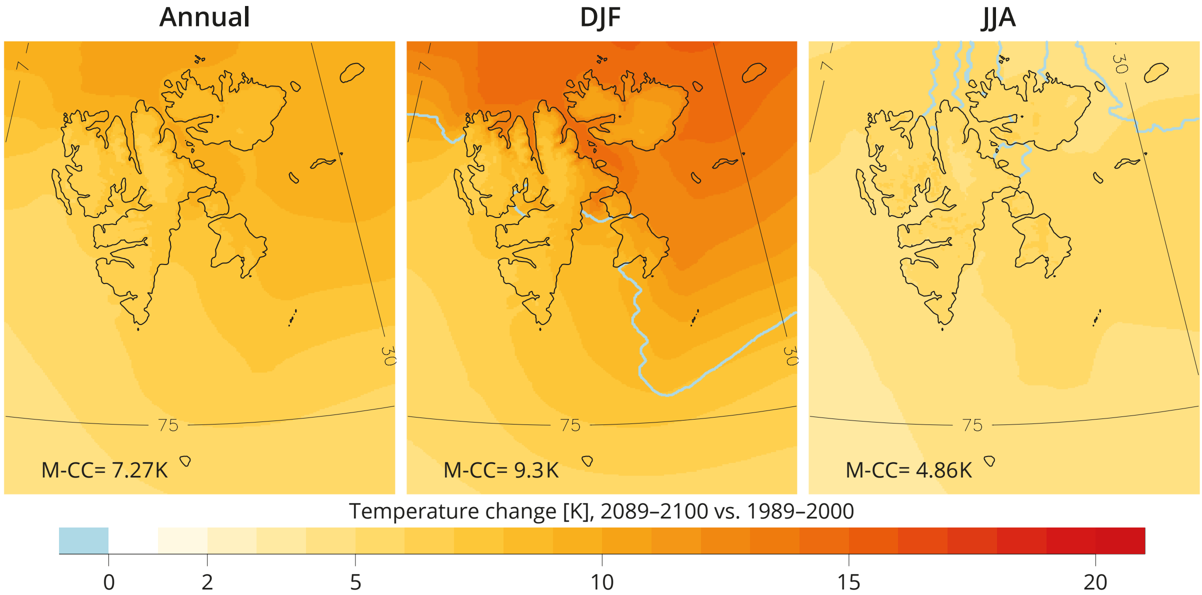


The points and black curve show single years and smoothed decadal variability based on observations from 1900 to 2017, respectively. Future projections are based on (orange spread) Coordinated Regional Climate Downscaling Experiment (CORDEX), (brown spread) empirical-statistical downscaling (ESD) and (red diamond) COSMO-CLM (CCLM) simulations following the high emission scenario RCP8.5.

A recent publication documents that the regional differences on Svalbard are large.[65] Over the last 20 years, the temperature increase was 5.4 °C in the north-western parts of the Svalbard archipelago. In comparison, the increase was 2.9 °C in Longyearbyen.

[65] Isaksen, K., et al. (2022): *Exceptional warming over the Barents area, Scientific Reports, 12, 9371*.

Figure 6.9 Projected temperature change for the year, winter (DJF) and summer (JJA) from 1989–2000 to 2089–2100 based on the RCP8.5 scenario.



Average sea ice border (80 per cent ice concentration) for the period 1989–2000 is shown as a light blue line for the two seasonal maps. For the scenario period, the ice border is north of Svalbard.

Figure 6.9 illustrates results from simulations with a regional climate model, providing realistic present-day temperatures for the Svalbard area. The results are based on rather short present and future time periods (12 years) but illustrate the stronger warming during winter than summer and that the warming is stronger in the north-eastern parts (Nordaustlandet and the Barents Sea) than at the south-western coast of Spitsbergen. The strongest warming is found in areas where sea ice is replaced by open water.

6.5.2.2 Precipitation

In Svalbard, the relative increase in annual precipitation is projected to be larger than that for mainland Norway, i.e. approximately a 65 per cent increase.[65] However, the absolute values of precipitation today are low (approximately 400 mm/year at Ny-Ålesund).

6.5.2.3 Permafrost

Permafrost thawing may contribute to triggering rockslides.[65] However, there is no scientific evidence that indicates that climate change will increase the frequency or magnitude of large rockslides.

In addition to the above-mentioned processes, Svalbard will also experience changes related to thawing of near-surface permafrost in coastal and low-altitude areas and an increase in erosion and sediment transport.

6.5.2.4 Sea level rise

Along the coast of Svalbard, the relative sea level is projected to fall because of continued loss of local ice masses.[65] Storm surges are not expected to become worse because of sea level rise. However, thawing of permafrost makes coastal erosion a larger challenge.

6.5.2.5 Snow and glaciers

The snow season is expected to become shorter at Svalbard.[65] A one-month shift has been modelled in the maximum snow storage, shifting the timing of the deepest snow from June (in 1971–2000) to May (in 1971–2000) or even earlier in the southernmost parts. The high emission scenario RCP8.5 projects a reduction in the maximum snow storage across the archipelago, whereas the intermediate emission scenario RCP4.5 poses a less dramatic picture and even an increase in snow amount at the highest elevations.

Almost 60 per cent of the land area of Svalbard is covered by glaciers, and the glacier area is projected to reduce substantially towards 2100.

6.5.2.6 Runoff

For Svalbard as a whole, runoff is expected to increase gradually. In summer, this increase is attributed to glacier melt, and in the other seasons, it is attributed to an increase in precipitation, as well as more precipitation falling as rain rather than snow.

Although the exact magnitude of runoff changes remains uncertain due to methodological issues (the projected contribution of glacier melt is likely too high), the direction of change remains unambiguous.[65]

6.5.2.7 Floods

Flood estimates at Svalbard are highly uncertain due data sampling issues, including that there are just a few operative runoff stations, and that the measuring device is encapsulated in ice during most of the period from October to June.[65] In general, however, flood magnitudes are expected to increase as a response to increasing glacial melt, snowmelt and rainfall.

6.5.3 Vulnerability to climate change and expected impacts on biodiversity and natural ecosystems

AMAP documents that the rapidly changing cryosphere is affecting ecosystems throughout the Arctic, changing the productivity, seasonality, distribution and interactions of species in terrestrial, coastal and marine ecosystems. Changes in sea ice type, extent and seasonality, and in snow cover on land and sea ice, along with the rapid loss of perennial ice and the Greenland Ice Sheet, are causing fundamental changes in ecosystems that affect the cycling of carbon and greenhouse gases. Unique ecosystems, such as those associated with multi-year sea ice or millennia-old ice shelves, are at risk, and some are vanishing.

The comprehensive Arctic Biodiversity Assessment (ABA) from the Conservation of Arctic Flora and Fauna (CAFF) concludes that "climate change is by far the most serious threat to Arctic biodiversity and exacerbates all other threats". CAFF also published the report *State of the Arctic Marine Biodiversity* Report in 2017, which builds on the ABA, and compiles available knowledge and monitoring data on a specific set of marine ecosystem components. The report gives an overview of detectable changes in biodiversity in marine areas in different Arctic regions, including northern parts of the Norwegian Sea and the Barents Sea.

In 2021, CAFF published the state of the Arctic terrestrial biodiversity report.[66] The assessment report documents that climate change is the overwhelming driver of change in terrestrial Arctic ecosystems, causing diverse, unpredictable, and significant impacts that are expected to intensify. Species from southern ecosystems are moving into the Arctic and are expected to push Arctic

[66] CAFF (2021): State of the Arctic Terrestrial Biodiversity: Key Findings and Advice for Monitoring. Conservation of Arctic Flora and Fauna (CAFF) International Secretariat, Akureyri, Iceland.

species northwards, create an "Arctic squeeze", and change species' interactions. A recent assessment of Norwegian Arctic tundra ecosystems shows have since the climatic reference period (1961–1990), these ecosystems have undergone rapid and substantial changes in the abiotic conditions manifested particularly as increasing surface temperatures, longer and warmer growing seasons, shortening of the snow-covered season, and increasing permafrost temperatures.[67] The same assessment concludes that Norwegian Arctic tundra ecosystems are overall in a good ecological condition, with fundamental structures and functions still maintained, despite substantial abiotic changes. Low Arctic tundra in Finnmark shows more pronounced and consistent deviations in biotic characteristics than the High Arctic tundra in Svalbard. In Finnmark, the Arctic tundra ecosystems are on a trajectory of losing Arctic endemic species (Arctic fox and snowy owl) and is bioclimatically on a trajectory away from low Arctic subzones towards boreal subzones.

In 2019, CAFF published its freshwater assessment report, which concludes that Arctic freshwater ecosystems (e.g. lakes, rivers, and associated wetlands) are highly threatened by climate change and human development, which can alter the distribution and abundance of species and affect biodiversity and the ecosystem services on which many Arctic peoples depend.[68] In the ocean, loss of sea ice is already affecting the timing and patterns of primary production, altering food webs and reducing the availability of sea ice to walrus and ice seals for resting, molting, breeding and rearing young. The total loss of some key habitats, such as multi-year pack ice, is expected.

[67] Pedersen, Å.Ø., et al. (2021): Norwegian Arctic Tundra: a Panel-based Assessment of Ecosystem Condition. Report Series 153. Norwegian Polar Institute, Tromsø, Norway.

[68] CAFF (2019): State of the Arctic Freshwater Biodiversity: Key Findings and Advice for Monitoring. Conservation of Arctic Flora and Fauna (CAFF) International Secretariat, Akureyri, Iceland.

In the process of rapid change and transitions, new combinations of species are altering Arctic ecosystems. The pace of the temperature rise in the Arctic is very high, causing difficulties for the Arctic species to adapt. The consequences of climate change on Arctic marine biodiversity are difficult to forecast. This is partly due to the fact that current biodiversity monitoring is not sufficient to describe status and trends for many arctic species[69] but also because the ecological changes that are detected, vary between the Arctic regions. A number of Arctic species are shifting their ranges northwards to seek more favourable conditions as the Arctic warms. Many species and habitats that are characteristic of the Arctic today, however, will be unable to move further north to find new areas of habitat with a suitable climate. Species and ecosystems associated with the sea ice are particularly vulnerable to climate change and risk having their ranges severely restricted or disappearing due to loss of sea ice. This includes polar bears, hooded seals, harp seals, ringed seals, narwhals, little auks, ivory gulls, polar cod and a number of species, like algae and small animals living inside the sea ice. The Svalbard area and the Northern Barents Sea is losing sea ice faster than most parts of the Arctic, and the risks from climate change to ecosystems and species in these areas are high.

Rising temperatures will continue to result in a northward shift in the distribution of species and habitats. The Arctic species and habitats found in the region are gradually displaced by species and habitats that are currently found further south. Tundra areas north of the Arctic treeline are some of the terrestrial habitats that will continue to undergo the most dramatic changes as the permafrost thaws.

[69] CAFF (2017): State of the Arctic Marine Biodiversity: Key Findings and Advice for Monitoring. Conservation of Arctic Flora and Fauna (CAFF) International Secretariat, Akureyri, Iceland.

Marine ecosystems change as the sea temperature rises. Higher temperatures and the retreat of the sea ice allows more southerly species to move into Arctic sea areas, and purely Arctic species will meet growing competition, greater predation pressure and a higher risk of disease and parasites. Many seabird species are or will be expected to be negatively affected by climate change.[70] The distribution of commercially important fish species, such as cod, haddock, herring and capelin, have already changed and may change more in the future.

The declining sea ice cover is making marine and coastal waters in the Arctic more accessible for fisheries, maritime transport, mining activities, cruise ships and oil and gas activities. If not managed properly, the increase in activity levels may lead to unsustainable harvesting, infrastructure development, habitat loss and fragmentation, the spread of invasive alien species, disturbance of the fauna and the risk of pollution.

Delegations from Canada, China, Denmark in respect of the Faroe Islands and Greenland, the European Union, Iceland, Japan, the Republic of Korea, Norway, Russia and the USA concluded negotiations in late 2017 on the draft *Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean*. Fishing in the central Arctic Ocean, an area that is roughly 2.8 million km^2 in size, has never been possible, nor is it likely to occur in the near future.

6.5.4 Vulnerability to climate change and expected impacts on society

According to AMAP,[62] Arctic climate change is posing widespread risks to safety, health and well-being, damaging infrastructure and causing economic impacts to many sectors. Commercial fisheries, aquaculture and cruise tourism are expanding in the Arctic, with implications for coastal communities and livelihoods, vulnerable ecosystems and demand for search-and-rescue services. Climate change is also affecting the subsistence, harvest-based livelihoods and food security of small Arctic communities—especially Indigenous communities.

In Svalbard, as in mainland Norway, climate change is increasing the risk of landslides, avalanches and floods and result in more frequent and more severe extreme weather events. Coastal erosion could also become a growing problem in Svalbard. Infrastructure such as roads, buildings and port facilities will be vulnerable to such natural hazards. Their isolation may make the settlements more vulnerable to climate-related events that disrupt critical infrastructure. Incidents of avalanches and landslides in or in close proximity of the settlements in Svalbard has happened in recent years. These incidents also affect outdoor activities and tourism.

The rapid climate change has made Svalbard's natural and cultural environment more vulnerable. The rising temperature and increased precipitation are affecting the conservation conditions for archaeological sites, as well as cultural heritage buildings and other standing structures. At the same time, tourism and traffic have increased sharply. This has already left clear traces in many places in Svalbard. Both climate change and tourism growth are expected to continue.

For the cultural environment, rot damage and increased degradation of material, coastal erosion and changing foundation conditions (thawing of permafrost and/or increasing the active layer) are the biggest challenges for conservation and predictable management of the cultural environment. This development is much more visible in Svalbard than on the mainland (cf. the Arctic amplification).

[70] CAFF (2021): State of the Arctic Marine Biodiversity Report Update: Seabirds. Conservation of Arctic Flora and Fauna (CAFF) International Secretariat, Akureyri, Iceland.

The infrastructure and houses in the largest settlement at Svalbard, Longyearbyen, is mainly founded on piles into the ground, supported by the permafrost. When the permafrost slowly melts, it causes sentence damages. Svalbard airport experiences major challenges both on the runway, terminal and other buildings. The airport is critical for the citizens' safety, and the airport operator Avinor is now monitoring the development of sentence, to prepare possible actions.

Research and the travel and tourism industry are important sectors in Svalbard that will be affected by climate change. The increasing length of periods without sea ice in the summer is making areas more accessible to cruise ships. At the same time, an earlier spring thaw and a reduction in ice cover on the fjords will shorten the season for snowmobile-based tourism and restrict the areas available for such activities. There will be less opportunity for visitors to observe ice-dependent species, and the travel and tourism industry will have to adapt its activities to a situation in which many species are under stress as a result of climate change.

Svalbard is one of the most important sites for scientific research in the Arctic. However, climate change affects research in a number of ways, including through changes in natural conditions and the accessibility of areas and biodiversity. The opportunity to study climate change in the Arctic is one of the drivers behind the growing interest in research and teaching activities in the archipelago.

The warmer climate and loss of sea ice are also resulting in changes in activity patterns in the waters around Svalbard. Such changes in activity patterns may make it necessary to upgrade fisheries inspection, maritime safety, oil spill preparedness and response and search and rescue capacity in these waters. Changes in temperature, precipitation and extreme weather events will affect offshore activities and maritime transport.

6.5.5 Adaptation measures

6.5.5.1 Ecosystems

The speed of climate change in the Arctic highlights the need for adaptation measures. Reports from the AMAP-led Arctic Council project *Adaptation Actions for a Changing Arctic* (AACA)[71] and a report from the Norwegian Polar Institute[72] have assessed possible adaptation measures in the Arctic, including the Norwegian Arctic. One of the findings in the AACA project is that it is increasingly important to recognize the significance of natural capital, ecosystem services and resilience in the context of adaptation.

Climate change will pose considerable challenges for the nature management in Svalbard. In the same way as in mainland Norway, it will be necessary to strengthen instruments to safeguard threatened species and habitats that may come under increasing pressure as a result of climate change and increased accessibility and human impact due to less severe sea ice conditions.

Some measures have already been introduced in Svalbard in response to areas now being more accessible due to reduced sea ice. Regulations in and outside protected areas have been adapted to meet the challenges posed by climate change and increased traffic. The cruise operators Association of Arctic Expedition Cruise Operators (AECO) have developed site guidelines, which aim at safeguarding the environment and cultural remains. To reduce the risk of a shipwreck or grounding, carrying heavy bunker oil is prohibited in all of Svalbard's territorial waters, and cruise ships that

[71] AMAP (2017): Adaptation Actions for a Changing Arctic (AACA) – Barents Area Overview report, Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway, 24 pp.

[72] NPI (2016): Klimaendringer på Svalbard – Effekter på naturmangfold og konsekvenser for den fremtidige naturforvaltningen [C.H. von Quillfeldt, E. Øseth (eds.).], the Norwegian Polar Institute (NPI) kortrapport 042

call in the nature reserves in the eastern part of Svalbard may not carry more than 200 passengers. In addition, compulsory pilotage has been introduced, and charting of the waters around Svalbard is being improved. For the emergency preparedness towards an acute pollution incident, a tool (*PRIMOS*) has been developed, which collates mapped information about the environmental values in Svalbard.

Climate change adaptation of management practice is one of the elements of the management plans that are being drawn up for the protected areas in Svalbard. These protected areas cover most of Svalbard's land and territorial waters. Furthermore, an action plan from 2017 to prevent the introduction and spread of invasive alien species in Svalbard is being implemented, in part as a response to the fact that climatic barriers to invasive species are weakened due to climate change. At the same time, Norway is following up the Arctic Invasive Alien Species Strategy and Action Plan 2017 from CAFF and Protection of the Arctic Marine Environment (PAME) under the Arctic Council.

Results from the extensive research, monitoring and mapping of species and ecosystems are reported through the environmental monitoring program for Svalbard and Jan Mayen (in Norwegian: "Miljøovervåking Svalbard og Jan Mayen", abbreviated MOSJ), which includes several indicators of impacts of climate change in Svalbard.[73] National Environmental Goals and the state and development of the Norwegian Arctic are also presented on Norway's official State of the Environment Norway web-page.[74] An ecosystem-based monitoring program for land ecosystems in the Norwegian Arctic, *Climate-ecological Observatory for Arctic Tundra* (COAT)[75] has been developed during the last years. COAT is particularly designed to be able to detect impacts on climate change.

In 2021, Norwegian Arctic tundra ecosystems was assessed.[71] The assessment report shows that since the climatic reference period (1961–1990), these ecosystems have undergone rapid and substantial changes in the abiotic conditions manifested particularly as increasing surface temperatures, longer and warmer growing seasons, shortening of the snow-covered season and increasing permafrost temperatures. The biotic implications of these changes are still mostly limited. The report concludes that the Norwegian Arctic tundra ecosystems are overall in a good ecological condition, with fundamental structures and functions still maintained, despite substantial abiotic changes. However, some biotic ecosystem characteristics show deviations from the reference condition, while others are presently on significant change trajectories, which should be considered a warning of more extensive, incipient ecosystem changes.

6.5.5.2 Human activities and settlements

Climate changes add strain to critical infrastructure in Svalbard that is already vulnerable, thereby creating a need for upgrading and adaptation. Climate-related incidents can also pose a threat to life and health. It is, therefore, important that land-use and community planning in the planning areas take climate change into account. The guide to land-use planning under the Svalbard Environmental Protection Act has been revised. A description of how the planning areas in Svalbard should take climate change into account is included in the revised guide.

[73] NPI (2022): Environmental monitoring of Svalbard and Jan Mayen, https://www.mosj.no/en/.

[74] NPI (2020): The polar regions, https://www.environment.no/topics/the-polar-regions/.

[75] Klimaøkologisk Observasjonssystem for Arktisk Tundra (COAT), *http://www.coat.no/*.

NVE supports the local authorities on Svalbard on the same terms as on the mainland. The support in mapping, land-use planning, early warning, protection and crisis management related to floods, avalanches and landslides is prioritized based on a cost-benefit approach. Since 2016, NVE has built protection measures against floods and avalanches around Longyearbyen.

The integrated management plans for the Barents Sea–Lofoten area and the Norwegian Sea are important tools for overall adaptation of the framework for activities in Arctic seas to changes in the climate, environmental conditions and patterns of activity. These management plans are presented as governmental white papers. They are updated at regular intervals. The last update came in 2020,[76] and the next is planned for 2024.

6.5.5.3 Cultural heritage

Since 2018, the Directorate for Cultural Heritage and the office of cultural heritage management at the Governor of Svalbard have seen an increase in the number of cases as a result of the challenges mentioned in section 6.5.4 *Vulnerability to climate change and expected impacts on society*.

In order to meet the challenge of increased coastal erosion, the directorate and the Governor of Svalbard has, among other things, moved and carried out documentation of several cultural remains to safeguard source values and help to gather knowledge before they are lost. The Directorate for Cultural Heritage sees that the loss of cultural-historical values because of climate change will – in some cases – be inevitable or due to a shortage of resources to safeguard them. A lack of systematic monitoring of the cultural environment in recent years contributes to unpredictability in the long-term management of the cultural environment in Svalbard and challenges the resource situation

The Governor of Svalbard is monitoring erosion at exposed cultural heritage sites and has developed an archaeological research plan for selected sites. There is a great need for more knowledge about the effects of climate change on conservation of cultural heritage on Svalbard.

6.5.5.4 Emergency preparedness

By increasing the accessibility of Arctic marine areas to human activities, the need for search and rescue (SAR) operations also increases. In 2013 the Arctic SAR Agreement entered into force. The treaty coordinates international search and rescue coverage and response in the Arctic, and establishes the area of SAR responsibility of each state party. All the member states of the Arctic Council — Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States — signed the agreement. In response to the increase in activity and the wider geographical area of responsibility, the Governor of Svalbard has two large helicopters. In addition, search and rescue vessels of a suitable size for the helicopters. This has strengthened search and rescue capacity in Svalbard and nearby sea areas. More and better (winterized) oil spill response equipment has also been stored on Svalbard. These changes are based on the experience from off-loading fuel from the trawler Northguider and the following wreck removal.

Surveillance of ship traffic in the Arctic is established with national automatic identification system (AIS) satellites and access to other AIS satellite services. New AIS satellites with enhanced functionalities are in trial with a view to possible future enhancement of the present constellation. Also, Norway has added shore-based AIS receivers increasing surveillance in the coastal areas around

[76] Ministry of Climate and Environment (2020): Norway's integrated ocean management plans — Barents Sea–Lofoten area; the Norwegian Sea; and the North Sea and Skagerrak — Report to the Storting (white paper), *Meld. St. 20 (2019–2020).*

the Svalbard archipelago. Moreover, in 2010, the International Maritime Organization (IMO) introduced obligatory long-range identification, and tracking of passenger ships, cargo ships (300 gross tonnage and upwards) and mobile offshore drilling units (LRIT) also provides information on ship traffic. This means that Norway has access to information on maritime activity in Arctic waters, valuable for SAR operations and other purposes.

Through the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (MOSPA), the Arctic countries have also strengthened cooperation, coordination and mutual assistance on oil pollution preparedness and response in the Arctic in order to protect the marine environment from pollution by oil.

The relevant rules of the Act relating to ports and navigable waters and associated regulations on pilotage are applicable to Svalbard. This means that the rules relating to the state pilotage service, compulsory pilotage and pilot exemption certificates are the same as for mainland Norway in the waters around Svalbard.

6.5.5.5 International cooperation

There is effective, binding international cooperation in the High North, which promotes environmental protection and sound resource management. The Arctic Council is the most important arena for dealing with common challenges in the Arctic. In May 2017, all member states of the Arctic Council signed the *Agreement on Enhancing International Arctic Scientific Cooperation*, aiming at developing and expanding international Arctic scientific cooperation.

Over the years, the Arctic Council working groups have published a number of reports that synthesise and assess new knowledge on climate change and adaptation in the Arctic. Following Russia’s invasion of Ukraine, Arctic Council activities, including scientific assessment activities, has paused.

7 FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY, INCLUDING INFORMATION UNDER ARTICLES 10 AND 11 OF THE KYOTO PROTOCOL

The impacts of climate change are increasingly visible and felt around the world, especially in developing countries who are the most severely affected and the least equipped to respond to its consequences. The poorest and most vulnerable communities are experiencing the effects of climate change through extreme weather events such as floods, drought, hurricanes and sea level rise. Climate change has the potential to reverse significant development gains made in developing countries. Norway recognises the critical need for support to developing countries with respect to both climate mitigation and adaptation. In the period 2019–2020 Norway has continued to provide a wide range of financial, technological and capacity-building support to developing country Parties in order to build their capacity to reduce carbon emissions and to support adaptation to take action against the negative effects of climate change.

7.1 Finance

Table 7.1 presents total figures of Norwegian public climate finance. The Norwegian public climate finance amounted to USD 734 million (NOK 6 459 million) in 2019 and USD 706 million (NOK 6 646 million) in 2020.

The majority of Norwegian climate finance is earmarked support, including bilateral contributions and earmarked contributions through multilateral institutions. The earmarked contributions amounted to USD 582 million (NOK 5 122 million) in 2019 and USD 489 million (NOK 4 607 million) in 2020. The estimated climate specific share of core support to multilateral organisations (imputed multilateral core contributions) amounted to USD 152 million (NOK 1 337 million) and USD 217 million (NOK 2 039 million) in 2019 and 2020, respectively.

The earmarked contributions targeting climate change are separated into three categories: adaptation (only), mitigation (only) and cross-cutting (both adaptation and mitigation). In 2020, USD 67 million (NOK 626 million) was targeting climate change adaptation only (14 per cent of total earmarked support), USD 373 million (NOK 3 513 million) targeting climate change mitigation only (76 per cent of total earmarked support), and USD 50 million (NOK 468 million) was cross-cutting support (10 per cent of total earmarked support).

In addition to the public climate financing, these interventions mobilised private climate relevant investments in developing countries. The private finance mobilised amounted to USD 16 million (NOK 145 million) in 2019 and USD 33 million (NOK 313 million) in 2020.

7.1.1 Provision of 'new and additional' financial resources

The overall objective of Norwegian development cooperation is to fight poverty, save lives and alleviate suffering, in accordance with the humanitarian imperative. The strong inter-linkages between climate change and development have been emphasised, as well as the linkages between the Paris agreement, the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction.

There is no internationally agreed definition of what constitutes “new and additional” resources under Article 4.3 under the Convention. One frequently used definition, supported by many countries, is that climate financing should be additional to the international development aid goal of 0.7 per cent of gross national income. Norwegian total ODA has exceeded 0.7 per cent of Gross National Income (GNI) for many years, and oscillated around 1 per cent. According to the definition above, Norway’s climate finance could be viewed as new and additional. The volume of the Norwegian ODA budget has steadily increased as the economy has been growing.

Furthermore, as is underlined in the 2030 agenda, we acknowledge the importance of taking into account the three dimensions (social, economic and environmental) of sustainable development. Well-designed actions can produce multiple local and global benefits, including those related to climate change. Efforts are being made, where relevant, to integrate climate change concerns into all our development efforts. This is not always captured in the report or in the numbers. It is sometimes difficult to single out assistance for adaptation from more general development assistance, which often also contributes to improving resilience to climate change.

Table 7.1 Provision of public financial support, 2019–2020.

	2019		2020	
Type of assistance	NOK mill	USD mill	NOK mill	USD mill
Earmarked contributions				
Adaptation only	464	53	626	67
Mitigation only	4 205	478	3 513	373
Cross-cutting	453	51	468	50
Total earmarked contributions	**5 122**	**582**	**4 607**	**489**
Imputed multilateral contributions	**1 337**	**152**	**2 039**	**217**
Total	**6 459**	**734**	**6 646**	**706**

7.1.2 Assistance to developing country Parties that are particularly vulnerable to climate change

Norwegian funding prioritises support to reducing vulnerability and developing robust societies. The main recipients of Norwegian bilateral climate finance are least developed countries, except for Norway’s International Climate and Forest Initiative. Regarding Norwegian multilateral climate finance, the main channel is the Green Climate Fund (GCF).

7.1.3 Provision of financial resources, including financial resources under Article 11 of the Kyoto Protocol

7.1.3.1 Measuring public climate finance

The monitoring of Norwegian development finance targeting the objectives of the United Nations framework convention for climate change (UNFCCC) is based on the OECD Development Assistance Committee’s (DAC) reporting system (CRS). We use DAC purpose codes for sector classifications. Norwegian development climate finance includes climate-related official development assistance (ODA) and other official flows (OOF).

The OOF activities are interventions by Norfund providing equity, loans and guarantees to companies operating in challenging markets in developing countries. Norfund's outflows are reported to the OECD DAC as OOF to avoid double counting as the funding that Norfund receives through the State budget is reported as ODA, in accordance with the institutional approach for ODA reporting of private sector instruments.

The tracking of Norwegian development finance targeting climate change is separated into earmarked contributions and imputed multilateral core contributions. Below we describe these methodologies as well as the tracking of private climate finance mobilised by official development interventions.

The amounts reported are gross disbursements during the year reported for, meaning that inflows (e.g. repayments, sales) are not reported as negative disbursements. These negative disbursements amounted to USD 16.5 million in 2019 and USD 22.9 million in 2020. The amounts are reported in NOK and USD based on average exchange rates (NOK-USD): 2019: 8.7986 and 2020: 9.4132.

Earmarked contributions

Earmarked contributions are support through bilateral and multilateral channels. Norway monitors earmarked climate specific activities using the OECD DAC Rio Markers *Climate change adaptation* and *Climate change mitigation*. The Rio Markers identify development activities targeting climate change (adaptation and/or mitigation), and whether targeting climate change is a principal or significant objective.

Contributions to activities targeting climate change as a principal objective are reported as 100 per cent climate finance, and the full amount disbursed counted. As a conservative estimate, and in line with other major donors, 40 per cent of the support to activities with a significant climate change objective is reported as climate finance. Contributions to cross-cutting activities targeting both climate change adaptation and mitigation are reported as 40 per cent climate finance if neither adaptation nor mitigation are principal project objectives. Consequently, the earmarked contributions targeting climate change objectives are approximations.

All earmarked climate financing is reported in Table 7.6 and 7.7, including earmarked contributions through multilateral institutions. The earmarked contributions through multilateral institutions are included in Table 7.6 and 7.7 (instead of 7.4 and 7.5) for transparency, as these contributions can be disaggregated by region/country and/or sector.

In table 7.6 and 7.7, we report aggregates by the type of support (adaptation/mitigation/cross-cutting) for each recipient country/region to limit the table sizes printed in the report. The information on financial instruments is grouped into *grants* and *PSI* (a group of different types of private sector instruments). However, in the online CTF submission we report granular information for each in activity (including financial instrument), and we include the OECD CRS ID in the *Additional information* column to ensure full transparency on the connection between each development finance intervention reported to the OECD DAC and the reported public climate finance.

Norwegian climate-specific ODA to Ukraine is excluded from the reporting as Ukraine is an Annex 1 country.

When referring to support for specific programmes, partners and activities (outside the standardised tables), the amounts are total disbursements regardless of climate relevance (if not specified).

Multilateral core contributions

We report estimates of Norwegian climate specific core contributions to multilateral institutions. These estimates – imputed climate-specific multilateral ODA – are calculated and published by the OECD. This methodology makes it possible to impute multilateral aid outflows targeting climate change back to the donors of multilateral core contributions. By using this methodology, only the estimated climate-specific shares of multilateral core contributions are reported as climate finance.

The OECD methodology for calculating imputed multilateral core support for climate change is a two-step procedure: 1) The percentage of each multilateral agency's total annual commitments to climate change objectives is calculated. This calculation is carried out only in respect of agencies' commitments of grants or concessional (ODA) loans from core resources. 2) The calculated climate specific percentage is applied to the donor's core contribution in the same year as to the organisation to estimate the imputed climate specific core contribution.

The imputed multilateral core contributions targeting climate change are not disaggregated by the type of support: adaptation, mitigation and cross-cutting. Therefore, the imputed multilateral core contributions are reported as *Type of support = Other* in Table 7.2 and 7.3. In table 7.4 and 7.5, these estimates are included in the column *climate-specific*, not in column *core/general*, as the estimate includes only the climate specific share of core contributions.

Imputed multilateral core support is not calculated for all multilateral institutions receiving core support, but for about 20 multilateral institutions per year. These agencies account for around 90 per cent of donor countries' multilateral core contributions. Core contributions to other multilateral institutions are not included in the reporting as there are no official climate shares available.

Table 7.2 Provision of public financial support: summary information in 2019.

Allocation channels	2019			
	Norwegian krone – NOK			
	Core/ general	Climate-specific		
		Mitigation	Adaptation	Cross-cutting
Total contributions through multilateral channels:				
Multilateral climate change funds				
Other multilateral climate change funds				
Multilateral financial institutions, including regional development banks				
Specialised United Nations bodies				
Total contributions through bilateral, regional and other channels		4 205 445 674,32	464 034 043,06	452 616 194,54
Total		4 205 445 674,32	464 034 043,06	452 616 194,54

Table 7.3 Provision of public financial support: summary information in 2020.

Allocation channels	2020			
	Norwegian krone – NOK			
	Core/ general	Climate-specific		
		Mitigation	Adaptation	Cross-cutting
Total contributions through multilateral channels:				
Multilateral climate change funds				
Other multilateral climate change funds				
Multilateral financial institutions, including regional development banks				
Specialised United Nations bodies				
Total contributions through bilateral, regional and other channels		3 513 000 570,15	626 078 852,43	468 014 627,46
Total		3 513 000 570,15	626 078 852,43	468 014 627,46

	USD				
	Core/ general	Climate-specific			
Other		Mitigation	Adaptation	Cross-cutting	Other
1 336 682 352,02					151 919 890,89
609 829 338,80					69 309 815,06
32 711 438,80					3 717 800,42
647 089 865,97					73 544 639,60
79 763 147,25					9 065 436,23
		477 967 594,20	52 739 531,64	51 441 842,40	
1 336 682 352,02		477 967 594,20	52 739 531,64	51 441 842,40	151 919 890,89

	USD				
	Core/ general	Climate-specific			
Other		Mitigation	Adaptation	Cross-cutting	Other
2 039 302 466,66					216 642 849,05
1 187 376 171,58					126 139 481,96
28 417 971,58					3 018 949,09
796 646 055,62					84 630 737,22
55 280 239,46					5 872 629,87
		373 199 397,67	66 510 735,18	49 718 972,02	
2 039 302 466,66		373 199 397,67	66 510 735,18	49 718 972,02	216 642 849,05

Table 7.4 Provision of public financial support: contribution through multilateral channels in 2019.

Donor funding	Total amount	
	Core/general	
	Norwegian krone – NOK	USD
Total contributions through multilateral channels		
Multilateral climate change funds		
1. Global Environment Facility		
2. Least Developed Countries Fund		
3. Special Climate Change Fund		
4. Adaptation Fund		
5. Green Climate Fund		
6. UNFCCC Trust Fund for Supplementary Activities		
7. Other multilateral climate change funds		
SCF – Strategic Climate Fund		
GGGI – Global Green Growth Institute		
Multilateral Fund for the Implementation of the Montreal Protocol		
Multilateral financial institutions, including regional development banks		
1. World Bank		
2. International Finance Corporation		
3. African Development Bank		
4. Asian Development Bank		
5. European Bank for Reconstruction and Development		
6. Inter-American Development Bank		
7. Other		
AFDF – African Development Fund		
AIIB – Asian Infrastructure Investment Bank		
IDB Invest		
Specialised United Nations bodies		
1. United Nations Development Program		
2. United Nations Environment Program		
3. Other		
IFAD – International Fund for Agricultural Development		
FAO – Food and Agriculture Organization		
UNFCCC – United Nations Framework Convention on Climate Change		
IPCC – Intergovernmental Panel on Climate Change		

7.1.4 Core contributions to multilateral institutions

Table 7.4 and 7.5 provides OECD estimates of Norwegian climate specific core contributions to multilateral institutions, in total USD 152 million (NOK 1 337 million) in in 2019 and USD 217 million (NOK 2 039 million) in 2020.

As described in the methodology section 7.1.3.1, the imputed climate-specific core contributions reported does not give the total overview of Norwegian climate-specific core funding, as there are multilateral institutions where the climate-specific share of the core contributions is unknown. Examples of such multilateral institutions receiving core contributions from Norway are CGIAR (NOK 230 million in core contributions in 2019–2020), UNEP (NOK 27 million in core contributions in 2019–2020) and UNDP (NOK 1 110 million in core contributions in 2019–2020). Core contributions to these multilateral institutions are not included as climate financing.

Climate-specific		Status	Funding source	Financial instrument	Type of support	Sector
Norwegian krone – NOK	USD					
1 336 682 352,02	151 919 890,89					
609 829 338,80	69 309 815,06					
108 293 900,00	12 308 083,10	Disbursed	ODA	Grant	Other	Not applicable
90 000 000,00	10 228 900,05	Disbursed	ODA	Grant	Other	Not applicable
378 824 000,00	43 055 031,48	Disbursed	ODA	Grant	Other	Not applicable
32 711 438,80	3 717 800,42					
14 516 902,80	1 649 910,53	Disbursed	ODA	Grant	Other	Not applicable
18 194 536,00	2 067 889,89	Disbursed	ODA	Grant	Other	Not applicable
647 089 865,97	73 544 639,60					
354 002 720,00	40 233 982,68	Disbursed	ODA	Grant	Other	Not applicable
552 759,50	62 823,57	Disbursed	ODA	Grant	Other	Not applicable
292 534 386,47	33 247 833,34					
231 036 560,69	26 258 332,09	Disbursed	ODA	Grant	Other	Not applicable
58 098 870,38	6 603 194,87	Disbursed	ODA	Grant	Other	Not applicable
3 398 955,40	386 306,39	Disbursed	ODA	Grant	Other	Not applicable
79 763 147,25	9 065 436,23					
79 763 147,25	9 065 436,23					
44 295 600,00	5 034 391,84	Disbursed	ODA	Grant	Other	Not applicable
19 267 547,25	2 189 842,39	Disbursed	ODA	Grant	Other	Not applicable
16 200 000,00	1 841 202,01	Disbursed	ODA	Grant	Other	Not applicable

In table 7.4 and 7.5, we have included the World Bank Group in the predefined category *World bank*, except for the IFC reported in the predefined category *IFC*.

Below the tables follows a description of support provided to some of these organisations. There might be discrepancies between the table figures and the narrative below, as only the climate specific amounts are included in the tables.

7.1.4.1 Global Environment Facility

The Norwegian government`s contribution to the Global Environment Facility (GEF) for the GEF-7 period 2018–2021 was NOK 520 million (USD 63 million). In GEF 7 the climate change focal area receives approximately 20,5 per cent of GEF resources. In addition, several multi focal area and integrated projects and programmes are introduced, mainly involving the focal areas of climate change, biodiversity and land degradation. As reported in table 7.4 and 7.5, Norway's climate

Table 7.5	Provision of public financial support: contribution through multilateral channels in 2020.

Donor funding	Total amount		
	Core/general		
	Norwegian krone – NOK	USD	
Total contributions through multilateral channels			
Multilateral climate change funds			
1. Global Environment Facility			
2. Least Developed Countries Fund			
3. Special Climate Change Fund			
4. Adaptation Fund			
5. Green Climate Fund			
6. UNFCCC Trust Fund for Supplementary Activities			
7. Other multilateral climate change funds			
SCF – Strategic Climate Fund			
GGGI – Global Green Growth Institute			
Multilateral Fund for the Implementation of the Montreal Protocol			
Multilateral financial institutions, including regional development banks			
1. World Bank			
2. International Finance Corporation			
3. African Development Bank			
4. Asian Development Bank			
5. European Bank for Reconstruction and Development			
6. Inter-American Development Bank			
7. Other			
AFDF – African Development Fund			
AIIB – Asian Infrastructure Investment Bank			
IDB Invest			
Specialised United Nations bodies			
1. United Nations Development Program			
2. United Nations Environment Program			
3. Other			
IFAD – International Fund for Agricultural Development			
FAO – Food and Agriculture Organization			
UNFCCC – United Nations Framework Convention on Climate Change			
IPCC – Intergovernmental Panel on Climate Change			

specific contribution to GEF was NOK 108 million (USD 11 million), in both 2019 and 2020.

7.1.4.2 The Green Climate Fund

The Green Climate Fund (GCF) was established to support the efforts of developing countries to respond to the challenge of climate change. GCF helps developing countries limit or reduce their greenhouse gas (GHG) emissions and adapt to climate change. It seeks to promote a paradigm shift to low-emission and climate-resilient development, taking into account the needs of nations that are particularly vulnerable to climate change impacts. Norway's pledge to The Green Climate Fund for the period 2020–2023 (GCF 1) was NOK 3.6 billion (USD 417.48 million). As reported in table 7.3, Norway's climate specific contribution to GCF was NOK 378 million in 2019 and NOK 1 000 million in 2020.

Climate-specific						
Norwegian krone – NOK	USD	Status	Funding source	Financial instrument	Type of support	Sector
2 039 302 466,66	216 642 849,05					
1 187 376 171,58	126 139 481,96					
108 958 200,00	11 575 043,56	Disbursed	ODA	Grant	Other	Not applicable
50 000 000,00	5 311 689,97	Disbursed	ODA	Grant	Other	Not applicable
1 000 000 000,00	106 233 799,35	Disbursed	ODA	Grant	Other	Not applicable
28 417 971,58	3 018 949,09					
9 865 472,70	1 048 046,65	Disbursed	ODA	Grant	Other	Not applicable
18 552 498,88	1 970 902,44	Disbursed	ODA	Grant	Other	Not applicable
796 646 055,62	84 630 737,22					
450 968 810,60	47 908 130,14	Disbursed	ODA	Grant	Other	Not applicable
19 090 560,00	2 028 062,72	Disbursed	ODA	Grant	Other	Not applicable
31 614 682,33	3 358 547,82	Disbursed	ODA	Grant	Other	Not applicable
294 972 002,69	31 335 996,55					
254 741 196,10	27 062 125,11	Disbursed	ODA	Grant	Other	Not applicable
35 337 840,66	3 754 073,07	Disbursed	ODA	Grant	Other	Not applicable
4 892 965,93	519 798,36	Disbursed	ODA	Grant	Other	Not applicable
55 280 239,46	5 872 629,87					
55 280 239,46	5 872 629,87					
43 714 800,00	4 643 989,29	Disbursed	ODA	Grant	Other	Not applicable
11 065 439,46	1 175 523,68	Disbursed	ODA	Grant	Other	Not applicable
500 000,00	53 116,90	Disbursed	ODA	Grant	Other	Not applicable

7.1.4.3 Adaptation Fund

Norway supported the Adaptation Fund with NOK 90 million (USD 10.9 million) in core support in 2019 and NOK 50 million (USD 6.1 million) in 2020. The Adaptation Fund was launched in December 2007 to finance concrete adaptation projects and programmes in developing country Parties to the Kyoto Protocol. The fund's approach focuses on two main result areas: reducing vulnerability to the adverse impacts of climate change; and increasing adaptive capacity to cope with and address the adverse impacts of climate change.

7.1.4.4 Earmarked contributions

Table 7.6 and 7.7 provides a summary of public earmarked climate finance, in total USD 582 million (NOK 5 122 million) in 2019 and USD 489 million (NOK 4 607 million) in 2020. Section 7.1.3 describes the methodology and figures included in the tables.

Table 7.6 Provision of public financial support: contribution through bilateral, regional and other channels in 2019.

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru-ment	Type of support	Sector
Total	5 122 095 911,92	582 148 968,24					
Angola	3 323 250,00	377 702,13	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.02 NOK mill.); 151 – Government and civil society, general (0.64 NOK mill.); 430 – Other multisector (1.66 NOK mill.)
Angola	644 007,60	73 194,33	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Burundi	2 402 753,96	273 083,67	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (2.3 NOK mill.); 321 – Industry (0.11 NOK mill.)
Burundi	1 604 999,97	182 415,38	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Cameroon	1 123 333,20	127 671,81	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Cameroon	566 024,67	64 331,22	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.12 NOK mill.); 410 – General environmental protection (0.45 NOK mill.)
Congo, Dem. Rep.	3 895 331,00	442 721,68	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (1.03 NOK mill.); 311 – Agriculture (0.6 NOK mill.); 430 – Other multi-sector (2.26 NOK mill.)
Congo, Dem. Rep.	27 347 681,66	3 108 185,58	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (3.68 NOK mill.); 312 – Forestry (5.14 NOK mill.); 410 – General environmental protection (18.53 NOK mill.)
Congo, Dem. Rep.	885 046,00	100 589,41	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Congo, Rep.	840 000,00	95 469,73	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Egypt	22 901 628,00	2 602 871,82	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Ethiopia	99 866 038,64	11 350 219,20	Disbursed	ODA	Grants	Adaptation	112 – Basic education (0.77 NOK mill.); 114 – Post-secondary education (0.29 NOK mill.); 140 – Water and sanitation (3.66 NOK mill.); 151 – Government and civil society, general (0.12 NOK mill.); 240 – Banking and financial services (3.59 NOK mill.); 311 – Agriculture (6.77 NOK mill.); 410 – General environmental protection (0.25 NOK mill.); 430 – Other multisector (84.41 NOK mill.)
Ethiopia	215 386 654,60	24 479 650,69	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (0.02 NOK mill.); 410 – General environmental protection (215.37 NOK mill.)
Ethiopia	51 583 911,94	5 862 740,88	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (4.17 NOK mill.); 410 – General environmental protection (31.97 NOK mill.); 430 – Other multisector (15.44 NOK mill.)
Gabon	763 333,20	86 756,21	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ghana	2 455 706,40	279 101,95	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (0.32 NOK mill.); 410 – General environmental protection (2.14 NOK mill.)
Ghana	114 279,60	12 988,38	Disbursed	ODA	Grants	Cross-cutting	321 – Industry
Kenya	6 691 861,20	760 559,77	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.01 NOK mill.); 313 – Fishing (3.59 NOK mill.); 410 – General environmental protection (3.09 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru-ment	Type of support	Sector
Kenya	92 950 289,60	10 564 213,58	Disbursed	ODA (2.85 NOK mill.); OOF (90.1 NOK mill.)	Grants (2.85 NOK mill.); PSI (90.1 NOK mill.)	Mitigation	140 – Water and sanitation (0.22 NOK mill.); 232 – Energy generation, renewable sources (90.1 NOK mill.); 321 – Industry (2.62 NOK mill.)
Kenya	3 008 841,52	341 968,21	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Liberia	468 552,42	53 253,07	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified
Liberia	12 666 720,11	1 439 629,04	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.44 NOK mill.); 410 – General environmental protection (12.23 NOK mill.)
Madagascar	637 825,20	72 491,67	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.03 NOK mill.); 313 – Fishing (0.61 NOK mill.)
Madagascar	222 374,00	25 273,79	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation
Madagascar	6 070 177,03	689 902,60	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (0.41 NOK mill.); 410 – General environmental protection (5.66 NOK mill.)
Malawi	9 468 024,15	1 076 083,03	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (0.24 NOK mill.); 311 – Agriculture (4.5 NOK mill.); 430 – Other multi-sector (4.73 NOK mill.)
Malawi	3 035 660,00	345 016,25	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (1.12 NOK mill.); 311 – Agriculture (1.92 NOK mill.)
Malawi	16 475 274,85	1 872 488,22	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Mali	30 148 187,26	3 426 475,49	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (1.42 NOK mill.); 311 – Agriculture (26.59 NOK mill.); 410 – General environmental protection (2.14 NOK mill.)
Mali	684 478,80	77 794,06	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Mali	30 000 000,00	3 409 633,35	Disbursed	ODA	Grants	Cross-cutting	430 – Other multisector
Mozambique	26 817 988,78	3 047 983,63	Disbursed	ODA	Grants	Adaptation	160 – Other social infrastructure and services (19 NOK mill.); 311 – Agriculture (7.19 NOK mill.); 430 – Other multisector (0.63 NOK mill.)
Mozambique	23 186 994,60	2 635 305,00	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (22.33 NOK mill.); 321 – Industry (0.86 NOK mill.)
Mozambique	2 889 444,00	328 398,15	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Niger	35 400 000,00	4 023 367,35	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (14 NOK mill.); 430 – Other multisector (21.4 NOK mill.)
Niger	1 441 543,00	163 837,77	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nigeria	41 558 664,00	4 723 326,89	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Nigeria	22 296 502,00	2 534 096,56	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy (1.3 NOK mill.); 311 – Agriculture (21 NOK mill.)
Somalia	13 999 980,66	1 591 160,03	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1 NOK mill.); 430 – Other multisector (9 NOK mill.); 720 – Emergency Response (4 NOK mill.)
South Africa	1 646 400,00	187 120,68	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection
South Africa	35 505 771,00	4 035 388,70	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South Sudan	2 662 916,40	302 652,29	Disbursed	ODA	Grants	Mitigation	114 – Post-secondary education
Sudan	520 000,00	59 100,31	Disbursed	ODA	Grants	Adaptation	152 – Conflict prevention and resolution, peace and security
Sudan	1 605 000,00	182 415,38	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru- ment	Type of support	Sector
Tanzania	14 028 270,93	1 594 375,35	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (2.64 NOK mill.); 311 – Agriculture (8.01 NOK mill.); 410 – General environmental protection (3.38 NOK mill.)
Tanzania	5 021 333,13	570 696,83	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (4.61 NOK mill.); 410 – General environmental protection (0.41 NOK mill.)
Tanzania	7 676 135,90	872 426,97	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (6.82 NOK mill.); 410 – General environmental protection (0.86 NOK mill.)
Togo	2 189 053,00	248 795,60	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Uganda	3 549 489,20	403 415,23	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (2.82 NOK mill.); 311 – Agriculture (0.73 NOK mill.)
Uganda	38 828 065,44	4 412 982,23	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (16 NOK mill.); 231 – Energy Policy (7.21 NOK mill.); 232 – Energy generation, renewable sources (8.36 NOK mill.); 236 – Heating, cooling and energy distribution (6.85 NOK mill.); 311 – Agriculture (0.18 NOK mill.); 410 – General environmental protection (0.23 NOK mill.)
Uganda	8 287 062,16	941 861,45	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (4.86 NOK mill.); 311 – Agriculture (2.53 NOK mill.); 410 – General environmental protection (0.9 NOK mill.)
Zambia	511 584,60	58 143,86	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.26 NOK mill.); 410 – General environmental protection (0.25 NOK mill.)
Zambia	3 478 241,60	395 317,62	Disbursed	ODA (0.24 NOK mill.); OOF (3.24 NOK mill.)	Grants (0.24 NOK mill.); PSI (3.24 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (0.24 NOK mill.); 232 – Energy generation, renewable sources (3.24 NOK mill.)
Zambia	1 163 648,00	132 253,77	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Zimbabwe	683 072,40	77 634,21	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Bolivia	895 084,12	101 730,29	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.63 NOK mill.); 410 – General environmental protection (0.26 NOK mill.)
Brazil	74 120 425,44	8 424 115,82	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation (0.28 NOK mill.); 151 – Government and civil society, general (7.23 NOK mill.); 410 – General environmental protection (66.61 NOK mill.)
Brazil	1 058 193,24	120 268,36	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Colombia	226 026,00	25 688,86	Disbursed	ODA	Grants	Adaptation	313 – Fishing (0.08 NOK mill.); 410 – General environmental protection (0.1 NOK mill.); 430 – Other multi-sector (0.05 NOK mill.)
Colombia	221 382 797,83	25 161 139,02	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Colombia	6 836 964,75	777 051,43	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (1.55 NOK mill.); 410 – General environmental protection (5.29 NOK mill.)
Ecuador	113 428 711,00	12 891 677,20	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ecuador	35 000,00	3 977,91	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general
Guatemala	6 999 999,76	795 581,09	Disbursed	ODA	Grants	Adaptation	430 – Other multisector

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instru-ment	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Guyana	415 164 974,66	47 185 344,79	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Haiti	1 006 010,00	114 337,51	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation
Honduras	133 155 449,00	15 133 708,66	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Jamaica	19 200,00	2 182,17	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nicaragua	1 018 432,00	115 749,32	Disbursed	ODA	Grants	Adaptation	113 – Secondary education
Panama	1 451 296,00	164 946,24	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Paraguay	232 000,00	26 367,83	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
Peru	55 271 189,56	6 281 816,38	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (6.33 NOK mill.); 410 – General environmental protection (48.94 NOK mill.)
Peru	9 000 000,00	1 022 890,01	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Afghanistan	1 711 999,97	194 576,41	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation
Afghanistan	2 637 643,65	299 779,93	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Bangladesh	189 104,80	21 492,60	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.18 NOK mill.); 311 – Agriculture (0.01 NOK mill.)
Bangladesh	211 201,20	24 003,95	Disbursed	ODA	Grants	Mitigation	122 – Basic health (0.15 NOK mill.); 311 – Agriculture (0.06 NOK mill.)
Bangladesh	96 774,40	10 998,84	Disbursed	ODA	Grants	Cross-cutting	112 – Basic education
Cambodia	761 209,64	86 514,86	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (0.05 NOK mill.); 311 – Agriculture (0.64 NOK mill.); 430 – Other multisector (0.07 NOK mill.)
Cambodia	801 905,02	91 140,07	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (0.08 NOK mill.); 152 – Conflict prevention and resolution, peace and security (0.08 NOK mill.); 311 – Agriculture (0.46 NOK mill.); 410 – General environmental protection (0.19 NOK mill.)
China	1 923 142,80	218 573,73	Disbursed	ODA	Grants	Adaptation	313 – Fishing (0.81 NOK mill.); 410 – General environmental protection (1.11 NOK mill.)
China	29 015 582,88	3 297 749,97	Disbursed	ODA	Grants	Mitigation	160 – Other social infrastructure and services (0.92 NOK mill.); 231 – Energy Policy (0.2 NOK mill.); 250 – Business and other services (0.61 NOK mill.); 410 – General environmental protection (15.26 NOK mill.); 430 – Other multisector (12.02 NOK mill.)
China	2 062 960,00	234 464,57	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Georgia	12 853 134,96	1 460 815,92	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (11 NOK mill.); 232 – Energy generation, renewable sources (1.85 NOK mill.)
India	6 216 895,45	706 577,80	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.15 NOK mill.); 311 – Agriculture (0.08 NOK mill.); 410 – General environmental protection (5.8 NOK mill.); 430 – Other multisector (0.18 NOK mill.)
India	9 544 715,40	1 084 799,33	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
India	31 033 821,06	3 527 131,71	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.31 NOK mill.); 321 – Industry (0.71 NOK mill.); 410 – General environmental protection (1.02 NOK mill.); 430 – Other multisector (29 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru-ment	Type of support	Sector
Indonesia	335 002 954,75	38 074 574,90	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (7.42 NOK mill.); 232 – Energy generation, renewable sources (0.68 NOK mill.); 410 – General environmental protection (326.91 NOK mill.)
Indonesia	7 546 472,80	857 690,18	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Laos	943 402,00	107 221,83	Disbursed	ODA (0.11 NOK mill.); OOF (0.83 NOK mill.)	Grants (0.11 NOK mill.); PSI (0.83 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (0.83 NOK mill.); 410 – General environmental protection (0.11 NOK mill.)
Malaysia	110 000,00	12 501,99	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Myanmar	104 879,00	11 919,96	Disbursed	ODA	Grants	Adaptation	232 – Energy generation, renewable sources
Myanmar	31 809 918,86	3 615 338,67	Disbursed	ODA (20.58 NOK mill.); OOF (11.23 NOK mill.)	Grants (20.58 NOK mill.); PSI (11.23 NOK mill.)	Mitigation	151 – Government and civil society, general (0.71 NOK mill.); 231 – Energy Policy (6.01 NOK mill.); 232 – Energy generation, renewable sources (11.23 NOK mill.); 410 – General environmental protection (13.86 NOK mill.)
Nepal	9 841 855,29	1 118 570,60	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.74 NOK mill.); 151 – Government and civil society, general (1.67 NOK mill.); 311 – Agriculture (0.82 NOK mill.); 430 – Other multisector (6.61 NOK mill.)
Nepal	28 335 883,20	3 220 499,08	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (7.2 NOK mill.); 232 – Energy generation, renewable sources (0.86 NOK mill.); 236 – Heating, cooling and energy distribution (20.28 NOK mill.)
Pakistan	1 230 499,98	139 851,79	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation
Sri Lanka	1 009 082,80	114 686,75	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (0.25 NOK mill.); 313 – Fishing (0.06 NOK mill.); 430 – Other multisector (0.7 NOK mill.)
Sri Lanka	1 978 917,28	224 912,75	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (1.18 NOK mill.); 232 – Energy generation, renewable sources (0.8 NOK mill.)
Thailand	106 666,80	12 123,16	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Viet Nam	5 436 058,44	617 832,21	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (0.58 NOK mill.); 114 – Post-secondary education (2.25 NOK mill.); 410 – General environmental protection (2.6 NOK mill.)
Viet Nam	4 902 401,39	557 179,71	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.68 NOK mill.); 240 – Banking and financial services (0.27 NOK mill.); 311 – Agriculture (0.8 NOK mill.); 410 – General environmental protection (3.16 NOK mill.)
Global Unspecified	110 454 989,25	12 553 700,50	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.6 NOK mill.); 311 – Agriculture (15.2 NOK mill.); 313 – Fishing (12.54 NOK mill.); 410 – General environmental protection (20.4 NOK mill.); 430 – Other multisector (60.2 NOK mill.); 740 – Disaster prevention and preparedness (0.51 NOK mill.)

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instru- ment	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Global Unspecified	1 547 763 469,24	175 910 198,13	Disbursed	ODA (1340.66 NOK mill.); OOF (207.1 NOK mill.)	Grants (1340.66 NOK mill.); PSI (207.1 NOK mill.)	Mitigation	140 – Water and sanitation (0.11 NOK mill.); 151 – Government and civil society, general (27.64 NOK mill.); 231 – Energy Policy (272.76 NOK mill.); 231 – Energy Policy (37.93 NOK mill.); 232 – Energy generation, renewable sources (70.75 NOK mill.); 232 – Energy generation, renewable sources (169.17 NOK mill.); 321 – Industry (0.56 NOK mill.); 322 – Mineral resources/ mining (0.01 NOK mill.); 410 – General environmental protection (964.63 NOK mill.); 430 – Other multisector (1.6 NOK mill.); 998 – Unallocated/unspecified (2.6 NOK mill.)
Global Unspecified	219 031 531,87	24 893 907,20	Disbursed	ODA	Grants	Cross-cutting	112 – Basic education (0.56 NOK mill.); 151 – Government and civil society, general (2.89 NOK mill.); 312 – Forestry (0.58 NOK mill.); 410 – General environmental protection (214.79 NOK mill.); 720 – Emergency Response (0.21 NOK mill.)
Papua New Guinea	9 608 000,00	1 091 991,91	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (4.38 NOK mill.); 410 – General environmental protection (5.22 NOK mill.)
Jordan	1 449 000,00	164 685,29	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Lebanon	1 520 000,00	172 754,76	Disbursed	ODA	Grants	Mitigation	313 – Fishing
Palestine	8 000 000,00	909 235,56	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewa-ble sources
Africa Regional	26 150 000,00	2 972 063,74	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (1.55 NOK mill.); 430 – Other multi-sector (24.6 NOK mill.)
Africa Regional	64 505 319,00	7 331 316,23	Disbursed	ODA (62 NOK mill.); OOF (2.51 NOK mill.)	Grants (62 NOK mill.); PSI (2.51 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (62 NOK mill.); 232 – Energy generation, renewable sources (2.51 NOK mill.)
Eastern Africa, regional	1 488 000,00	169 117,81	Disbursed	ODA	Grants	Adaptation	311 – Agriculture
Eastern Africa, regional	44 000 000,00	5 000 795,58	Disbursed	ODA	Grants	Mitigation	236 – Heating, cooling and energy distribution
Middle Africa regional	400 000 000,00	45 461 778,01	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
South of Sahara Regional	12 628 595,76	1 435 296,04	Disbursed	ODA	Grants	Adaptation	430 – Other multisector (4.63 NOK mill.); 740 – Disaster prevention and preparedness (8 NOK mill.)
South of Sahara Regional	45 447 776,00	5 165 341,76	Disbursed	ODA (0.55 NOK mill.); OOF (44.9 NOK mill.)	Grants (0.55 NOK mill.); PSI (44.9 NOK mill.)	Mitigation	231 – Energy Policy (10.92 NOK mill.); 232 – Energy generation, renewable sources (0.55 NOK mill.); 232 – Energy generation, renewable sources (31.49 NOK mill.); 250 – Business and other services (2.49 NOK mill.)
South of Sahara Regional	1 743 269,06	198 130,28	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Western Africa regional	7 416 667,00	842 937,17	Disbursed	ODA	Grants	Mitigation	311 – Agriculture (7 NOK mill.); 410 – General environmental protection (0.42 NOK mill.)
America Regional	1 690 576,00	192 141,48	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
America Regional	110 000,00	12 501,99	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instru-ment	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Caribbean & Central America, regional	10 000 000,00	1 136 544,45	Disbursed	ODA	Grants	Adaptation	740 – Disaster prevention and preparedness
Caribbean & Central America, regional	3 662 802,00	416 293,73	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South America Regional	15 559 527,70	1 768 409,49	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Asia Regional	11 366 640,00	1 291 869,16	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Asia Regional	40 777 015,00	4 634 489,01	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (0.81 NOK mill.); 232 – Energy generation, renewable sources (30 NOK mill.); 410 – General environmental protection (9.96 NOK mill.)
Asia Regional	10 136 941,27	1 152 108,43	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Central Asia Regional	3 800 000,00	431 886,89	Disbursed	ODA	Grants	Cross-cutting	160 – Other social infrastructure and services
Far East Asia Regional	5 310 395,84	603 550,09	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
South Asia Regional	532 406,40	60 510,35	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Europe Regional	1 042 746,00	118 512,72	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
Oceania Regional	5 000 000,00	568 272,23	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy

Table 7.7	Provision of public financial support: contribution through bilateral, regional and other channels in 2020.

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instru-ment	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Total	4 607 094 050,04	489 429 104,88					
Angola	4 012 500,00	426 263,12	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection
Angola	132 252,80	14 049,72	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Cameroon	594 921,25	63 200,74	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Cameroon	522 118,48	55 466,63	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.11 NOK mill.); 410 – General environmental protection (0.41 NOK mill.)
Congo, Dem. Rep.	7 524 946,52	799 403,66	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.71 NOK mill.); 140 – Water and sanitation (4 NOK mill.); 311 – Agriculture (0.54 NOK mill.); 430 – Other multisector (2.28 NOK mill.)
Congo, Dem. Rep.	22 098 786,44	2 347 638,04	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (2.88 NOK mill.); 312 – Forestry (4.86 NOK mill.); 410 – General environmental protection (14.36 NOK mill.)
Congo, Dem. Rep.	938 969,49	99 750,30	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Congo, Rep.	1 055 998,76	112 182,76	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Egypt	924 151,00	98 176,07	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Ethiopia	116 293 217,94	12 354 270,38	Disbursed	ODA	Grants	Adaptation	112 – Basic education (1.64 NOK mill.); 114 – Post-secondary education (0.81 NOK mill.); 140 – Water and sanitation (0.18 NOK mill.); 151 – Government and civil society, general (0.11 NOK mill.); 240 – Banking and financial services (3.56 NOK mill.); 311 – Agriculture (10.73 NOK mill.); 410 – General environmental protection (0.22 NOK mill.); 430 – Other multi-sector (99.06 NOK mill.)
Ethiopia	171 412 563,00	18 209 807,82	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ethiopia	51 854 953,73	5 508 748,75	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (3 NOK mill.); 410 – General environ-mental protection (37.61 NOK mill.); 430 – Other multisector (11.24 NOK mill.)
Gabon	659 895,12	70 103,17	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ghana	1 265 909,60	134 482,39	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ghana	354 252,00	37 633,54	Disbursed	ODA	Grants	Cross-cutting	321 – Industry
Kenya	4 130 817,73	438 832,46	Disbursed	ODA	Grants	Adaptation	313 – Fishing (1.04 NOK mill.); 410 – General environmental protection (3.09 NOK mill.)
Kenya	54 341 441,60	5 772 897,80	Disbursed	ODA (0.89 NOK mill.); OOF (53.46 NOK mill.)	Grants (0.89 NOK mill.); PSI (53.46 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (53.46 NOK mill.); 321 – Industry (0.89 NOK mill.)
Kenya	3 056 352,16	324 687,90	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (2.73 NOK mill.); 410 – General environmental protection (0.33 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru-ment	Type of support	Sector
Liberia	115 091 257,78	12 226 581,59	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.56 NOK mill.); 410 – General environmental protection (114.53 NOK mill.)
Madagascar	1 462 863,60	155 405,56	Disbursed	ODA	Grants	Adaptation	313 – Fishing
Madagascar	5 840 517,20	620 460,33	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (0.31 NOK mill.); 410 – General environmental protection (5.53 NOK mill.)
Malawi	31 609 693,61	3 358 017,85	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (18.9 NOK mill.); 430 – Other multisector (12.71 NOK mill.)
Malawi	4 175 032,00	443 529,51	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.58 NOK mill.); 311 – Agriculture (3.6 NOK mill.)
Mali	28 592 845,02	3 037 526,56	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (26.07 NOK mill.); 410 – General environ-mental protection (2.52 NOK mill.)
Mali	939 273,60	99 782,60	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Mali	7 312 317,00	776 815,22	Disbursed	ODA	Grants	Cross-cutting	430 – Other multisector
Mozambique	28 405 434,01	3 017 617,18	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (3.87 NOK mill.); 311 – Agriculture (13.91 NOK mill.); 430 – Other multisector (10.62 NOK mill.)
Mozambique	3 236 923,60	343 870,69	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (1.91 NOK mill.); 321 – Industry (1.1 NOK mill.); 410 – General environmental protection (0.23 NOK mill.)
Mozambique	2 940 511,54	312 381,71	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Niger	42 934 792,80	4 561 126,16	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (5.93 NOK mill.); 311 – Agriculture (14 NOK mill.); 430 – Other multisector (23 NOK mill.)
Niger	1 365 474,42	145 059,54	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nigeria	8 837 850,00	938 878,38	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Nigeria	22 279 374,80	2 366 822,63	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy (1.28 NOK mill.); 311 – Agriculture (21 NOK mill.)
Somalia	11 266 597,93	1 196 893,50	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (2.6 NOK mill.); 430 – Other multisector (8.66 NOK mill.)
South Africa	612 280,00	65 044,83	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection
South Africa	18 491 132,00	1 964 383,21	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South Sudan	12 000 000,00	1 274 805,59	Disbursed	ODA	Grants	Adaptation	311 – Agriculture
South Sudan	320 875,60	34 087,83	Disbursed	ODA	Grants	Mitigation	114 – Post-secondary education
Tanzania	11 781 647,80	1 251 609,21	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.36 NOK mill.); 311 – Agriculture (9.42 NOK mill.); 410 – General environmental protection (2 NOK mill.)
Tanzania	1 647 408,28	175 010,44	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instru- ment	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Tanzania	9 400 150,14	998 613,66	Disbursed	ODA	Grants	Cross-cutting	240 – Banking and financial services (0.07 NOK mill.); 311 – Agriculture (3.97 NOK mill.); 312 – Forestry (0.31 NOK mill.); 410 – General environmental protection (5.05 NOK mill.)
Togo	2 155 113,66	228 945,91	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Uganda	9 354 787,40	993 794,61	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.63 NOK mill.); 151 – Government and civil society, general (8 NOK mill.); 311 – Agriculture (0.72 NOK mill.)
Uganda	12 249 533,20	1 301 314,45	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (7.21 NOK mill.); 232 – Energy generation, renewable sources (4.02 NOK mill.); 236 – Heating, cooling and energy distribution (0.74 NOK mill.); 410 – General environmental protection (0.27 NOK mill.)
Uganda	9 182 444,03	975 485,92	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (5.19 NOK mill.); 311 – Agriculture (2.83 NOK mill.); 410 – General environmental protection (1.16 NOK mill.)
Zambia	818 880,00	86 992,73	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.62 NOK mill.); 410 – General environmental protection (0.2 NOK mill.)
Zambia	635 604,00	67 522,63	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Zambia	989 577,48	105 126,57	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Zimbabwe	194 580,00	20 670,97	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Bolivia	590 868,44	62 770,20	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.42 NOK mill.); 410 – General environmental protection (0.17 NOK mill.)
Brazil	104 841 571,26	11 137 718,44	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation (0.21 NOK mill.); 151 – Government and civil society, general (21.94 NOK mill.); 410 – General environmental protection (82.69 NOK mill.)
Brazil	685 861,45	72 861,67	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Colombia	213 748,73	22 707,34	Disbursed	ODA	Grants	Adaptation	313 – Fishing (0.07 NOK mill.); 410 – General environmental protection (0.09 NOK mill.); 430 – Other multisector (0.05 NOK mill.)
Colombia	90 345 097,15	9 597 702,92	Disbursed	ODA	Grants	Mitigation	312 – Forestry (4.68 NOK mill.); 410 – General environmental protection (85.67 NOK mill.)
Colombia	29 601 007,20	3 144 627,46	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (1.6 NOK mill.); 410 – General environmental protection (28 NOK mill.)
Ecuador	1 069 974,00	113 667,40	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Guatemala	6 969 664,67	740 413,96	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Guyana	22 566 046,12	2 397 276,82	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Haiti	10 496 950,80	1 115 130,97	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.5 NOK mill.); 430 – Other multi-sector (9 NOK mill.)
Haiti	7 120 000,00	756 384,65	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (1.52 NOK mill.); 410 – General environmental protection (5.6 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru- ment	Type of support	Sector
Nicaragua	1 009 025,60	107 192,62	Disbursed	ODA	Grants	Adaptation	113 – Secondary education
Panama	1 451 296,00	154 176,69	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Peru	57 502 055,06	6 108 661,78	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (10.08 NOK mill.); 410 – General environmental protection (47.42 NOK mill.)
Peru	12 481 892,40	1 325 998,85	Disbursed	ODA	Grants	Cross-cutting	312 – Forestry
Afghanistan	12 972 262,80	1 378 092,76	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (10.37 NOK mill.); 152 – Conflict prevention and resolution, peace and security (2.6 NOK mill.)
Afghanistan	594 309,60	63 135,77	Disbursed	ODA	Grants	Mitigation	311 – Agriculture
Afghanistan	3 763 838,00	399 846,81	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Armenia	2 000 000,00	212 467,60	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Azerbaijan	2 000 000,00	212 467,60	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Bangladesh	6 014 991,20	638 995,37	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Cambodia	444 281,06	47 197,66	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (0.06 NOK mill.); 311 – Agriculture (0.39 NOK mill.)
Cambodia	821 705,73	87 292,92	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (0.08 NOK mill.); 152 – Conflict prevention and resolution, peace and security (0.08 NOK mill.); 311 – Agriculture (0.46 NOK mill.); 410 – General environmental protection (0.2 NOK mill.)
China	955 939,20	101 553,05	Disbursed	ODA	Grants	Adaptation	313 – Fishing
China	39 348 277,62	4 180 117,03	Disbursed	ODA	Grants	Mitigation	160 – Other social infrastructure and services (0.81 NOK mill.); 231 – Energy Policy (1.12 NOK mill.); 410 – General environmental protection (25.69 NOK mill.); 430 – Other multisector (11.72 NOK mill.)
China	1 598 578,00	169 823,01	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Georgia	2 289 325,22	243 203,72	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
India	6 860 178,80	728 782,86	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection (6.67 NOK mill.); 430 – Other multisector (0.19 NOK mill.)
India	3 641 996,40	386 903,11	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
India	8 804 290,97	935 313,28	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.24 NOK mill.); 321 – Industry (0.55 NOK mill.); 410 – General environmental protection (0.79 NOK mill.); 430 – Other multisector (7.22 NOK mill.)
Indonesia	127 825,74	13 579,41	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Indonesia	450 872 175,10	47 897 864,18	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (9.54 NOK mill.); 232 – Energy generation, renewable sources (0.38 NOK mill.); 410 – General environmental protection (440.94 NOK mill.)
Indonesia	26 088 742,40	2 771 506,23	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instru-ment	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Laos	1 953 993,00	207 580,10	Disbursed	ODA (0.72 NOK mill.); OOF (1.23 NOK mill.)	Grants (0.72 NOK mill.); PSI (1.23 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (1.23 NOK mill.); 410 – General environmental protection (0.72 NOK mill.)
Malaysia	594 921,25	63 200,74	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Myanmar	47 965 734,89	5 095 582,26	Disbursed	ODA (24.6 NOK mill.); OOF (23.36 NOK mill.)	Grants (24.6 NOK mill.); PSI (23.36 NOK mill.)	Mitigation	151 – Government and civil society, general (1.5 NOK mill.); 231 – Energy Policy (5.48 NOK mill.); 232 – Energy generation, renewable sources (23.36 NOK mill.); 410 – General environmental protection (17.63 NOK mill.)
Myanmar	5 822 923,00	618 591,23	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nepal	9 273 549,03	985 164,35	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.31 NOK mill.); 151 – Government and civil society, general (1.67 NOK mill.); 311 – Agriculture (0.71 NOK mill.); 430 – Other multi-sector (6.58 NOK mill.)
Nepal	27 494 755,60	2 920 872,35	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (1.23 NOK mill.); 236 – Heating, cooling and energy distribution (26.26 NOK mill.)
Pakistan	3 719 503,40	395 136,98	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.68 NOK mill.); 152 – Conflict prevention and resolution, peace and security (1.61 NOK mill.); 430 – Other multisector (0.43 NOK mill.)
Pakistan	74 219,20	7 884,59	Disbursed	ODA	Grants	Cross-cutting	140 – Water and sanitation
Sri Lanka	930 389,59	98 838,82	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (0.28 NOK mill.); 313 – Fishing (0.45 NOK mill.); 430 – Other multisector (0.2 NOK mill.)
Sri Lanka	1 101 306,23	116 995,95	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Tajikistan	7 621 038,40	809 611,86	Disbursed	ODA	Grants	Mitigation	236 – Heating, cooling and energy distribution
Thailand	366 599,49	38 945,26	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Viet Nam	369 765,00	39 281,54	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education
Viet Nam	6 308 937,21	670 222,37	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (3.42 NOK mill.); 240 – Banking and financial services (0.22 NOK mill.); 311 – Agriculture (0.57 NOK mill.); 410 – General environmental protection (2.1 NOK mill.)
Global Unspecified	208 606 392,40	22 161 049,63	Disbursed	ODA	Grants	Adaptation	121 – Health, general (13.6 NOK mill.); 151 – Government and civil society, general (0.7 NOK mill.); 311 – Agriculture (32 NOK mill.); 313 – Fishing (8.03 NOK mill.); 410 – General environmental protection (19.75 NOK mill.); 430 – Other multisector (128.94 NOK mill.); 720 – Emergency Response (0.1 NOK mill.); 740 – Disaster prevention and preparedness (5.5 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru-ment	Type of support	Sector
Global Unspecified	1 427 373 251,12	151 635 283,55	Disbursed	ODA (1180.52 NOK mill.); OOF (246.85 NOK mill.)	Grants (1180.52 NOK mill.); PSI (246.85 NOK mill.)	Mitigation	151 – Government and civil society, general (36.08 NOK mill.); 231 – Energy Policy (172.08 NOK mill.); 231 – Energy Policy (40.61 NOK mill.); 232 – Energy generation, renewable sources (40 NOK mill.); 232 – Energy generation, rene-wable sources (206.24 NOK mill.); 321 – Industry (0.56 NOK mill.); 322 – Mineral resources/ mining (1.16 NOK mill.); 410 – General environmental protection (925.65 NOK mill.); 720 – Emergency Response (2.4 NOK mill.); 998 – Unallocated/unspecified (2.6 NOK mill.)
Global Unspecified	246 110 222,10	26 145 223,95	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (2.78 NOK mill.); 250 – Business and other services (0.2 NOK mill.); 410 – General environmental protection (200.94 NOK mill.); 720 – Emergency Response (42.2 NOK mill.)
Papua New Guinea	8 538 201,59	907 045,59	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (3.86 NOK mill.); 410 – General environmental protection (4.68 NOK mill.)
Jordan	2 000 000,00	212 467,60	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Lebanon	1 280 000,00	135 979,26	Disbursed	ODA	Grants	Mitigation	313 – Fishing
Africa Regional	27 454 427,60	2 916 588,15	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (4.93 NOK mill.); 430 – Other multisector (22.52 NOK mill.)
Africa Regional	131 405 958,00	13 959 754,17	Disbursed	ODA (40 NOK mill.); OOF (91.41 NOK mill.)	Grants (40 NOK mill.); PSI (91.41 NOK mill.)	Mitigation	231 – Energy Policy (10.69 NOK mill.); 232 – Energy generation, renewable sources (40 NOK mill.); 232 – Energy generation, renewable sources (80.71 NOK mill.)
Africa Regional	120 466,05	12 797,57	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Eastern Africa, regional	4 720 069,20	501 430,88	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.03 NOK mill.); 311 – Agriculture (4.69 NOK mill.)
Eastern Africa, regional	25 910 716,40	2 752 593,85	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation (0.91 NOK mill.); 236 – Heating, cooling and energy distribution (25 NOK mill.)
Middle Africa regional	400 000 000,00	42 493 519,74	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
South of Sahara Regional	12 980 917,00	1 379 012,13	Disbursed	ODA	Grants	Adaptation	430 – Other multisector (3.78 NOK mill.); 720 – Emergency Response (3.2 NOK mill.); 740 – Disaster prevention and preparedness (6 NOK mill.)
South of Sahara Regional	50 418 973,00	5 356 199,06	Disbursed	OOF	PSI	Mitigation	231 – Energy Policy (7.59 NOK mill.); 232 – Energy generation, renewable sources (42.83 NOK mill.)
South of Sahara Regional	1 158 560,50	123 078,28	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Western Africa regional	8 352 806,56	887 350,38	Disbursed	ODA	Grants	Mitigation	311 – Agriculture (8.31 NOK mill.); 410 – General environmental protection (0.05 NOK mill.)
America Regional	1 573 691,00	167 179,17	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instru- ment	Type of support	Sector
Caribbean & Central America, regional	2 651 818,00	281 712,70	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South America Regional	6 552 536,94	696 100,89	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Asia Regional	6 015 373,00	639 035,93	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.02 NOK mill.); 313 – Fishing (4 NOK mill.); 430 – Other multisector (2 NOK mill.)
Asia Regional	50 229 232,00	5 336 042,15	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (2.04 NOK mill.); 232 – Energy generation, renewable sources (2 NOK mill.); 410 – General environmental protection (46.19 NOK mill.)
Asia Regional	10 124 170,40	1 075 529,09	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Far East Asia Regional	5 801 329,00	616 297,22	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
South & Central Asia Regional	81 401 370,00	8 647 576,81	Disbursed	OOF	PSI	Mitigation	231 – Energy Policy
South Asia Regional	566 416,00	60 172,52	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.43 NOK mill.); 311 – Agriculture (0.14 NOK mill.)
South Asia Regional	193 149,67	20 519,02	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Europe Regional	513 770,40	54 579,78	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
Oceania Regional	5 000 000,00	531 169,00	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Oceania Regional	3 000 000,00	318 701,40	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education

7.1.5 Bilateral cooperation in selected countries

Below follows a description of Norwegian cooperation with a selection of countries. The examples are referring to 2019 and 2020.

7.1.5.1 Ethiopia

Norway has an extensive collaboration with Ethiopia on forestry, landscape restoration, agriculture, food security, environment and climate change, and the funding from the Embassy in Addis Ababa was over NOK 605 million in the period 2019–2020. The funds support Ethiopia in implementing their green development plan and in order to achieve the sustainable development goals.

A majority of the funds goes to support Government of Ethiopia to roll out large national programmes within agriculture and forestry, both focusing on improving the livelihood of small-scale farmers and rehabilitating large areas of land. At the end of 2020, this had resulted in 440 000 ha natural forest protected due to participatory forest management, and 600 000 ha of land restored, including planting of new forest. More than 557 921 households received land use right certificates, providing farming households with security and incentives to develop and protect their land holdings. Institutional cooperation between Ethiopian universities and universities abroad had in 2020 supported 117 MSc and PhD students involved in watershed management, agroforestry, climate smart agriculture, renewable energy sources and crop and livestock production.

7.1.5.2 Malawi

Norwegian support to Malawi for agriculture, food security and environment was NOK 74.7 million in 2020. The main support in this area was through a multi-donor trust fund with the World Bank. With this joint support, the Malawian Ministry of Agriculture were able to provide guidance to 81 444 farmers in climate adapted farming methods with a focus on climate change adaptation. Norway is also supporting civil society organizations that enables small holder farmers to become more food secure, increased their nutritional status by crop and livestock diversification and increased their income. Support to build capacity to teach and to carry out research on different climate challenges affecting Malawi was, and still is, a key part of Norwegian support to the Lilongwe University of Agriculture & Natural Resources (LUANAR). In addition, Norway supported feasibility studies for a hydroelectric project in southern Malawi. The dam will have the potential to generate a total of 350 megawatts and is expected to commence in 2023. The hydroelectric power plant is estimated to supply electricity to approximately 2 million people, and avoid emissions of 520 000 tonnes of CO_2 per year.

7.1.5.3 Tanzania

Norway's climate related support to Tanzania has been for projects on REDD+ and REDD readiness through the Vice President's office. This includes capacity building for carbon monitoring and carbon project registry through the National Carbon Monitoring Centre. Support has also been given to Southern Agricultural Growth Corridor of Tanzania (SAGCOT) to promote agriculture productivity through climate smart practices and support for developing alternative livelihoods for forest dwellers and sustainable timber production through the Eastern Arc Mountains Conservation Endowment Fund (EAMCEF). The Agricultural council of Tanzania has in the past been supported to finance extension services to farmers that will enable them to adopt climate smart agricultural practices.

7.1.6 The Government of Norway´s International Climate and Forest Initiative

Norway's International Climate and Forest Initiative (NICFI) supports global efforts that reduce greenhouse gas emissions from deforestation and forest degradation in developing countries (REDD+). Forest and land use emissions are estimated to account for about 10 per cent of global net anthropogenic greenhouse gas emissions. It represents an even bigger part of the near term potential solution by simultaneously halting forest loss and restoring forest lands. Forest and land use emissions are a necessary part of the solution of the ambitious target of the Paris-Agreement of limiting the global warming to below 2 degrees Celsius. This is also among the most cost-effective ways to mitigate climate change, and contributes to most of the sustainable development goals.

From 2008 through 2020 Norway had disbursed NOK 31 billion through NICFI, and is committed to continue allocating NOK 3 billion a year. These funds are used to pay for verified emission reductions in partner countries, to finance efforts to build up global and national REDD frameworks, build satellite technology to monitor global forests in real time, and to support civil society and indigenous peoples around the world. See table below for details of the disbursements.

7.1.6.1 Transparency, civil society and private sector

Since 2009 NICFI has contributed to a technology revolution that provides completely new opportunities for monitoring the forest. Satellite pictures have improved massively, and pictures are made available more frequently, and open to the public. The Global Forest Watch website is developed with support from Norway, providing forest countries with free data on forests, deforestation over time, forest fires etc. It is also a key priority to support the countries' own forest monitoring systems, so that they can better manage their resources.

Access to information otherwise has increased and improved the framework conditions for civil society and indigenous peoples organisations. With the support of NICFI, they can report on illegalities, thus imposing responsibility for both authorities and private actors. Law enforcement institutions have furthermore received training of by UN and INTERPOL.

Civil society organisations received over NOK 500 million from NICFI yearly in 2019–2020. Between 2013–2015 42 civil society actors received support. Priority areas were sustainable landscapes, sustainable commodity supply chains, analysis and knowledge production and global consensus on REDD+. A new portfolio of organisations was selected in 2015 through a call for proposals for the period 2016–2020. Priority areas are transparency, deforestation free supply chains, indigenous peoples and global consensus on REDD+.

NICFI aims at developing innovative models for public-private cooperation. An example of this is the fund &Green, established in 2017. The fund will promote deforestation-free business models by absorbing private sector risks as well as encouraging individual jurisdictions to raise their standards to qualify for &Green financing. Norway has disbursed a total of NOK 500 million to the fund. Meeting places between public and private sectors for deforestation supply chains are established through, among others, the Tropical Forest Alliance and the Business and Sustainable Development Commission, established with the support of Norway's Ministry of Climate and Environment.

7.1.6.2 Bilateral partnerships

In 2008 Norway pledged to contribute up to USD 1 billion to the Amazon Fund in Brazil until 2015, if Brazil could show that deforestation in the Amazon went down. From 2008 to 2014, Brazil reduced deforestation in the Amazon by around 60 per cent. Based on these results, by the end of 2015 Norway fulfilled its 2008-commitment to contribute USD 1 billion to the Brazilian Amazon Fund in recognition of Brazil's massive reductions of deforestation in its Amazon region. Since 2015 the deforestation in the Brazilian Amazon has increased. Norway only pays Brazil when it reduces deforestation.

At the climate summit in Paris in 2015, Colombia, Germany, Norway and the UK announced a partnership[77]to protect Colombia's rainforest, at the summit in Glasgow 2021 it was extended up to 2025. Colombia will implement an ambitious package of cross-sectoral actions and strengthened self-governance of ethnic territories to reduce deforestation and promote sustainable development. To support that commitment, Germany, Norway and the United Kingdom will contribute close to USD 300 million through the REM-program, primarily through results-based payments for reduced deforestation. From 2016–2019 Norway has paid Colombia NOK 300 million through the REM-program, rewarding 7.5 mill. tons of reduced emissions from deforestation in Colombia's Amazon rainforest.

In 2014, Peru, Germany and Norway entered into a partnership to support Peru's efforts in reducing greenhouse gas emissions from deforestation and forest degradation in the Peruvian Amazon. In 2021, this collaboration was extended up to 2025, and the United States and the United Kingdom joined the partnership. Norway is committed to support Peru's efforts with up to NOK 1 800 million – more than USD 200 million, up to 2025. Of this, up to NOK 1 500 million are payments for reduced deforestation, certified by the third-party standard Architecture for REDD+ Transactions.

Norway and Guyana signed a climate and forest partnership in November 2009[78]. Norway has fulfilled the pledge of paying Guyana a total of NOK 1.5 billion, of which 1.2 billion for a total of 34.7 million tons of verified emission reductions. Most of the contribution is channelled through the Guyana REDD+ Investment Fund (GRIF), administered by the World Bank. Guyana spends the money on projects to realise Guyana's low carbon development strategy.

In 2010, Norway signed a partnership with Indonesia to support the country's efforts to reduce greenhouse gas emissions from deforestation, forest degradation and the destruction of peat with up to 1 billion USD. Norway has so far disbursed almost NOK 1 billion to climate and forest efforts in Indonesia. Indonesia has made substantial policy changes in the partnership period, e.g. by adopting a moratorium on the destruction of forests on peat lands, and has had a massive reduction in deforestation.

In 2012, Norway entered into a climate- and forest agreement with Vietnam. The agreement includes a support of 180 million to strengthen Vietnam's capacity to reduce greenhouse gas emissions from forests, strengthen sustainable forest management in six pilot provinces, and contributing to increased collaboration with neighbouring countries to combat illegal logging and trade in timber. Norway disbursed NOK 189 million to Vietnam through the UNDP and UN REDD, until the partnership ended in 2018.

In 2013 Norway and Ethiopia entered into an agreement to reduce emissions from deforestation and forest degradation and increase the uptake of carbon in forests. Norway has pledged to support REDD+ efforts in Ethiopia with up to USD 20 million yearly, depending on progress and results. The agreement builds on a broader climate cooperation signed during the UN climate summit in Durban in 2011. Ethiopia has designed a REDD+ strategy, developed a framework for safeguards, and invested in institution building and a system

[77] https://www.regjeringen.no/en/aktuelt/norway-and-colombia-join-forces-to-protect-rainforest/id2422635/
[78] https://www.regjeringen.no/no/aktuelt/solheim-signerer-historisk-regnskogavtal/id584986/

for monitoring and reporting carbon emission from deforestation. Ethiopia is now implementing concrete projects to reduce deforestation, restore forest and enhance the legal framework in the forest sector. Through 2020 Norway has disbursed about NOK 850 million to Ethiopia under the partnership.

In 2014 Liberia and Norway entered into a partnership with the aim of facilitating green growth through emphasize on community forests, sustainable forest management and the development of a “deforestation free” agricultural sector. Norway will support Liberia’s efforts with up to NOK 1 billion, including supporting improved management and enhancing sustainable economic activities in priority forest landscapes, delivering multiple benefits such as resilient livelihoods, income generating activities, and emissions reductions. An innovative public private model is developed for deforestation free palm oil, through using public funds to support project development and leverage private investments for community outgrowers, in return for multi-party commitment to protect natural forest. Through 2020 Norway has disbursed about NOK 400 million under the partnership with Liberia.

The Congo Basin is the world’s second largest rainforest. Central African Forest Initiative (CAFI) was established in 2015. CAFI’s[79] goals are to recognize and preserve the value of the forests in the region to mitigate climate change, reduce poverty, and contribute to sustainable development. CAFI is the largest international collaboration to protect the Congo Basin. It consists of six Central African countries (DRC, Republic of Congo, Gabon, Cameroon, Equatorial Guinea and the Central African Republic), five donors (UK, France, Germany, EU and Norway) and international organisations (UN and the World Bank). In 2016, CAFI and the Minister of Finance of the DR Congo signed a letter of intent[80] (LOI) for 200 million US dollars to address deforestation and forest degradation in the country and to promote sustainable development. This LOI[81] is the first signed between CAFI and a country of the Central Africa region, and the largest one ever concluded on REDD+ in Africa. In 2019 Gabin signed a results-based payment agreement worth USD 150 million with CAFI. CAFI is the main channel for Norwegian support to the Congo basin forests, through 2020 NOK 2 billion has been channelled through CAFI. In addition Norway supports civil society organisations and multilateral initiatives that operate in the region.

7.1.6.3 Multilateral collaboration

The UN-REDD Programme is the United Nations Collaborative Initiative on Reducing Emissions from Deforestation and forest Degradation (REDD+) in developing countries. The Programme was launched in 2008 and builds on the convening role and technical expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The UN-REDD Programme supports nationally led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including indigenous peoples and other forest-dependent communities, in national and international REDD+ implementation. For the period 2017 through 2020, the contributions totalled NOK 370 million.

The Readiness Fund of the World Bank’s Forest Carbon Partnership Facility (FCPF) supports tropical and sub-tropical developing countries in preparing themselves to participate in a future, large-scale,

[79] http://www.cafi.org/

[80] https://www.regjeringen.no/globalassets/departementene/kld/kos/drc/undp-pr-cafi-drc.pdf

[81] https://www.regjeringen.no/globalassets/departementene/kld/kos/drc/letterofintent_drc_cafi.pdf

system of positive incentives for REDD+. This includes: adopting national REDD+ strategies; developing reference emission levels (RELs); designing measurement, reporting, and verification (MRV) systems; and setting up REDD+ national management arrangements, including proper environmental and social safeguards. For the period 2013 through 2016, Norway contributed NOK 252 million.

The Carbon Fund of the World Bank's Forest Carbon Partnership Facility (FCPF). Countries that have made significant progress in their REDD+ readiness endeavours may be selected to participate in the Carbon Fund, through which they can receive results-based payments for verified emmission reductions. The Carbon Fund's payments are intended to provide an incentive to the recipient countries and the various stakeholders – including forest-dependent indigenous peoples, other forest dwellers or the private sector – within each of these countries, to achieve long-term sustainability in financing forest conservation and management programs. This would help reduce the negative impact on the global climate from the loss and impoverishment of forests. For the period 2017 through 2020, Norway contributed NOK 590 million to the Carbon Fund, which concluded the Norwegian contribution to FCPF.

Table 7.8 Disbursements from Norway's International Climate and Forest Initiative (NICFI).

NICFI disbursements (*1000 NOK*)	2020	2008–2020
Brazil	53 416	8 467 803
Indonesia	410 170	1 943 296
Guyana	9 989	1 485 210
Colombia	87 728	696 462
Ecuador	0	173 469
Tanzania	4 879	385 406
Vietnam	0	189 000
Ethiopia	201 860	847 400
Peru	35 657	171 535
Liberia	105 000	409 008
Congo Basin*	400 000	2 686 306
Civil Society and indigenous peoples	590 509	3 622 983
Green economy initiatives	12 330	184 770
Public-private[82] initiatives	182 859	1 010 797
UN-REDD program	136 535	1 941 211
FCPF – Readiness and Carbon fund	0	2 856 621
BioCarbon Fund (T3 and +)	0	805 350
The Green Climate Fund	300 000	380 000
FIP	0	855 000
Other	517 721	2 847 799
Total	**3 048 653**	**31 400 653**
Administration[83]	102 031	868 287

*Central African Forest Initiative (CAFI) from 2015. Before: Congo Basin Forest Fund (CBFF), CARPE

[82] https://www.regjeringen.no/no/tema/klima-og-miljo/klima/klima--og-skogsatsingen/kos-innsikt/regnskogen-og-naringslivet/id2345594/
[83] https://www.regjeringen.no/no/tema/klima-og-miljo/klima/klima--og-skogsatsingen/kos-innsikt/klima--og-skogsatsingens-ansatte/id734275/

7.1.7 Norwegian earmarked support to adaptation

In 2020, USD 67 million in earmarked support was targeting climate change adaptation only (14 per cent of total earmarked support), and USD 50 million was cross-cutting support (10 per cent of total earmarked support). When focusing on total earmarked adaptation financing[84] (without excluding cross-cutting support), the earmarked adaptation support amounted to USD 96 million in 2019 and USD 107 million in 2020.

This earmarked support for adaptation includes climate smart agriculture and food security, strengthening resilience and early warning systems. In 2020, the four largest areas for our earmarked climate adaptation support was Other multisector (NOK 363 million), General environmental protection (NOK 309 million), Agriculture (NOK 182 million) and Government and civil society (NOK 24 million).

Africa received the largest share of this support, about 46 per cent of the total adaptation support in 2020. Among countries, Ethiopia, Niger and Mali received the highest amount of funding for climate change adaptation in 2020.

A large part of Norway's support for adaptation, however, is core support to multilateral institutions, amongst others the Adaptation fund and the GCF. As specified in section 7.1.3. we do not report climate specific multilateral core support to adaptation.

In line with the mandate of the GCF, about half of Norway's support to the GCF, NOK 1 400 million in the period 2019–2020, will go to adaptation with a floor of 50 per cent of the adaptation allocation for particularly vulnerable countries. Support to the GEF and the United Nations Environment Programme (UNEP) also includes adaptation to climate change.

While a large part of total Norwegian climate finance is allocated to REDD+ and renewable energy programmes, both of which are classified as mitigation, several REDD projects may have strong adaptation components, since forest conservation in many cases will increase climate change resilience.

Below are some examples of measures and programmes that Norway supports, and which are relevant to adaptation:

7.1.7.1 UNISDR / UNDRR

Norway supported the 2016–2019 work programme of UNs disaster risk reduction agency UNISDR with NOK 25 million (USD 3.0 million) in 2019 and UNDRR 2021–2022 work program with NOK 42 million (USD 5.1 million) in 2020. UNDRR (former UNISDR) oversees the implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030, supporting countries in its implementation, monitoring and sharing what works in reducing existing risk and preventing the creation of new risk. UNDRR also works to foster coherence between the Sendai Framework and the Paris Agreement. UNDRR's vision is a substantial reduction of disaster losses and risk for a sustainable future.

7.1.7.2 Global Facility for Disaster Reduction and Recovery (GFDRR)

Norway supported the World Bank's Global Facility for Disaster Reduction and Recovery with an annual contribution of NOK 30 million (USD 3.6 million) in 2019 and multiannual contribution for 2020–2025 with NOK 50 million (USD 6.1 million) in 2020. GFDRR is a global partnership that sup-

[84] There are discrepancies between total earmarked adaptation support and the sum of adaptation and cross-cutting. This is because cross-cutting activities may have different scores (principal/significant) on the two Rio markers, and therefore different coefficients are applied 100/40 when calculating climate financing.

ports developing countries better understand and reduce their vulnerability to natural hazards and climate change. GFDRR contributes to the implementation of the Sendai Framework for Disaster Risk Reduction by helping countries to integrate disaster risk management and climate change adaptation into development strategies and investment programmes and recover from disasters quickly and effectively.

7.1.7.3 International Centre for Integrated Mountain Development (ICIMOD)

Norway has supported ICIMOD's work aiming at improved well-being for the people of the Hindu Kush Himalayas from eight countries. The funds cover Core Support and support to two Regional Programmes. One is focusing on transboundary River Basins and the Cryosphere. The second one Climate Adaption and Disaster Risk Reduction, including support for monitoring air pollution (black carbon). This includes pilot projects like the pilot on Resilient Mountain Villages in Kavre, Nepal that has been implemented in 8 villages, with 1089 households and 83 per cent women participants. The approach has been a basis for the Government of Nepal's climate smart villages programme, which is to be implemented in 14 districts and 116 villages.

7.1.7.4 Global Framework for Climate Services (GFCS)

Norway has since 2011 supported GFCS programmes on improving the quality and availability of climate services in Africa. GFCS provides basic data on climate and hydrology that are important to avert immediate loss and damage, but it is also an important planning tool for infrastructure investment, agriculture and energy. It has aimed at increasing the resilience of people most vulnerable to the impacts of weather and climate-related hazards. Norway's support has since 2013 targeted support to Tanzania and Malawi in four areas: 1. Strengthened capacity of national hydromet agencies to provide climate services; 2. Strengthened use of climate information to vulnerable communities for food security and livelihoods; 3. Strengthened capacity of health professionals to use climate information for public heath preparedness and resilience to climate related health risks; and 4. Increased use of climate and weather information by vulnerable communities to improve disaster risk reduction in vulnerable communities.

7.1.8 Norwegian Assistance to Renewable Energy

Norway has been supporting renewable energy projects in developing countries for many years. The funds are primarily used to support the generation of renewable energy, access to energy, including clean cooking, building of transmission and distribution systems, establishment of power pools and strengthening of institutions and increased capacity in the energy sector.

In 2020, Norwegian support to renewable energy amounted to USD 150 million (NOK 1 409 million), of which USD 77 million (NOK 729 million) was ODA and USD 72 million (NOK 680 million) was Norfund's investments (Other official flows). Renewable energy support reported as climate financing amounted to USD 101 million (NOK 952 million).

Of the total ODA support to renewable energy sectors, Africa received 43 per cent and Asia 22 per cent, whereas 34 per cent was distributed globally through multilateral and regional organisations and initiatives, civil society and commercial development. Furthermore, Norfund – which serves as the commercial investment instrument of Norway's development policy – invested NOK 680 million in renewable energy in 2020. Not all these projects are climate spesific.

The focus in Norway's development cooperation on renewable energy has been measures that facilitate private and commercial investments, especially in generation of renewable energy. Key areas are policy dialogue and cooperation on reform, legislation, institution-building, planning and regional cooperation. Based on the private investments in new generation, access to electricity has been supported through development support to the extension of the grid as well as support to off grid solutions. Norfund is the primary vehicle to support large-scale projects for generation of renewable energy.

The only way to overcome the major challenges of ensuring global access to electricity services is to accelerate investment in long-term solutions making use of the renewable energy resources available in each country. Norway aims at leveraging funds for the reduction of energy poverty. Public and donor funds are not alone able to finance the significant amounts needed to boost energy sector development; thus, Norwegian assistance for clean energy uses public sources to mobilise and incentivise commercial investment that lead to increased energy access and energy efficiency. Only by including the private sector is it realistic for renewable energy to become an important tool in the fight against global climate change.

Some examples from bilateral and multilateral partnerships follow below:

7.1.8.1 Bilateral partnerships

Mozambique

Norway has been a partner to the energy sector in Mozambique for more than 40 years. Norway provides funding to technical assistance, development of legal and regulatory framework, mobilising of private investments and energy access. The Contributions for 2019 and 2020 were NOK 119 million and NOK 66 million, respectively. Through a World Bank multi-donor fund, Norway contributed to 18 000 connections in 2020, supplying 90 000 people. The 40 MW Mocuba power plant, where Norway supported transmission infrastructure, had its first year of full operation in 2020 and generated appr. 70 GWh, contributing to CO_2 emission reductions.

Nepal

Norway has supported Nepal's electricity sector for almost 60 years. The Contributions for 2019 and 2020 were NOK 73 million and NOK 71 million, respectively. Through the collaboration with the Asian Development Bank (ADB) and the Government of Nepal, Norway has contributed to 301 km of transmission lines, which facilitates hydropower development. This collaboration has also contributed to 692 km of distribution network and 22 substations between 2011 and 2020. Norway has also contributed to capacity building in the hydropower sector through university and research cooperation and through the International Finance Corporation (IFC).

7.1.8.2 Multilateral partnerships

IRENA (The International Renewable Energy Agency)

Norway has been an active member of IRENA, the leading global centre of excellence on renewable energy, since its establishment. In addition to Norway's core assessed contribution, there has been a voluntary contribution of NOK 59 million between 2017–2020 to IRENA's Work Programme and Budget.

Climate Investment Funds (CIF, World Bank)

Norway was active in the design and consultation process leading up to the establishment in 2008 of the umbrella framework for climate funds, the Climate Investment Funds (CIF) hosted by the World Bank. SREP contributes to energy transition. Norway has contributed NOK 802 million (2010–2018) to SREP (Scaling up Renewable Energy in Low Income Countries). Ongoing projects have started to deliver results, including electricity production of 167 of the expected 3 778 GWh per year and reduced CO_2 emissions of 235 of the expected 2.8 million tonnes per year.

Sustainable Energy Fund for Africa (SEFA)
Norway has contributed NOK 125 million to the African Bank's Sustainable Energy Fund (SEFA) in 2017–2022. In 2020, SEFA contributed to developing renewable energy in Africa corresponding to 21 MW and 40 600 tonnes of CO_2 reductions. SEFA contributed to energy access for 30 000 households. SEFA also contributed to more than 4 000 new jobs in Africa. With funds from SEFA, AfDB created the covid-19 "Off-Grid Recovery Platform", which assists companies with loans so that they could maintain their business through the pandemic.

The Energy Sector Management Assistance Program (ESMAP)
Norway contributed 11.3 per cent of the financing (NOK 360 million) of the World Bank's programme for support to governance and capacity building in the energy sector (ESMAP) in 2017–2020. ESMAP has catalysed energy investments and loans through the World Bank, contributing to electricity access for nine million people by 2019/2020. In Uganda, the sale of over 64 000 efficient stoves contributed to a 30 per cent reduction in greenhouse gas emissions, i.e. 35 754 tonnes of CO_2 annually.

Clean Energy Financing Partnership Facility (Asian Development Bank)
Norway contributed in total NOK 92 million in 2017–2020 to the Clean Energy Fund under the Clean Energy Financing Partnership Facility, which aims at improving energy security and decrease the rate of climate change in ADB developing member countries through clean energy development.

Energising Development (EnDev)
Norway is one of the contributors to the partnership Energising Development (EnDev), which has reached 23.8 million people with modern energy services since 2005. Corresponding annual CO_2 emission reductions by 2020 are 2.39 million tons, mostly through improved cook-stoves. The majority of EnDev's activities targets least developed countries and Sub-Saharan Africa. Norway's contribution to EnDev was NOK 140 million in 2017–2020.

International Centre for Hydropower (ICH)
The Norwegian-based International Centre for Hydropower (ICH) has members from the hydropower industry as well as Norwegian public institutions. ICH contributes to capacity building in sustainable hydropower in emerging markets and developing countries through courses and training.

Enterprise Development for Jobs
The Norwegian Agency for Development Cooperation (Norad) manages the Enterprise Development for Jobs (EDFJ) support scheme. EDFJ provides project development support and guarantee subsidies for renewable energy projects. In 2019 and 2020, EDFJ contributes to developing more projects towards financial close. Two examples are the 150 MW Sukkur (construction phase) solar power project in Pakistan and the 206 MW Ruzizi III project (planning phase) on the border between Rwanda and the Democratic Republic of the Congo (DC).

7.2 Technology development and transfer

Transfer of technology and expertise in order to promote development, availability and efficiency of energy constitutes an important element of ODA and has significant environmental co-benefits that are consistent with the promotion of the Convention on Climate Change. In addition, Norway supports a wide range of technology transfer efforts, of which a few are described in more detail below. Norway considers the Global Energy Transfer Feed-in Tariff pilot programme to be a success story related to technology transfer, see chapter 6.7 of the Biennial Report. Norway has no information to report on failure stories related to technology transfer. For information on steps taken to support development and enhancement of endogenous capacities and technologies of developing countries, see chapter 6.6 of the BR. For tabular information on provision of technology development and transfer support, see table A3-24 in the BR.

7.2.1 Support to the Technology mechanism

The Climate Technology Centre and Network (CTCN) is the operational arm of the technology mechanism under the UN's Framework Convention on Climate Change and serving the Paris Agreement. Norway has since the establishment of the CTCN been a major donor. In addition, come in-kind contributions in the form of membership in the Advisory Board over several periods. The Centre promotes the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries. Over 100 requests from developing countries have been/are in the process of receiving technical assistance to provide technology solutions, capacity building and advice on policy, legal and regulatory frameworks tailored to the needs of individual countries.

7.2.2 Private Finance Advisory Network (PFAN, UNIDO)

Private Finance Advisory Network (PFAN) is a multilateral cooperative activity that identifies and nurtures promising, innovative clean and renewable energy projects by bridging the gap between investors, clean energy entrepreneurs and project developers. PFAN is one of few actors in the climate finance field addressing the barriers for small and medium enterprises (SMEs) in developing countries and emerging economies, by leveraging private sector investment with a small amount of public funds. PFAN was developed by the Climate and Technology Initiative established at the first Conference of the Parties to the UNFCCC in 1995 under an implementing agreement with the International Energy Agency. UNIDO and REEEP have taken over the hosting of the PFAN initiative.

7.2.3 The Clean Energy Ministerial

Norway is a member of the Clean Energy Ministerial (CEM). CEM is a high-level global forum for promotion of policies and programmes that advances clean energy technology, for sharing lessons learned and best practices, and for encouraging the transition to a global clean energy economy. Initiatives are based on areas of common interest among participating governments and other stakeholders. The CEM focuses on three global climate and energy policy goals: Improving energy efficiency worldwide; Enhancing clean energy supply and; Expanding clean energy access

The main object is to improve policies and enhance deployment of clean energy technologies. Focused dialogue can accelerate the global clean energy transition. CEM initiatives focus on empowering energy decision-makers around the world with the up-to-date information and tools they need to improve the policy environment for clean energy. This low-cost, high-impact technical work also facilitates international coordination that amplifies each government's clean energy deployment efforts.

Norway provides funding for the CEM Secretariat, The CEM CCUS Initiative and CEM Hydrogen Initiative.

7.2.4 Mission Innovation

Norway has participated in Mission Innovation since the start of the initiative in November 2015.

Today, 22 countries and the European Union participate in the initiative. Mission Innovation aims to reinvigorate and accelerate public and private global clean energy innovation with the objective to make clean energy widely affordable. Each participating country will seek to double its governmental and/or state-directed clean energy R&D investment over five years. New investments will be focused on transformational clean energy technology innovations that can be scalable to varying economic and energy market conditions that exist in the participating countries and in the broader world.

The goal under Mission Innovation was to double the already considerable public resources devoted to developing and demonstrating clean energy technologies and solutions from 2015 to 2020. This means increased efforts on renewable energy technologies, energy efficiency and carbon capture and storage. Important stakeholders will be the Research Council of Norway (RCN), Enova, Gassnova, as well as energy research institutions and the private sector. In 2019 the number was increased to NOK 387.7 million from a baseline of NOK 128.7 million (2015).

Norway has always given high priority to the development, use and deployment of environmentally sound technologies. Mission Innovation will put the world on a faster route to the point where we can secure energy access for all, while at the same time curbing global emissions of greenhouse gases.

In 2021 Mission Innovation was renewed for a five-year period. Building on the success of the first phase and recognising the vital need for clean energy investment to accelerate innovation, each Member seeks to sustain, and wherever possible increase investment in clean energy research, development and demonstrations over the second phase. Members will accelerate innovation through strengthened international cooperation in areas of mutual interest. Members will actively participate in at least one major Mission Innovation initiative, through a demonstrable leadership role in either a Mission or the Innovation Platform, identifying opportunities to bring resources to support the delivery of common goals and sharing knowledge. Members will also support coordination through their engagement with other clean energy alliances and initiatives.

7.2.5 International support and activities related to carbon capture and storage

Both the International Energy Agency (IEA) and the findings of the Intergovernmental Panel on Climate Change have pointed out that CO_2 capture and storage (CCS) will be an important mitigation tool. In order for CCS to become a viable mitigation tool, countries and companies need to invest in technology development and demonstration of CO_2 capture and storage projects.

International cooperation on developing and commercialising new technology is also essential. Norway therefore provides funding for CCS projects abroad in cooperation with other countries and through existing programmes and institutions.

Norway is participating actively in a range of regional and international initiatives. For example, Norway is involved in the North Sea Basin Task Force, the World Bank CCS Capacity Building Trust Fund, the Zero Emission Platform (the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP)) and the Carbon Sequestration Leadership Forum and Clean Energy Ministerial CCUS Initiative. Norway is also working with international organisations like the International Energy Agency (IEA).

Below follow a few examples of our support.

7.2.5.1 The Carbon Sequestration Leadership Forum

The Carbon Sequestration Leadership Forum (CSLF) has 23 member states including China, India, South Africa, Mexico, the Republic of Korea, Brazil, Saudi Arabia, and United Arab Emirates; and is today one of the most important arenas for promoting CO_2 capture and storage. The CLSF has a policy group and a technical group. The CSLF has established a capacity building fund, to which Norway has contributed NOK 5 million. This Fund has been transferred to Clean Energy Ministerial CCUS Initiative. It funds membership of developing countries membership fees and, where appropriate, travel costs for participation in meetings.

7.2.5.2 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, Statoil, Shell and Total.

TCM helps to spread knowledge about CO_2 capture by presenting results at international conferences, receiving visitors from around the world and releasing publications in professional forums.

In addition to cooperation within the partnership and with technology providers, TCM is working actively to establish cooperation with companies and institutions involved in the development of CO_2 capture technology.

TCM has also taken the initiative to form a global knowledge-sharing network for large test centres for CO_2 capture. TCM's initiative is important as international cooperation and information exchange will ensure faster progress in the *CCS* field.

7.3 Capacity building

Many of the elements already reported in this chapter of the Seventh national Communication, which has focused on ODA, also facilitate transfer of technology and capacity building.

Capacity building is part of most of the examples given under adaptation or bilateral support above. For information on capacity-building support that responds to existing and emerging capacity-building needs identified by non-Annex I Parties, see chapter 6.6 of the Biennial Report.

7.3.1 UNFCCC Secretariat

Norway has contributed substantial amounts of supplementary funding to the UNFCCC Secretariat for activities not covered by the core budget and for developing country participation in the process. Over the last few years, Norway has been one of the largest contributors in absolute figures. In 2019 and 2020, Norway allocated NOK 31.2 million (USD 3.5 million) and NOK 21.1 million (USD 2.2 million) respectively[85].

7.3.2 Alliance of Small Island States (AOSIS)

Norway is contributing to building institutional capacity of small island states through the Alliance of Small Island States (AOSIS) for its members to engage effectively in the major global development processes within the UN, the implementation of the 2030 agenda and the follow-up of the Paris agreement on climate change. Norway's contribution was NOK 3,5 million in 2019 (USD 0.37 million) and NOK 10 million (USD 1.2 million) in 2020.

7.3.3 Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC)

Norway became a member of the CCAC in 2012, and contributed NOK 15 million in the period

[85] Of the core funding to the UNFCCC Secretariat i 2019 and 2020, NOK 16.2 million and NOK 11.1 million was reported as ODA.

2019–20 to the CCAC trust fund. The funding went to support the CCAC-secretariat, and programs and initiatives working to reduce emissions of short-lived climate pollutants in developing countries. This helps protect the climate and improve air quality and includes co-benefits which promote development and protect public health. CCAC launched a new 2030-strategy in 2021, and is also a core implementing partner of the Global Methane Pledge.

7.3.4 The Intergovermental Panel on Climate Change (IPCC)

Norway has consistently supported the work of the IPCC and developing country participation therein. For 2019 and 2020 a total of NOK 13.5 million were transferred to the IPCC Trust Fund.

7.3.5 The UN Partnership for Action on the Green Economy (PAGE)

PAGE supports nations and regions reframing economic policies and practices around sustainability. Norway has supported PAGE with a total of NOK 49 million between 2017 and 2020.

7.3.6 The Global Green Growth Institute (GGGI)

GGGI is an inter-governmental organisation dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies. Norway's total support to The Global Green Growth Institute (GGGI) amounted to NOK 71 million and NOK 89 million in 2019 and 2020, respectively.

7.3.7 Fossil fuel subsidies reform. Global Subsidies Initiative.

Norway takes part in the Friends of Fossil Fuel Subsidy Reform (FFFSR), an informal group of non-G20 countries aiming to build political consensus on the importance of fossil fuel subsidy reform. The FFFSR works closely with the Global Subsidies Initiative (GSI) within the International Institute for Sustainable Development (IISD). GSI is dedicated to analysing subsidies and how they support or undermine efforts to achieve sustainable development. It provides analytical and administrative support to the FFFSR and promotes fossil fuel subsidy reform internationally – including SWAPS, where countries implement fossil fuel subsidy reform and allocate savings from reform toward sustainable energy and development (e.g. renewables, energy efficiency and public transport). Norway's contribution to the Global Subsidies Initiative was NOK 10 million in the period 2019–2021.

8 RESEARCH AND SYSTEMATIC OBSERVATION

8.1 General policy on and funding of research and systematic observation

The Norwegian government's white paper on research Meld. St. 5 (2022–2023) *Long-term plan for research and higher education 2023–2032* outlines the Government policy for research and higher education. The white paper identifies climate change as the defining challenge in the world today. The Government will scale up appropriations to research and higher education within six long-term priority areas:

- Oceans and coastal areas
- Climate, the environment and energy
- Health Enabling and industrial technologies
- Social security and preparedness
- Trust and community

International cooperation is a prerequisite for carrying out high-level research. Norway is part of the global knowledge development trend and participates extensively in international cooperation on research and education with countries throughout the world. Norway is participating in Horizon Europe, EUs Research and Innovation programme (2021–2027) and is well-integrated in the European collaboration on research and higher education. Norway has taken part in this competitive arena for more than 20 years. The Government states in the white paper that it will continue its work to stimulate institution-based, long-term international collaboration.

The most recent white paper on climate policy Meld. St. 13 (2020–2021) *Norway's climate action plan for 2021–2030*, emphasizes the development of knowledge through research and innovation to combat climate change. The Government has, in line with the EU, a target that public funding of research and innovation should amount to 1 per cent of the gross domestic product (GDP). Since 2016, this target has been achieved, and in 2020 the amount was 1,15 per cent.

8.2 The Research Council of Norway

The Research Council of Norway (RCN) is the national strategic and funding agency for research and innovation activities. With an annual budget of approximately NOK 11 billion, nearly one-quarter of public allocations to research and innovation are channelled through the RCN. The remaining allocations consist mainly of direct funding to universities and research institutes. The RCN supports research and innovation of high quality and relevance, to generate knowledge to enable Norway to deal with key challenges to society and the business sector. The Research Council's strategy for 2020–2024 aims in particular at restructuring society, sustainable development and ground-breaking research.

The total funding of climate research through the RCN, the research institutions, by industry and by the European Framework programmes makes climate research the third biggest national research area in Norway (after energy and the environment). Norwegian climate research is strongly rooted in both Norwegian research policy and climate policy.

8.3 Research

The RCN covers all climate research areas, i.e. the climate system and how it changes, the effects of climate changes on society and nature and how society can transform to meet the climate challenges (adaptation and mitigation). Research on the development of technology to reduce greenhouse gas emissions and the development of low emission energy systems is given high priority. RCN collaborates with Innovation Norway and Enova which support innovation and technology development of low emission and environmental technologies in the phase of demonstration and market introduction. This funding has increased substantially over the last years. See chapter 4 for more information about Innovation Norway and Enova. Gassnova and the RCN jointly provide funding for research, development and demonstration of technologies for carbon capture and storage through the CLIMIT programme.

Norwegian climate researchers are active in international research cooperation, e.g. under the Nordic framework, the Arctic Council, the EU Framework programmes and related European initiatives and programmes. Norway participates in JPIs (Joint Programming Initiatives), European Partnerships in Horizon Europe and the SET-plan (Strategic Energy Technology Plan) as well as the Belmont Forum, IIASA (The International Institute for Applied Systems Analysis) and Future Earth. International collaboration outside these established frameworks is also important, and bottom-up international and bilateral cooperation within research projects is common. For instance, projects under the climate research programme KLIMAFORSK in 2021 included partners from 29 countries. In addition, the RCN participates in climate relevant calls to facilitate bilateral cooperation, in particular with the prioritised countries of the Panorama strategy[86].

Norway has world-leading climate research groups with a widespread international reputation and impact. The number of Norwegian researchers serving as authors for the IPCC reports is very high, with as many as 19 to the Sixth Assessment Report. A number of Norwegian researchers also contribute to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and as one response to the deepened understanding of the synergies between biodiversity and climate change, Norway supports the collaboration between IPCC and IPBES. The Norwegian Earth System Model (NorESM) is highly recognized and has been used extensively as input for the sixth assessment report from Intergovernmental Panel on Climate Change (IPCC). NorESM has generated several hundreds of publications/papers. In 2021 the Arctic Monitoring and Assessment Programme (AMAP) under the Arctic Council presented a scientific report on Arctic climate change including key trends and impacts with Norwegian scientists as lead and contributing authors.

The RCN's climate research portfolio was NOK 876 million in 2021, including funding through the RCN and EU of NOK 689 and 187 million, respectively. This is a substantial increase since 2018. Further, the RCN's portfolio on energy and low emissions was NOK 2 billion in 2021, including funding through the RCN and EU.

The RCN plans, organises and funds basic and applied climate research through an array of different instruments, such as researcher-driven projects, projects involving the public and private sectors, centres such as Centres for Research-based Innovation scheme and Centres for Environment-friendly Energy Research, and through mobilising Norwegian research actors, public sector and industry to participate in the EU Framework programmes. The largest and most relevant RCN activities are described below. All activities aim at increasing international research cooperation and

[86] The Panorama Strategy (2021–2027), *https://www.regjeringen.no/en/dokumenter/the-panorama-strategy-20212027/id2845286/*

promoting sharing and use of research infrastructure and data.

8.3.1 Research and innovation programmes under the research council

8.3.1.1 Climate research

The KLIMAFORSK programme is RCN's most important funding instrument for achieving wide-ranging, high-quality Norwegian climate research. The objective of the programme is to enhance the quality of Norwegian climate research, and raise knowledge and awareness of climate change, including its impacts and solutions. The calls for proposals are divided into three broad research fields on:

- Natural and anthropogenic climate change
- Impacts of climate change on nature and society
- The transition to a low-emission society and adaptation to climate change

KLIMAFORSK's strategic priorities include enhancing the international profile and contribution of Norwegian research groups, recruitment of a new generation of climate researchers and dissemination of research results to relevant target groups. Over the past years funding of social science climate research has increased, as well as projects aiming to strengthen user participation in climate research. The large-scale project PLATON will gain and disperse knowledge about how the policy system works and can be adjusted to satisfy the reporting commitments and meet the 2030 and 2050 emission targets of Norway. A recent evaluation of KLIMAFORSK concluded that the ambitious objective, of promoting outstanding climate research and generating essential knowledge about the climate for the benefit of society, has been achieved[87].

[87] *Evaluation of KLIMAFORSK.* The Research Council of Norway 2021.

8.3.1.2 Energy research

The ENERGIX programme and the Centres for Environment-friendly Energy Research provide funding for research on renewable energy, efficient use of energy, energy systems and energy policy. These two large funding initiatives are central in Norway's research efforts on climate change mitigation. They encompass technological, natural and social sciences as well as humanities-related research and development activities.

The energy research funded by the RCN provides support for the long-term development of the energy system. The research activity should contribute to the following main objectives:

- A climate neutral society that preserves biological diversity
- A knowledge based, inclusive and fair energy transition
- A secure and resilient energy system in Norway based on renewable energy resources.

The PILOT-E scheme is a funding scheme for the Norwegian business sector launched as a collaboration between the RCN, Innovation Norway and Enova SF. The objective of the scheme is to promote more rapid development and deployment of new, environment-friendly energy technology and services to help to reduce emissions both in Norway and internationally. Calls for proposals under the PILOT-E scheme are targeted towards specific societal challenges, and the scheme is a good fit for larger consortia that address complex challenges ranging from research activity to commercial realisation. PILOT-E is designed to follow up participants throughout the entire technology development pathway from concept to market. Calls under the scheme have so far targeted zero-emissions related to maritime transport, land-based goods transport, the energy system of the digital age, sustainable industrial processes, the hydrogen value chain and construction and facilities.

8.3.1.3 CO_2 capture and storage

CLIMIT is Norway's public programme to accelerate the commercialisation of CCS. Through the programme applications can be submitted for funding for research, development and demonstration of technologies for CO_2 capture, transport and storage. CLIMIT's main focus areas are:

- Decarbonisation of industry and energy resources
- Large-scale CO_2 storage sites on the Norwegian continental shelf
- Innovative technology development and solutions for CCS CO_2

CLIMIT is administrated by both the RCN and Gassnova (a state enterprise for CCS activities) in unison. The RCN manages research and development activities while Gassnova manages the development, piloting and demonstration of CCS technologies.

8.3.1.4 The Green Platform Initiative

The aim of the Green Platform initiative is to accelerate the green transition of Norwegian businesses. This is done by providing funding for enterprises and research institutes engaged in green growth and restructuring driven by research and innovation. Beyond high ambitions for value creation for the businesses, the funded projects should provide reductions in greenhouse gas emissions, and at the same time do no harm to biodiversity nor the environment. The Government wishes to use the Green Platform Initiative to stimulate bigger and more rapid investments from companies in green sustainable solutions and products. This will strengthen Norwegian exports and value creation enabling us to implement the green transition and create green growth. It will also make Norwegian companies and research institutions better equipped to exploit the opportunities provided by the EU's Green Deal initiative.

The objective is to trigger opportunities for green value creation through major projects. They should comprise the whole value chain from research and knowledge production to testing, commercialisation and industrialisation of sustainable, green products and services. The initiative is managed by the RCN, Innovation Norway and Siva and is funded by The Ministry of Trade, Industry and Fisheries.

8.3.1.5 Polar research

The Polar Research Programme (POLARPROG) is the RCN's most important funding instrument for achieving wide-ranging, high-quality Norwegian polar research.

The priorities of RCN's funding of polar research are climate and environment, sustainable business development in the polar regions and policy and management. Climate and environment issues are the most prominent of the three thematic areas. Polar research is highly international. RCN's funding aims at strengthening international cooperation, recruitment of a new generation of polar researchers and dissemination of research results. The Norwegian polar research is dominated by Arctic research with Antarctic research less than 10 per cent of the total. Approximately 80 per cent of the RCN funded polar research projects are within natural sciences where climate related disciplines and biological sciences dominates. Social sciences make up a smaller part (<5 per cent) of Norwegian polar research, partly because Norwegian polar (Arctic) research is within high Arctic only.

The Nansen Legacy is a novel and holistic Arctic research project providing integrated scientific knowledge for sustainable management of the marine environment and resources of the northern Barents Sea and adjacent Arctic Basin. The Nansen Legacy unites about 280 researchers, early career scientists and technicians from ten Norwegian research institutions. The research team includes interdisciplinary arctic marine expertise within physical, chemical, and biological oceanography, as well as geologists, modelers and underwater robotic engineers. The total budget for the Nansen Legacy project is NOK 740 million. The project runs for seven years (2018–2024) and is funded by the RCN and the Ministry of Education and Research. They provide 50 per cent of the budget while the participating institutions contribute with 50 per cent in-kind.

8.3.1.6 Environmental Research for a Green Transition

The research programme MILJØFORSK has a very wide thematical scope and is cross-disciplinary. It generates more knowledge about key environmental challenges to the government administration, trade and industry, and society at large with a better foundation on which to take decisions to promote a green societal transition. The budget's thematic responsibilities are terrestrial biodiversity, terrestrial pollution, cultural heritage, and land use. Through a number of cross-cutting thematic calls in cooperation with related budgets, MILJØFORSK contributes substantially to new research with relevance for climate. Recent call topics with relevance for climate where MILJØFORSK takes part are Areas under pressure, Marine and coastal environment, Food systems, and Circular economy.

8.3.1.7 Marine research

The research programme on Marine Resources and the Environment (MARINFORSK) is responsible for research related to ocean and coastal areas, and is the RCN's most important thematic initiative in the field of marine research. MARINFORSK is designed to provide the government administration with a sound knowledge base and promote increased value creation based on marine resources, with sustainability as an underlying principle. Among core priorities are research to improve knowledge on marine ecosystems as such and how marine ecosystems they are affected by climate change, pollution and other anthropogenic factors. The different anthropogenic drivers of change most often involve complex interactions, where the response to a driver of change may depend on others. Understanding how these drivers interact with one another requires targeted studies and multidisciplinary approaches. Climate change affects the established distribution of natural resources and areas among various national and international interests, which leads to social and economic consequences. There is also a major need for research on the Law of the Sea regarding, for instance, issues of safeguarding national rights associated with changes in migration patterns in fish stocks due to changing climate

8.3.1.8 Land-based food, the environment and bioresources

The portfolio covers research and innovation on landbased food, biological resources, circular economy, biodiversity and the environment and aims to promote research that increases the level, profitability and sustainability of production in the bio-based industries. The expected societal impact of the portfolio addresses climate gas emissions directly, and there is an increased investment in research projects addressing reduced emissions. During the last three years, investment in reduced emissions of greenhouse gasses has more than doubled, in line with expectations from Ministry of Agriculture and Food and Ministry of Climate and Environment.

8.3.1.9 Circular economy

The purpose of the programme on circular economy (SIRKULÆRØKONOMI) is to ensure that the RCN targets circular economy in a holistic manner. The concept covers a wide array of topics such as sustainable production and consumption, consumer behaviour, framework conditions and innovative business models. Furthermore, the programme coordinates the funding cooperation the RCN has with the Norwegian Retailers' Environment Fund for research targeting plastics.

Since 2020 there has been annual national calls dedicated specifically to the circular economy. The programme contributes substantially to the green transition by the projects it funds.

8.3.1.10 Norway – Global Partner

With funds from the Ministry of Foreign Affairs, the RCN has several activities within north-south research cooperation. Among them, NORGLOBAL-2 stimulates innovative high quality research in support of global efforts towards the UN's Sustainable Development Goals (SDGs). The ambition is to enhance Norway's contribution to global research and knowledge production, and all projects have partner institutions from developing countries. Adopting a challenge-based approach, there is great emphasis on research with the potential for positive impacts on development ideas, policies and aid. NORGLOBAL-2 aims to contribute to progress towards UNs sustainable development goals by research-based knowledge of high quality on poverty reduction and sustainable development that can inform development policies, development programs, private sector investments and further research.

8.3.2 Research infrastructure

The objective of the National Financing Initiative for Research Infrastructure (INFRASTRUKTUR) is to provide researchers with the equipment they need to perform high-quality science and efficiently meet the needs of the business as well as public sector for high-level research. In addition, the initiative aims to enhance the Norwegian research community's international reputation as a provider of outstanding research and observation infrastructure.

INFRASTRUKTUR has since the first call in 2009 allocated NOK 7,6 billion to new infrastructure in all fields of research, including climate relevant infrastructures such as polar buoys and autonomous underwater vehicles, drones, infrastructure for high-precision palaeoecological analyses and databases for climate and environmental data.

Norway takes active part in the ESFRI-work (European Strategy Forum on Research Infrastructures). Norway is hosting the ECCSEL (European Carbon Dioxide Capture and Storage Laboratory Infrastructure) project. The main objective is to address the primary tasks necessary to establish a new distributed, goal-oriented, integrated pan-European infrastructure for state-of-the-art research on technologies enabling CO_2 capture, transport and storage (CCS). The consortium team is from 10 countries across Europe.

Of particular importance to Norwegian climate research is the ESFRI Argo drifting buoy, ICOS (Integrated Carbon Observation System), ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) and the Svalbard Integrated Arctic Earth Observing System (SIOS). SIOS is an international infrastructure project and observing system for long-term measurements in and around Svalbard addressing Earth System Science questions. The SIOS consortium consists of 28 institutions from 10 nations. The SIOS Knowledge Centre and services are financed by the Ministry of Education and Research through a Norwegian Research Council project and is coordinated by The University Centre in Svalbard (UNIS) and the Norwegian Polar Institute (NPI). Furthermore, INFRASTRUKTUR is funding the Climate-Ecological Observatory for Arctic Tundra (COAT), that monitors long term effects of climate change on land areas in North-East Norway and Svalbard, as well as upgrading of the Norwegian Earth System Model NorESM.

Antarctica and the Southern Ocean are important parts of the Earth system. INFRASTRUKTUR has recently provided funding to the establishment of the Troll Observing Network (TONe) as a state-of-the-art, multi-platform, multidisciplinary observing network in the data-sparse region of Dronning Maud Land, Antarctica, to secure and make available key observational atmospheric, terrestrial and marine data required to respond to the societal challenges and uncertainties related to climate change.

8.4 Systematic observation

The Norwegian Environment Agency is responsible for management and funding of a number of environmental monitoring programmes. One of the monitoring programs that are conducted by the agency includes the monitoring of greenhouse gases, ozone layer thickness, UV-radiation levels, aerosols and other air pollutants.[88] Other monitoring programs that relate to climate change include coastal monitoring of flora and fauna, ocean acidification and terrestrial observations. These programmes are assigned to research institutions and in some cases combined with observations in the context of distributed European research infrastructures (e.g. Integrated Carbon Observation System (ICOS) and Aerosol, Clouds and Trace gases Research Infrastructure (ACTRIS)) and monitoring obligations (EU Water Framework Directive, European Monitoring and Evaluation Programme (EMEP) under the Convention on Long-range Transboundary Air Pollution (CLRTAP) or other international networks (e.g. Advanced Global Atmospheric Gases Experiment (AGAGE)). This is elaborated in the following.

8.4.1 Meteorological and atmospheric observations

The Norwegian Meteorological Institute (MET Norway) provides expertise on climate conditions on the global and national scale and provides climatological information for monitoring and planning purposes, and as input to the formulation of national climate policies.

MET Norway has included 10 existing meteorological surface observing stations and one upper air station (Jan Mayen) as part of the Global Climate Observing System (GCOS). The goal of GCOS is to provide comprehensive information on the total climate system, involving a multidisciplinary range of physical, chemical and biological properties, and atmospheric, oceanic, hydrological, cryospheric and terrestrial processes. The stations report to the World Meteorological Organisations (WMO) international data exchange according to standard procedures. Norway does not have a separate national GCOS programme.

MET Norway operates six upper air stations, including two stations at the Arctic islands of Jan Mayen and Bjørnøya, and a station at the Ekofisk oil field in the North Sea. These stations make soundings twice daily measuring temperature, humidity and wind every 2 sec up to a height of approximately 28 km. In the winter season, Jan Mayen and Bjørnøya make soundings four times a day. The institute also collects upper air data from a station operated at Ny-Ålesund, Spitsbergen by the Alfred Wegener Institute.

The surface-based meteorological network for real time synoptic observations comprises approximately 270 stations, including the manned Arctic stations at Jan Mayen, Bjørnøya, Hopen, Svalbard Airport and 11 automatic meteorological stations on Svalbard. In addition, MET Norway collects data from 41 offshore platforms, 5 buoys and 5 ships in the Norwegian and Barents Sea. Many of these stations report on an hourly basis. A synoptic meteorological station has also been set up at Troll, the Norwegian Research Station in Antarctica.

Real-time data from the Norwegian meteorological stations are exchanged internationally through the WMO international data exchange and are sent to the World Data Centres according to standard procedures. The institute also operates a network

[88] *http://miljodirektoratet.no/no/Tema/Miljoovervakning/Naturovervaking/Klima/Klima-ozon-og-atmosfariske-forurensninger/*

of manual precipitation stations consisting of 211 stations. Approximately 80 per cent of these stations report the data on a daily basis. The rest only report daily on weekdays or on a weekly basis.

MET Norway has operated meteorological observing stations for more than 100 years at a number of locations, and WMO has recognized 7 of these stations as Centennial Observing Stations. The climate database of the Norwegian Meteorological Institute therefore includes very long records of climate data. These databases are now freely available on the web at seklima.met.no. This web site includes both real-time data and long historical climate series. Data is also available for download from the Frost API (frost.met.no).

Norway contributes to the European Climate Assessment and Dataset (ECA&D), a service that provides a consistent climate database covering most of Europe. This is a European collaborative effort within the European Meteorological Services Network (EUMETNET), as well as being co-funded by several FP7 (The EU 7th Framework Programme for Research and Technological Development), projects within H2020 (Horizon 2020, The EU Framework Programme for Research and Innovation) and is now an operational service within the Copernicus Climate Change Service (C3S). Norway also contributes to the Nordic Climate Data Set (NKDS). This dataset contains high-quality monthly climate series back to the 1890s and is established in the project NORDKLIM within the framework of the national meteorological services in the Nordic countries (NORDMET). NORDMET aims to achieve better cost efficiency by sharing resources in such area as observation, information management, production and education. Furthermore, the Nordic Framework for Climate Services (NFCS) within NORDMET has the main objective to boost the availability of climate information in the Nordic countries, by developing and sharing best practices in data handling, climate service products and communication with users. Norway was also leading a EUMETNET-project (EUMETGRID) aiming at producing fine-scale climate maps for Europe. This initiative is now partly continued as one component in the Copernicus Climate Change Services (C3S), in which Norway has the responsibility to provide high-resolution regional gridded climate data for the Fennoscandia (Nordic Gridded Climate Dataset – NGCD).

NILU – Norwegian Institute for Air Research (NILU) has the main responsibility for performing the monitoring of greenhouse gases and aerosols (particles) in the atmosphere above Norway. Air sampling and measurements of meteorological parameters are mainly performed at two sites in Norway: Birkenes Observatory in the Southern part of Norway, and at Zeppelin Observatory outside Ny-Ålesund Research Station, Spitsbergen (Svalbard) in the Arctic. The unique location of the Zeppelin Observatory at Svalbard together with the infrastructure of the scientific research community at Ny-Ålesund Research Station, makes it very suitable for monitoring the hemispheric changes of the atmosphere. There are few local sources of emissions, and the location is important as the Arctic is a particularly vulnerable region. The observations at the Birkenes Observatory complement the Arctic site. Birkenes Observatory is located in a forest area with few local anthropogenic sources of greenhouse gases and climate-relevant air pollutants, but occasionally receiving polluted air downwind from Europe. NILU also operates the Trollhaugen Observatory in Antarctica, which also has a comprehensive measurement program related to atmospheric composition.

The main objective of the monitoring programmes is to observe, identify, analyse and interpret the changes in the atmospheric concentrations of all the main climate gases also those included in the Montreal protocol. Furthermore, the programme includes observations of aerosol properties and chemical composition. Information on these short-lived climate forcers provide increased understanding of climate change. The data provided from the monitoring programme are used for trend analysis and are also being used for a wide range of both Norwegian and international climate research projects and programmes.

A wide range of greenhouse gases are monitored at the Zeppelin Observatory, in total more than 40 gases These include CO_2, CH_4, N_2O, CO and more than 30 halocarbons, which is wide range of halogenated species (including CFC, HFC and HCFC gases, SF_6, NF3), some volatile organic carbon (VOC) compounds, and tropospheric and stratospheric ozone. In addition, the programme includes measurements of aerosol absorption (black carbon), scattering, size distribution, chemical composition, and Aerosol Optical Depth (AOD), which describes the total amount of aerosols in the atmosphere above the Zeppelin observatory. The Zeppelin Observatory is also the basis for measurements of aerosol properties performed by Stockholm University, funded by the Swedish Environmental Protection Agency and the Swedish Polar Research Secretariat. The station is a part of the WMO Global Atmosphere Watch (GAW) programme, and EMEP[89] site under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) under United Nations Economic Commission for Europe (UNECE). Zeppelin is an ICOS[90] and ACTRIS[91] site, contributing to two distributed European research infrastructures[92]. Furthermore, there are contributions to the Advanced Global Atmospheric Gases Experiment Network (AGAGE) and to the international Network for the Detection of Atmospheric Composition Change (NDACC).

NILU measures CO_2, CH_4, CO, tropospheric ozone and aerosol chemical, optical and physical properties (including aerosol optical depth) at the Birkenes site in Southern Norway, also contributing to EMEP, ACTRIS and ICOS. NILU also operates a number of background sites with air and precipitation chemistry observations in support of EMEP. NILU hosts the EMEP database and is the WMO-GAW World Data Centres for Aerosols and reactive gases. NILU also hosts the the ACTRIS Data Centre for the large EU infrastructure project *ACTRIS – Aerosols, Clouds, and Trace gases Research* Finally, NILU hosts the European part of the NDACC database and operates the European database for stratospheric ozone (NADIR), which contains data from several projects on stratospheric ozone founded by the European Commission.

Data generated from the atmospheric monitoring program are reported online in the EBAS-database[93]. This includes all EMEP data, all ACTRIS In-Sitiu datya and all data from the national monitoring program making all data accessible for both research communities and authorities. Three annual data reports are produced from this programme for the Norwegian environmental agency: one for greenhouse gases and aerosols, a second report for long-range transboundary air pollution and particles, and a third report for atmospheric ozone and UV-radiation levels. Annual reports are available at the Norwegian environmental agency web page[94].

8.4.2 Oceanographic observations

The Institute of Marine Research (IMR) has an extensive monitoring programme on physical and biological oceanographic parameters. Temperature and salinity observations are made at 9 fixed coastal stations from Skagerrak to the Barents

[89] EMEP: European Monitoring and Evaluation Programme: www.emep.int
[90] ICOS https://www.icos-cp.eu
[91] ACTRIS https://www.actris.eu
[92] https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures_en
[93] http://ebas.nilu.no/
[94] http://miljodirektoratet.no/no/Tema/Miljoovervakning/Naturovervaking/Klima/Klima-ozon-og-atmosfariske-forurensninger/

Sea with vertical profiles occupied 2–4 times per month. The monitoring started in 1936. IMR also occupies standard sections along the Norwegian coast between 2 and 4 times per year monitoring physical, chemical and biological oceanographic parameters. Most of these time series have been maintained since 1970s. IMR has a close collaboration with the Russian sister organisation PINRO in Murmansk, which maintain the hydrographic section Kola in the eastern Barents Sea and make the data available for IMR. The section is the most comprehensive oceanographic time series in the world, started by the Russians in year 1900 and taken monthly since the 1920s. In addition to fixed hydrographic stations and sections, IMR conduct regional physical, chemical and biological oceanographic monitoring on annual surveys covering the North, Norwegian and Barents Sea.

The ocean plays a key role in the global carbon cycle and absorbs about 25 per cent of the anthropogenic emitted CO_2 to the atmosphere. This again leads to acidification of the oceans and may have major consequence for the marine ecosystem. On behalf of the Norwegian Environment Agency, the IMR, The Norwegian Institute for Water Research (NIVA) and Uni Research monitor the carbonate system in Norwegian Seas including the areas in northern Barents Sea and Svalbard, since the Arctic is deemed particularly sensitive to ocean acidification. The program started in 2010. Data from ocean acidification monitoring are reported to CARINA (Carbon dioxide in the Atlantic Ocean), CDIAC (Carbon Dioxide Information Analysis Center) and SOCAT (Surface Ocean Carbon dioxide Atlas).

The ECOCOAST-monitoring program covers oceanographic coastal observations along the Norwegian coast from the border of Sweden in the south to the border of Russia in the north. It applies monthly sampling of key chemical and biological parameters in different water types, as well as annual biodiversity monitoring on hard- and soft-bottom. The monitoring program is a continuation of the coastal monitoring program along the southern coast with startup in the year 1990 and is funded and coordinated by the Norwegian Environmental Agency. The older data from the southern coast have proven to be very useful for assessing effects of climate change on biodiversity. Data from ECOCOAST are primarily reported to OSPAR, with ICES as data host. These data are also shared via ICES with the European Environment Agency (EEA) through the Eionet cooperation arena. It is also the intention that the same data should be included in our reporting to the EU Water Framework Directive (WFD).

The Norwegian Polar Institute (NPI) maintains a monitoring programme in the Fram Strait; the Fram Strait Arctic Outflow Observatory, monitoring the oceanic output from the Arctic Ocean to the subpolar seas. The programme is an international collaborative effort with the German Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI). The latter institution is responsible for monitoring the input of heat and salt to the Arctic, while NPI monitors the export of freshwater and sea ice since the early to mid 1990s, as well as Atlantic Water and deep ocean temperatures. Since 1990, sea ice thickness has been continuously monitored with two to four upward looking sonars, and the by now 30-year record, shows an exceptional large reduction in Arctic sea ice export in recent years. Since 2008, the programme also includes components to measure Arctic freshwater tracers, the carbonate system, and ocean acidification state. In recent years and in the near future, there has been an interest to expand the monitoring with marine plastic, biology and marine sediment. The Fram Strait program contributes to the national infrastructure NorEMSO. The Norwegian Polar Institute also monitors the marine living environment and sea ice properties in Kongsfjorden, Svalbard, as well as sea ice and snow thickness in Storfjorden and Hopen, Svalbard.

A-TWAIN (Long-term variability and trends in the Atlantic Water inflow region) is a NPI lead monitoring program established to gain understanding on how the inflowing current system is distributed at different depths along the continental slope in the Arctic Ocean north of Svalbard including how it responds to local, short lived atmospheric changes, and how it varies on seasonal and inter-annual timescales. The primary objective of this project is to understand how heat from the Atlantic Water influences the Arctic Ocean sea ice cover, but also to provide data for understanding the playing field for some of the key actors in the ecosystem, and components of the carbon system. The program receives funding from the Research Council of Norway through the SIOS-InfraNor project. International A-TWAIN collaborators include IOPAS (Poland), SAMS (UK), Sorbonne Université (FR), and WHOI (USA).

In 2019 NPI in collaboration with UiB established a Multidisciplinary Ocean Moored Observatory (MOMO) at the continental shelf break of Kong Håkon VII Hav along the coast of Dronning Maud Land. An array of multidisciplinary oceanographic moorings is maintained to monitor physical, chemical and biological parameters of the Antarctic coastal- and slope current, targeting key questions of the Southern Ocean overturning circulation, carbon cycle and ecosystem dynamics. Year-round time series along the Antarctic coast are rare and MOMO fills an important gap in monitoring the inflow region of the Weddell Gyre (Vernet et al. 2019, Lowther et al. 2022), extending national (UiB) and international efforts (AWI, BAS, L'OCEAN) that are traditionally focusing more on Weddell Sea further downstream. In addition to the open ocean moorings, NPI operates Fimbulisen Ice Shelf Observatory (FIO), which since 2009 provides continuous time series of ocean temperature and currents from below Fimbulisen, accounting for the world's longest continuous ice shelf cavity record. Else, at the coast of Dronning Maud Land in Rektangelbukta, opportunistic landfast sea ice thickness is measured and recorded during southern summer since 2005 when conditions allow. Since 2017, and in collaboration with UiB, the under-ice shelf moorings are complemented by ice shelf thickness radar and surface mass balance measurements, providing unique insights on glacier ocean interactions (and impact on sea level) on seasonal to interannual time scales in Dronning Maud Land and relation to oceanic and atmospheric changes. Both FIO and MOMO will be renewed, extended and maintained through the recently funded NPI-led NFR infrastructure project Troll Observing Network (TONe), also integrating with international networks, such as the Southern Ocean Observing System (SOOS) through a number of initiatives.

The Joint Assessment and Monitoring Programme (JAMP) adopted by OSPAR 2005 (MASH 05/6/Info.2) has been developed to provide the basis for considering OSPAR's requirements for monitoring the species and habitats. Norway also contributes to a reporting and coordinating mechanism for WMO operational marine activities, the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM).

SEAPOP (Seabird Population Management and Petroleum Operations) is a national seabird mapping and monitoring programme. The programme, which has been developed in collaboration with research institutes, oil industry and management, will provide improved data on seabirds. In addition to helping to implement ecosystem-based management, this will also provide valuable information on the possible impact of climate change on biodiversity. The programme now covers the whole Norwegian coast.

A national programme for mapping of coastal marine biodiversity started in 2007 as a joint venture project between the Ministry of Climate and Environment and the Ministry of Fisheries and Coastal affairs. The mapping is foreseen to be completed by 2018 and will result in a classification of marine habitats and key areas that are significant for biological diversity at a local, regional or national level in all the Norwegian counties along the coast.

The UN Decade of Oceans Science for Sustainable Development has indicated the need for a comprehensive map of the world's oceans seabed as a strategic pillar for the knowledge we need for the ocean we want. Norway (through the Norwegian Mapping Authority's representative) currently leads the global endeavour of improving seabed knowledge as chair of the joint IHO IOC GEBCO Guiding Committee.

MAREANO is an integrated mapping programme for the Norwegian seas and coastal areas carried out by the Institute of Marine Research (IMR), the Geological Survey of Norway (NGU) and the Norwegian Mapping Authority (NMA). The programme initiates a detailed baseline mapping of the physical, chemical, biological environment of the sea bottom in Norwegian offshores areas. The programme started mapping the Barents Sea in 2006, the Norwegian Sea in 2012. At the end of 2021 MAREANO has mapped approximately 288 000 km^2 of the depth and about 260 000 km^2 of the geological, biological and chemical environment. Norway has large natural resources in the coastal and shelf regions that are managed by different bodies within the government, counties and local communities. The MAREANO programme collects and compiles knowledge about offshore areas into an integrated database, and make the results available on the Internet using state-of-the-art GIS technology (*www.mareano.no*). The goal is to provide society with up-to-date, quality-controlled data for management, sustainable development and exploitation, making baseline data for any future changes in the composition of benthic communities that may reflect and quantify the biological effects of climatic change, among other factors. In 2022 MAREANO started mapping in the South area of the North Sea, to gather knowledge around the planned offshore wind farms.

In 2020 a 3-years pilot project was started with the name Marine Basemaps for the Coastal Zone. It is a cooperation project with the 3 MAREANO partners; NMA (leading the project), IMR and NGU. This cooperation allows for a streamlined process from data collection to distribution. It also has the added advantage of better coordination and management of resources. Marine Base Maps for the Coastal Zone, is all about gathering detailed information and boosting the knowledge of the sea bed and marine coastal systems along Norway's coast – for a sustainable ocean economy. The aim is to provide new business opportunities, stimulating and optimising the growth of industries, better public administration and effective coastal zone management to benefit people, nature and the economy. Marine base maps in Norway will (i) map on a large scale the seabed's physical, biological and chemical environments (ii) analyse the data and (iii) distribute a set of standardised products in formats that would cater to the different needs of end users. The marine data collected is distributed as stand-alone or combined with other datasets to create "Marine Base Maps". Parallel with the pilot we are working towards a national program: Marine Base Maps for the Coastal Zone, Norway and an investment proposal was delivered to the Norwegian government in October 2021. A socio-economic analysis and uncertainty analysis is part of the scope as is fundraising from the users as the national program will be co-funded by the users.

8.4.3 Sea level observations

The Norwegian Mapping Authority (NMA) provides expertise on tides, sea level extremes (storm surges), reference levels for use in planning, and observed and projected changes in sea level. The authority is also responsible for the operation and maintenance of Norway's sea level observing system and products related to this system. The system is comprised of the national tide gauge network and a network of GNSS (Global Navigation Satellite System) stations supplemented by other geodetic measurements. Observations from these networks are useful for climate, oceanographic and coastal sea level research. They also contribute to the overarching goals of the Global Geodetic Observing System (GGOS), the Global Climate Observing System (GCOS) and the World Climate Research Programme (WCRP).

The NMA operates a network of 24 permanent tide gauges on mainland Norway and one on Svalbard. The longest records from Oslo and Bergen date back to the early 1900s. The tide gauge network continuously monitors water levels along the coast of Norway. In addition to the permanent network, several hundred data series from temporary tide gauges help improve the spatial coverage of the observations. Both real-time and historical data from the network are freely available to view or download from *http://www.kartverket.no/sehavniva https://www.kartverket.no/en/at-sea/se-havniva*. The Norwegian tide gauge network contribute to the Global Sea Level Observing System (*GLOSS*) of the Intergovernmental Oceanographic Commission (IOC) of UNESCO. The core GLOSS network provides an evenly distributed sampling of global coastal sea level variations and contributes to monitoring long-term trends and accelerations in global sea level. Data is available through the different GLOSS data centers; both real-time and historical tide gauge observations, mean sea level data and land motion data. Data is also provided to a number of additional data portals, such as *EMODnet Physics* and *Copernicus Marine Service*. *https://www.psmsl.org/*

As data from the tide gauges are increasingly being used for prediction of meteorological surge (including preparedness to extreme surges) and adaptation to a changing climate, the NMA has identified that the main challenge with the existing network is the lack of geographic coverage. There are large coastal stretches and long fjords without any permanent tide gauges. The NMA therefore launched a project in 2021 that aims to provide Norway with a denser tide gauge network, according to the user needs. As tide gauge observations record the sea surface relative to the nearby land, local vertical land motion can be a significant contribution to the measured sea-level change. This is of particular importance for Norway where the Earth is rebounding following the last glacial. The Norwegian GNSS network thus provides important observations and constraint on land motion. The network was established in the 1990s and contributes to the work of the International GNSS service (IGS) on sea level. Currently the network is comprised of ~200 GNSS stations, the longest data series are over 20 years. All data from the network is stored at NMA and are freely available.

8.4.4 Terrestrial observations

Norway has some terrestrial monitoring programmes that include climate parameters or indicators, which also may be used to evaluate the effects of climate change. Mass balance of glaciers, permafrost and snow distribution in Svalbard (MOSJ), arctic tundra biodiversity (COAT), changes in populations of passerine birds in all terrestrial ecosystem (bird index), palsa mire changes, changes in forest growth and vitality in forests (National Forest Inventory) and changes in water chemistry and biota are some of the parameters or indicators that are useful to monitor with respect to climate responses.

Ongoing monitoring programmes of special interest with respect to climate change:

- Representative Nature Monitoring (ANO) covers the whole of the Norwegian mainland and records data on nature types, plant species cover and vegetation vertical structure in a representative sample of plots in all non-anthropogenic terrestrial ecosystems.
- The Bird Index is a national bird monitoring programme. This programme gives representative data on bird observations from a national network (fully established from 2013) to a "common bird index" for Norway, and is included in the European common bird index, reported by Norwegian Environment Agency/Norwegian Institute for Nature Research). Bird data are reported to EEA (European Environment Agency).
- Monitoring of palsa peatlands (Norwegian Environment Agency) captures the constant flux of changes caused by permafrost alternations, including palsa features, thermokarst pond development, pond colonization and vegetation change.
- The Global Observation Research Initiative in Alpine Environments (GLORIA) is an international long-term monitoring program and site-based network studying high-mountain vegetation and its biological diversity under the impact of accelerating anthropogenic climate change. Norway participates with six mountain sites in a coast – inland gradient in central Norway and Northern Norway. (Norwegian Environment Agency/Norwegian University of Science and Technology/ Norwegian Institute of Bioeconomy Research)
- Forest monitoring programme (Norwegian Institute for Bioeconomy Research). Data on state/vitality of forest ecosystems are reported to ICP Forests, which is the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests operating under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP). Data from monitoring of forest resources, Pan-European Criteria & Indicators are reported to the United Nations Economic Commission for Europe (UNECE)/Food and Agriculture Organization of the United Nations (FAO).
- National Forest Inventory (inventory of forest stocks and various environmental variables on permanent plots all over the country at 5-year intervals) (Norwegian Institute for Bioeconomy Research). Data on state/vitality of forest ecosystems are reported to ICP Forests.
- Ecosystem monitoring in freshwater (ECOFRESH – Norwegian Environment Agency/Norwegian institute for Water Research/Norwegian Institute for Nature Research) consists of two parts:
  - Monitoring of effects of acidification on chemistry and biology inn small acidified lakes and catchments. Time series from 1980s and 1990s. Although originally designed to monitor effects of acidification, the program also includes climate relevant parameters.
  - Reference monitoring of small to medium-size lakes according to the Water Framework Directive (Norwegian Environment Agency). Started in 2009. Some of the lakes have been selected as long-term monitoring sites to study effects of climate change.

Data from ECOFRESH are reported to the European Environment Agency (EEA), some sites are also reported to ICP Waters and ICP Integrated monitoring (CLRTAP-ECE).

- Ecosystem monitoring of large lakes (ECOLARGE) according to the Water Framework Directive (Norwegian Environment Agency) started in 2015. Some of the lakes have been selected as annual long-term monitoring sites to study effects of climate change. Data are reported to the European Environment Agency (EEA).
- The Norwegian Area Frame Survey of Land Cover and Outfield Land Resources (AR18X18) (Norwegian Institute for Bioeconomy Research)

which is a national survey of land cover resembling the Eurostat Land Use/Cover Area frame Survey (LUCAS).

- Environmental monitoring of Svalbard and Jan Mayen[95] (MOSJ) is managed by the Norwegian Polar Institute. MOSJ aims at collecting and interpreting monitoring data from the central components of the ecosystem, including climate and the major types of human impact in the Norwegian Arctic.
- Climate ecological Observatory for Arctic Tundra (COAT)[96] – coordinated by the University of Tromsø, is an ecosystem-based observation system aiming at detecting, documenting and understanding the impacts of climate change on arctic tundra. Data from COAT/MOSJ will be reported to CBMP (Circumpolar Biodiversity monitoring programme) coordinated by the biodiversity working group of the Arctic Council (CAFF – Conservation of Arctic Flora and Fauna). Some of the data are also reported to working groups under AMAP such as climate indicators and monitoring series on contaminants.
- The Riverine Inputs and Direct Discharges to Norwegian coastal waters (RID) Monitoring programme is carried out as a part of OSPAR's Joint Assessment and Monitoring Programme (JAMP). The monitoring programme has been on-going since 1990 and reports loads to the sea of nutrients, metals, some organic contaminants as well as various additional climate sensitive parameters (temperature, suspended particulate matter, turbidity, pH, conductivity, and total organic carbon).

8.4.4.1 Existing national plans

A national plan for biodiversity monitoring was adopted in 1998. This plan includes different threats against biodiversity, including climate. Recommendations from this plan have been implemented to a varying degree in ongoing national programmes.

The Norwegian nature index is presented every 5th year from 2010, next presentation is in 2020. The nature index presents trends in biodiversity for the main ecosystems by aggregating data from about 300 indicators/indexes, responding to different pressures, including climate change.

Since 2016 a system for assessment of ecological condition has been under development. Here ecological condition is assessed for the major ecosystems on the basis of seven different ecosystem characteristics, described by selected indicators. The assessment is based on data from environmental monitoring. So far ecological condition has been assessed for forests, mountains and arctic tundra throughout Norway.

Since 2016 Norway is a formal member of the International Long-Term Ecological Research Network (ILTER), *coordinated nationally by the Norwegian Institute for Water Research*. ILTER aims to coordinate and harmonize site-based long-term ecological studies to elucidate the possible effects of external drivers, climate change included, on ecosystem processes and biodiversity.

The Norwegian Red Lists for species and ecosystems, and national risk assessment on alien and invasive species, including a list of alien species that poses the most severe threats to Norwegian biodiversity, are produced and periodically revised by the Norwegian Biodiversity Information Centre. These systems provide important tools for nature management, including climate change assessments. The Norwegian Biodiversity Information Centre also presents map access to records of species occurrences in Norway (Species map service) and operates Species Observations System (a Citizen science project for recording species on maps into a national and freely accessible database).

[95] www.mosj.npolar.no/en
[96] http://www.coat.no/

8.4.5 Cryosphere climate observing systems

Long-term monitoring programs of several glaciers on the Norwegian mainland is performed mainly by the Norwegian Water Resources and Energy Directorate (NVE). The monitoring program includes measurements of mass balance, glacier length change, glacier velocity, meteorology and other glaciological investigations. In 2016, monitoring of mass balance was performed on 13 glaciers and monitoring of length change on 36 glaciers. The annual results from mass balance and glacier length changes are reported to the World Glacier Monitoring Service (WGMS) in Switzerland.

The Norwegian Polar Institute monitors glacier mass balance annually on five glaciers in Svalbard: four near Ny-Ålesund, and one on Austfonna, together with the University of Oslo. These are long-term measurements; the shortest time series starts in 2004, and the longest in 1966, the latter being among the longest Arctic mass balance time series. These data are reported annually to the World Glacier Monitoring Service (WGMS). As a contribution to the Global Environment Monitoring System (GEMS/GTOS) of the United Nations Environment Programme (UNEP) and to the International Hydrological Programme (IHP) of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the WGMS of the Commission on Cryospheric Sciences of the International Union of Geodesy and Geophysics (CCS/IUGG) and the Federation of Astronomical and Geophysical Data Analysis Services (FAGS/ICSU) today collect and publish worldwide standardised glacier data.

Frozen ground (as measured by permafrost temperatures and the thickness of the active layer) is sensitive to climate and environmental change in high latitude and high elevation regions. Changes in the thermal state of permafrost and subsurface conditions can have important impacts on terrain stability, coastal erosion, surface and subsurface water, the carbon cycle, and vegetation development. Combined monitoring of meteorological and hydrological variables, soil and vegetation parameters, carbon dioxide and methane fluxes, and the thermal state of the active layer and permafrost at upgraded "reference sites" is the recommended observing approach. On mainland Norway long term permafrost monitoring programs, measuring permafrost temperatures and the thickness of the active layer, are run mainly by University of Oslo and Norwegian Meteorological Institute (MET Norway) for 18 boreholes at 7 different sites and various depths. All the drilling sites have been carefully selected in order to avoid geothermal disturbance from undesirable sources. A significant upgrade and extension of the permafrost monitoring program on mainland Norway was performed by MET Norway in co-operation with University of Oslo in 2014 at three main sites (Juvvasshøe, Snøheim and Iskoras). They are now operational and a part of the official national network of real-time meteorological observations run by MET Norway. New official automatic weather stations (AWS) were also established at these sites. They serve as key-stations for the long-term permafrost and climate monitoring programs in Norway. On Svalbard more than 20 permafrost boreholes with continuous monitoring exist, mainly in central Spitsbergen (Longyearbyen-Adventdalen area). They are run mainly by The University Centre in Svalbard (UNIS), but also the Alfred Wegener institute (AWI) and MET Norway are responsible for some key reference sites. In recent years (2019–2021), new permafrost boreholes have been established at remote locations on Svalbard as part of the Svalbard Integrated Arctic Earth Observing System (SIOS, *https://sios-svalbard.org/*) and Climate-ecological Observatory for Arctic Tundra (COAT, *https://www.coat.no/en/*) projects. There are also established operational weather stations with extended measurement programmes at the same locations. This collocated monitoring provides daily updated data for investigating and monitoring the current state, trends, and impacts of e.g. extreme climate events on ground temperatures in the permafrost on Svalbard. The Norwegian permafrost program is reported to the Global Terrestrial Network for Permafrost (GTN-P), coordinated by the International Permafrost Association (IPA), which forms a GCOS/GTOS baseline network for these variables. The GTN-P Secretariat maintains both borehole temperature and active layer thickness metadata and coordinates data management and dissemination. A network of GTN-P National Correspondents (NC) was established in 2013. Currently 26 partner countries are involved through the involvement of National Correspondents and Young National Correspondents. One station (Janssonhaugen) at Svalbard is reported to MOSJ.

Snow cover is an indicator of climate change, since it is controlled by both temperature and precipitation. Snow cover is a complex unit to monitor, but at the same time very important both in the ecosystems and the climate system. Snow-covered ground greatly influences the exchange of energy to the atmosphere and is also a measure of an important feedback mechanism for climate, in that the ability of the ground to reflect (the albedo) is reduced when the snow-covered period is shortened. The observations are made in keeping with national and international guidelines for observations of snow cover. Snow depth is observed on a daily basis at many of MET Norway's weather and precipitation stations in mainland Norwand and on Svalbard. Many of the stations have long-term series for high-quality snow depth observations. Some of these stations are especially important for cryosphere research. Monitoring of snow cover duration is monitored on Svalbard at selected manned stations and reported within MOSJ.

The operational sea ice service (Norwegian Ice Service[97]) at MET Norway produces high resolution sea ice concentration charts based on a manual interpretation of satellite data. The ice charts are updated every weekday.

Sea ice products are produced on a daily basis and with global (or hemispherical) coverage. These products have been generated operationally for several years as part of the EUMETSAT OSI SAF programme in a cooperation between MET Norway and Danish Meteorological Institute (DMI). The products (also back in time) can be found in the EUMETSAT OSI SAF sea ice archive. In recent years more effort has been put into developing climate consistent data records of sea ice. This work has been carried out through the collaboration in several European projects, including EUMETSAT OSI SAF, ESA CCI and EU C3S (Copernicus Climate Change Service). Daily updated operational and climate products are found at cryo.met.no.

Further sea ice modelling, as part of coupled ocean/sea ice models, is performed on an operational basis and in several projects. Sea Ice is an important component of the Norwegian Earth System Model, NorESM that contributes to the international work on climate predictions. As a part of Copernicus Marine Service, The Nansen Centre, MET Norway and IMR are responsible for Arctic forecasting including sea ice, and MET Norway is running regional ocean and sea ice forecasting models for Norwegian areas of interest.

8.4.6 Space based observing programmes

8.4.6.1 Introduction

Observations from space provide information that greatly assists the understanding and management of climate change, also complementing

[97] http://polarview.met.no/

the ground based monitoring. The Norwegian membership of the European space organisation ESA (European Space Agency) has been the main pillar of Norwegian space research, since Norway became a member in 1987. It has enabled Norway to develop its own technological capacity, and at the same time have the advantage of scale from cooperating within a large organisation. Since the member states combined their resources through ESA, they have achieved results the majority of the countries would not otherwise have been capable of.

Norway takes part in international cooperation in space through ESA, through EUs Galileo and Copernicus programs, as well as in bilateral contracts with different nations. This cooperation gives the Norwegian research communities, governance and industry a secure access to data and possibility to influence which data should be chosen within the different satellite programmes. It also helps Norway building scientific and technological knowledge and capacity in areas that are of great strategic importance for Norway.

During the last 25 years, a rapid change in what can be measured from satellites has taken place. Although almost all Earth-observing satellite systems were not specifically designed for climate monitoring, space agency efforts have initiated a remarkably comprehensive climate data record that is forming the basis for a better understanding of the Earth's climate system. Much has been accomplished, but more remains to be done. Significant gaps remain in measurement capabilities and their continuity. CEOS (Committee on Earth Observation Satellites) agencies currently operates 107 satellites with an Earth observation mission including instruments. A number of important indicators and figures used and presented in IPCCs 6th assessment report derive from satellite observations, e.g. sea surface temperature and height, sea ice, aerosols, ozone, emission data from fires and sea level.

8.4.6.2 Using satellites in climate and environmental monitoring

Climate and environmental issues have been on the political agenda for many years, both in Norway and internationally. Enhanced political interest entails a need for improved knowledge to ensure that political decisions are based on solid foundation. Observations from space provide information that greatly assists the understanding and management of climate change, also complementing the ground based monitoring. Norway is taking part, through ESA and EUMETSAT (EUropean organisation for the Exploitation of METeorological SATellites), in the development of the next generation of polar and geostationary meteorological satellites.

Copernicus is the European Programme for the establishment of a long-term European capacity for Earth Observation. The provision of Copernicus services is based on the processing of environmental data collected from a space component consisting of several Earth observation satellites and an in-situ component consisting of a multitude of sensors on the ground, at sea or in the air. The European Environment Agency (EEA) is responsible for the development of the *in situ* component and coordinates the gathering of data coming from both European and non-European organizations.

Norway takes an active part as a participant in the Copernicus programme and through ESA and EU's H2020 Space. The ESA is developing and operating six missions called Sentinels specifically for the operational needs of the EU Copernicus programme. Each Sentinel mission is based on a constellation of two satellites to fulfil revisit and coverage requirements to provide robust datasets for Copernicus services. The Sentinel missions will have a free and open data policy.

The Copernicus services component is organised in six thematic services, namely the Atmosphere

Monitoring Service, Marine Environment Monitoring Service, Land Monitoring Service, Climate Change Service, Emergency Management Service, and Security Service. These Copernicus services support a wide range of downstream applications in various public and commercial domains.

The objective of the Climate Change Service that will be operational from 2017 is to build an EU knowledge base in support of mitigation and adaptation policies. The Copernicus Climate Change service is led by European Centre for Medium-Range Weather Forecasts (ECMWF) and will be of great importance to Norway. MET Norway and the Nansen Environmental and Remote Sensing Centre (NERSC) take part in these activities.

The CryoClim project supported by the Norwegian Space Centre and ESA and led by the Norwegian Computing Centre has developed a new operational and permanent service for long-term systematic climate monitoring of the cryosphere by satellite. The product production and the product depositories are hosted by mandated organisations (MET Norway, NVE and Norwegian Polar Institute), and the service is delivered through a state-of-the-art web service and web portal. The service provides sea ice and snow products of global coverage and glacier products covering Norway (mainland and Svalbard). Cryoclim has potential to be a Norwegian contribution into both the Copernicus Climate Change service and the WMO Global Cryosphere Watch Initiative.

The ESA's Climate Change Initiative (CCI) is making full use of Europe's Earth observation space assets to exploit robust long-term global records of essential climate variables. Norway is participating in CCI projects on sea ice (led by NERSC with MET Norway in the project team), aerosol (MET Norway and NILU), glaciers (University of Oslo and Norwegian Water Resources and Energy Directorate), ice sheets (NERSC and Science & Technology AS), ocean color (NERSC), sea level (NERSC) and sea surface temperature (MET Norway). CCI was cited in the IPCCs 5th assessment report with respect to glaciers, sea level and ice sheets, despite only preliminary results being available by the cut-off dates.

Norway currently operates two satellites that were launched on 14 July 2017, NorSat-1 and NorSat-2. NorSat-1 hosts a Total Solar Irradiance (TSI) instrument of high value for climate research.

Some other examples of how satellite observation is used in monitoring climate and research are shown below.

- Polar areas: Satellite measurements are unsurpassed in providing a quick overview of status in the polar areas. Sea ice is obviously applicable, since reliable measurement is in practice is impossible without data from satellites. In addition to edge, concentration, thickness and drift, information about the sea-ice as habitat and transport medium can be obtained. On land we can measure glaciers' characteristics, extent and volume as well as their dynamics (speed, changes over time). Snow cover can be mapped and wet snow (beginning of snow melt) determined. Change in vegetation, albedo and length of growth season can be determined.
- Oceans: Earth observation is particularity suitable over the open oceans, with limited needs for high spatial resolution. Satellites monitor sea level, sea ice, objects on the sea surface, height of waves, currents, ocean colour (for biological activity), sea surface salinity, sea surface temperature, for instance linked to content of particles, and extent of oil spill.
- Further, satellite measurements are essential for establishing data records on precipitation, earth radiation budget, upper air temperature, wind speed and direction, water vapour and cloud properties.

- Greenhouse gases and other climate drivers: The application is different for different gases, depending on their absorption characteristics. It is possible today to measure some greenhouse gases by satellite, and products for CO_2, CH_4 and H_2O are available. In Norway, satellite observation is used in combination with ground-based observations of CO and aerosols to detect and classify high aerosol episodes, like burning of agricultural waste and forest fires in Eastern Europe and Russia.
- Ozone, UV and insolation: Norway combines satellite-based monitoring of stratospheric ozone with ground-based observations of ozone and UV at 2–3 stations: Oslo, Andøya and Ny-Ålesund. The combined monitoring covers Norwegian territories and adjacent areas from 55 -80 degrees north. The results are shared with global observation networks and used for research in Norway and for international research activities on the development of UV radiation and the ozone layer. Satellite data provides valuable information on spatial distribution of ozone and UV radiation and makes it possible to monitor the geographical extent of low ozone episodes during spring and summer and thereby discover enhanced UV intensity on a regional level. Satellite monitoring of ozone in Norway has been carried out since 1979.
- Air pollution, local and global: Satellite observation is increasingly used in combination with models and in-situ data on the ground. Measurement of NO_2, SO_2, CO, CH_2O and aerosols will be further developed in the next decade e.g. through the Copernicus Atmosphere service in synergy with national activities. The good spatial coverage and the improved spatial and temporal resolution will probably make the Sentinel 5p/5 satellites essential tools in future atmospheric monitoring in Norway and the Arctic. Sentinel- 5p is scheduled to be launched in October 2017. Work is also underway to evaluate the possibility of including a satellite measuring global CO_2 in the long-term scenario of the Copernicus program.

Sentinel data will provide the long-term measurements that climate change science requires.

8.4.6.3 Geodesic Earth observations

The Norwegian Mapping Authority (NMA) measures changes to and motion of the Earth with an accuracy of millimeters from its geodetic observatory at Ny-Ålesund in Svalbard.

This facility forms part of a global network that contributes to the global geodetic reference frame. This reference frame is crucial for society's satellite-based infrastructure and provides the basis for accurate climate monitoring. With its northernmost location in the global network, Norway's geodetic calculations are a strong contribution to the worldwide collaboration on geodetic Earth observation. The importance of the global geodetic reference frame is now also a part of the UN-GGIM (United Nations Committee of Experts on Global Geospatial Information Management) agenda. In February 2015, the UN General Assembly adopted the resolution "A Global Geodetic Reference Frame for Sustainable Development" – the first resolution recognizing the importance of a globally coordinated approach to geodesy.

Using geopositioning, one can locate a point or an object as it moves within the terrestrial reference frame on the millimeter level. Such exquisitely precise measurements provides critical information for many factors such as global and regional sea level changes, ocean currents, ice melting, and movements in the Earth's crust and Earth orientation.

The global geodetic reference frame is a very accurate reference frame for the whole Earth. It is a coordinate system that allows you relate measurements taken anywhere on the Earth. The reference frame is established by equipping selected reference points with a combination of radio telescopes (Very Long Baseline Interferometry), laser ranging systems (SLR), Global Navigation Satellite System receivers (GNSS) and radio beacons, and sometimes gravimeters. The new state-of-the-art space geodetic observatory that NMA is establishing in Ny-Ålesund, Svalbard is an example of such a modern geodetic site.

Norway has participated in building the European satellite navigation systems Galileo and EGNOS (European Geostationary Navigation Overlay Service). Active Norwegian participation gives the Norwegian government, industry and institutions the opportunity to influence coverage, entry and use of services. A central aspect of participation in Galileo and EGNOS is to secure that the systems for satellite navigation and observation will perform sufficiently over Norwegian territories, especially in the Arctic.

8.5 Actions taken to support capacity-building related to research and systematic observations in developing countries

Cooperation between MET Norway and the NMHSs in Bangladesh, Myanmar and Vietnam on Capacity Building are supported and funded by the Norwegian Ministry of Foreign Affairs (MFA) and are in collaboration with Asian Disaster Preparedness Center (ADPC)[98]. The focus is on capacity building at the organizational and individual level, with emphasis on forecasting, forecast verification, climate services and ocean modelling, as well as to strengthen early warning systems as part of national prevention plans to prevent disasters by extreme weather. MET Norway's state-of-art facilities are used to strengthen and develop the operational forecasting and climate services through capacity building, by implementation of integrated forecasting tools and building and utilizing existing climate information in creating modern climate products and services. By working on digitization of climate data, quality control and establishing a climate database, the countries are now able to generate climate products and national climate reports.

8.6 Opportunities for and barriers to free and open international exchange of data and information

International exchange of data and information is facilitated by the formal requirements of EU research programmes and other international cooperative research initiatives. Increasing use of common data gathering platforms, like remote sensing and coordinated site-based networks, also contribute to better opportunities for reliable data exchange among researchers. However, there are still considerable challenges pertaining to free and open data exchange, including formal restrictions on data access, an unwillingness of scientists to share data, and incompatible methods and sampling protocols. Hence, increased efforts are needed to reduce such barriers to effective data exchange in research and management.

To secure a cost-efficient exchange of information, data and products, data providers need to implement standardised licenses that are widely used and understood, not only in the community as such but also among all potential user groups. Standardised licenses, e.g. the Creative Common attribution license, makes it easy for the data providers to handle the formalities as the license is made ready to use out of the box. It is also easy to cater for the need for compatible conditions when putting together information or mashing up data sets when using standardised licenses.

One of the biggest barriers to sharing data is conversion of data formats to suit the different

[98] http://www.wmo.int/gfcs/node/957

reporting systems. The development of IT solutions is required to overcome this challenge. The Norwegian Environment Agency has for instance been developing IT solutions that enable to extract and convert data from the Norwegian Water Information System (Vannmiljø) for reporting in the required formats to the relevant systems. However, reporting systems may require data that we do not have available.

9 EDUCATION, TRAINING AND PUBLIC AWARENESS

9.1 Introduction

The text of the Convention on Climate Change (UNFCCC) refers directly to education, training and public awareness, and these issues have been important elements of the Norwegian climate policy since the 1990s. Several activities have been initiated to give the general public a better understanding of climate change and its effects. This in turn should result in support for policy measures to deal with climate change and also encourage public participation in climate-related measures; in accordance with national policy for the green shift.

The Ministry of Education and Research is working closely across departments and ministries on the implementation of the Sustainable Development Goals at the national and global level. Each year, the ministry reports on progress for the SDGs to the Norwegian parliament, in the budget proposal. The Ministry of Education and Research is responsible for the national coordination of SDG 4: Quality Education, and is cooperating closely with the Ministry of Foreign Affairs on the follow-up of SDG 4 internationally. Norway is an active supporter of UNESCOs leading role in the global coordination of SDG 4. In an effort towards strengthening global academic and student mobility, Norway was the first country to ratify the Global Convention on the Recognition of Qualifications Concerning Higher Education in 2020.

9.2 Education

Awareness of and knowledge about issues related to sustainable development and climate change has long been embedded in the Norwegian education system. Norway takes part in the 2030 Agenda for Sustainable Development and UNESCO's the Global Action Programme on Education for Sustainable Development.Norway has set benchmarks for the global indicators of SDG 4, as part of the process initiated by UNESCO in 2021. The benchmarks were reviewed in 2022 and benchmarks were set for the seventh indicator on gender equity. The national benchmarks are aligned with national policies and strategies, and the targets they contain. National indicators were suggested as part of the National Action Plan for the 2030 Agenda, and the government will follow up on the further development of national indicators for SDG 4 in cooperation with Statistics Norway.

9.2.1 Early Childhood Education and Care

Kindergartens play an important role in promoting values, attitudes and practices for more sustainable communities, and Kindergartens shall promote sustainable development. The Kindergarten Act states that the children must learn to take care of themselves, each other and nature.

The Framework Plan for Kindergartens is a regulation on the contents and tasks of Kindergartens and the most recent version was adopted in 2017. One of the core values is sustainable development. Sustainable development is about how people who are alive today can have their basic needs met without denying future generations the opportunity to fulfil theirs. It is about thinking and acting locally, nationally and globally. Kindergartens shall help make the children understand that their actions today have consequences for the future.

Furthermore, one of the seven learning areas is “nature, environment and technology”. Kindergartens shall foster the children’s ability to think critically, act ethically and show solidarity. Children shall be given opportunities to give care and to look after their surroundings and the natural environment. For Sami children, this means living in harmony with, making use of and reaping the land. The children shall be given outdoor experiences and discover the diversity of the natural world, and kindergartens shall help the children to feel connectedness with nature.

9.2.2 Primary and Secondary Education

The Education Act states that the pupils and apprentices must learn to think critically and act ethically and with environmental awareness.

The core curriculum – values and principles for primary and secondary education and training – is part of the curriculum LK20 and LK20S that was adopted in 2020. The core curriculum elaborates on the core values in the Education Act and the overriding principles for primary and secondary education and training. Respect for nature and environmental awareness is part of the core values of the education and training. School shall help the pupils to develop an appreciation of nature so they can enjoy and respect nature and develop climate and environmental awareness. Throughout their schooling the pupils must acquire knowledge about and develop respect for nature. They must experience nature and see it as a resource and as a source of utility, joy, health and learning. The pupils shall develop awareness of how our lifestyles impact nature and the climate, and thus also our societies. The school shall help the pupils to develop the willingness to protect the environment.

In the Norwegian curriculum, three interdisciplinary topics are prioritised. These are *health and life skills*, *sustainable development* and *democracy and citizenship*. The interdisciplinary topics are based on prevailing societal challenges which demand engagement and effort from individuals and local communities, nationally and globally. The pupils develop competence in connection with the interdisciplinary topics by working with issues from various subjects. They shall gain insight into challenges and dilemmas in these topics. Pupils must understand where we can find solutions through knowledge and collaboration, and they must learn about the relationship between actions and consequences.

Sustainable development as an interdisciplinary topic in school shall help the pupils to understand basic dilemmas and developments in society, and how they can be dealt with. In working with this topic the pupils shall develop competence which enables them to make responsible choices and to act ethically and with environmental awareness. The pupils must learn to understand that all individual activities and choices are significant.

9.2.3 Higher education

The Parliament recently adopted changes to the *Act relating to universities and university colleges* in which the commitment to promote sustainable development is stated explicitly in the act for the first time.

The Norwegian government’s white paper on research Meld. St. 5 (2022–2023) *Long-term plan for research and higher education 2023–2032* outlines the Government policy for research and higher education. The white paper identifies climate change as the defining challenge in the world today. The Government will scale up appropriations to research and higher education within six long-term priority areas:

- Oceans and coastal areas
- Climate, the environment and energy
- Health Enabling and industrial technologies
- Social security and preparedness
- Trust and community

Norway is part of the global knowledge development trend and participates extensively in international cooperation on research and education with countries throughout the world. Norway is participating in Erasmus+, the world's largest educational exchange. The 2021–2027 programme places a strong focus on social inclusion and the green and digital transitions. The Government states in the white paper that it will continue its work to stimulate institution-based, long-term international collaboration.

9.3 Information

9.3.1 Generation Green – Climate Ambassadors

The Generation Green-initiative with Climate Ambassadors was a National Climate lecture tour in Norwegian middle schools and upper secondary schools (high school). The goal was to enhance climate change education and public awareness by creating a balance between education and positive storytelling that legitimizes and strengthens climate change as an important part of the curriculum.

9.3.2 The Environmental Information Act

The Ministry of Climate and Environment uses all available channels and information activities to provide different target groups with relevant information. The Environmental Information Act[99] entered into force on 1 January 2004. It aims to ensure public access to environmental information in accordance with *Section 112 of the Norwegian Constitution*[100] and Norway's obligations pursuant to the UNECE *Aarhus Convention*[101]. It provides any person with a legal right to obtain environmental information, both from the public authorities and from public and private undertakings. It obligates not only public authorities but also public and private undertakings to hold environmental information as defined in Section 2 and to provide access to such information.

The notion of environmental information is broadly defined and covers factual information and assessments concerning

- the status and development of the environment (including archaeological and architectural monuments and sites and cultural environments),
- factors that affect or may affect it,
- human health, safety and living conditions to the extent that they are or may be affected by the state of the environment or factors that affect or may affect it

Public authorities are obligated to hold general environmental information relevant to their areas of responsibility and functions, and make it accessible to the public. This obligation is implemented through a number of freely accessible websites such as *http://www.environment.no/* and *http://www.norskeutslipp.no/en/Frontpage/*. Public authorities are obliged to provide access on request to environmental information which they have or are obliged to hold as stated above. Rejection of individual requests for access to environmental information from public authorities may be appealed to the authority immediately superior to the one rejecting the request, and a complaint may also be submitted to the Parliamentary Ombudsman.

99 *https://www.regjeringen.no/en/dokumenter/environmental-information-act/id173247/*

100 https://www.stortinget.no/globalassets/pdf/english/constitutionenglish.pdf

101 https://www.unece.org/env/pp/treatytext.html

The Act obligates public and private undertakings to hold information about factors relating to their operations that may have an appreciable effect on the environment and to supply such information on request. All areas of activity are included and the obligation applies not only to commercial enterprises but also other organised activities. In practice, only private households are excluded from the obligation. It gives any person the right to request information on everything from how products and services are produced and supplied, the content of the products to what products and services are bought and used by the undertakings. Information on substances or product attributes that are or may be harmful to health and the environment must be available at all stages of production and use and be readily available for the users of the products.

Products that do not have any effects on the environment in Norway, may have environmentally harmful effects abroad during production and distribution. The Act gives any person the right to ask for this kind of information too.

An appeals board has been established to handle complaints concerning rejections of requests for information from public and private undertakings. The provisions regulating the composition and functioning of the appeals board requires that half the members of the appeals board have an industry background, and that the other half have a background from an environmental organisation, a consumer organisation or the media. The existence of the appeals board ensures proper evaluation and control of whether requests for information from public and private enterprises are handled in accordance with the Act.

A guideline[102] for the Environmental Information Act was published in Norwegian in 2020 in order to among others make the Act more known and used.

9.3.3 Public websites

State of the Environment Norway (www.miljostatus.no) aims to provide the public with the latest information about the state and development of the environment in Norway. The Ministry of Climate and Environment has assigned the production of State of the Environment Norway to the environmental authorities. The Norwegian Environment Agency has the overall editorial responsibility. The website covers twelve environmental topics which are further divided into several subtopics. Each topic is presented in a simple and easy-to-follow way and provides access to more detailed scientific presentations. The website includes an interactive map and environmental data available for download. Norway's environmental targets are also found here.

The Norwegian Environment Agency also has the editorial responsibility for the Norwegian Pollutant Release and Transfer Register (PRTR). The website www.norskeutslipp.no provides the public with information on chemical substances and pollutants released to air, water and soil from industrial activities in Norway, in addition to waste generated from industry. The data is searchable and can be presented by industry sector, by facility, by a chemical substance or groups of substances.

9.3.4 Statistics and guidance material to counties and municipalities

Municipalities and counties possess instruments to contribute to reductions in greenhouse gas emissions and need a sound knowledge base to make informed decisions. The knowledge base

[102] *https://www.regjeringen.no/contentassets/79d0463b787c486f9d7af6bbe7044a29/t-1572-b.pdf*

should consist of both statistics or inventories to track progress, and methodologies to calculate the potential for greenhouse gas emission reductions for different mitigation actions. Statistics Norway publishes statistics on greenhouse gas emissions at the county level. An analysis of greenhouse gas emissions for municipalities is produced and published by the Norwegian Environment Agency at *https://www.miljodirektoratet.no/tjenester/klimagassutslipp-kommuner/*.

The Norwegian Environment Agency has also developed and published guidance and tools to help counties and municipalities to quantify the potential effect of different mitigation actions. These are published at *https://www.miljodirektoratet.no/tjenester/klimagassutslipp-kommuner/beregne-effekt-av-ulike-klimatiltak/*

The Norwegian Environment Agency provides guidance on climate and energy planning for municipalities.[103] This guidance includes, among other topics, guidance on:

- How to organize and develop climate and energy plans, and what are the formal requirements
- How to set goals and develop an action plan
- How to use statistics
- How to calculate the effect of mitigation actions
- Examples of measures to reduce greenhouse gas emissions and energy use

In addition, the NEA share knowledge and experiences from municipal and regional projects through regular *webinars*, a *podcast* and an online searchable *list of all projects* that have received funding from the directorate. We also facilitate a range of physical and digital conferences, seminars and discussion groups for sharing knowledge.

[103] *http://www.miljokommune.no/Temaoversikt/Klima/Klima--og-energiplanlegging/*

9.3.5 Consumer information

Providing information about the environmental effects of products throughout their life cycles is an essential part of efforts to promote sustainable consumption patterns. The Nordic environmental label (Nordic Swan Label) is the predominant official eco-label in Norway, Sweden, Denmark, Finland and Iceland. The label is awarded only to those products in a product range that fulfil strict criteria for environmental impact throughout their life cycles. The Swan Label has been developed through cooperation between governments and business, environmental and consumer organisations, and the overall aim of the label is to stimulate both the supply of and demand for products with a reduced environmental impact. The label is available for 55 different product groups counting more than 200 different product types. More than 25 000 different products are sold with the Nordic Swan ecolabel in the Nordic countries. Everything from detergent to furniture and hotels can carry the Swan label. The Swan is a widely recognised eco-label in the Norwegian market. According to a Nordic consumer survey in 2019, nine out of ten Nordic consumers know the Nordic Swan ecolabel.

Figure 9.1 The Nordic Swan Label

Norway also takes part in the EU eco-labelling system (the Flower). There are over 83 000 products certified with the EU flower and it is most common in countries such as Spain, Italy, France and Germany. There is a close and active cooperation and coordination between the Flower and the Nordic Swan. The Swan Label is a member of the Global Eco-labelling Network (GEN), which is a non-profit association of eco-labelling organisations from around the world.

Figure 9.2 The EU flower

Norway has implemented EU-directives relating to energy efficiency.

The EU Energy Labelling Directive (2017/1369) regards energy labelling of products such as televisions, lighting, refrigerators, freezers and their combinations, tumble driers, washing machines, combined washer-driers, and air-conditioners. The label shows the product`s energy efficiency performance according to a classification system under the directive.

Directive 2018/844 amends the Energy Performance of Buildings Directive (2002/91/). The five 'overarching' standards have in common that each of these describes an important step in the assessment of the energy performance of building.

9.4 Public procurement policies

A revised law on public procurement was adopted by the Parliament in 2016. The law as well as revised regulations on public procurement procedures under the law entered into force from 1.1.2017. This regulatory reform includes implementation of the revised EU-directives on public procurement from 2014 into Norwegian legislation. The Norwegian law on public procurement includes a general duty for contracting authorities at central, regional and local administrative levels within the scope of the law, to ensure that the procurement policy of the authority does not cause adverse environmental effects and promotes climate friendly solutions where relevant. The law underlines life cycle cost assessments as particularly relevant tools when applying a cost-effective approach to the most economically advantageous tender and when assessing the best price-quality ratio. The regulations under the law stress the duty for the contracting authorities to minimise the environmental consequences of public procurement of works, supplies and services. The regulations allow for environmental aspects to be taken into account at various stages of the procurement process. Furthermore, a new procurement relevant regulation has been introduced establishing that all new vehicles/personal cars purchased after 01.01.2022 must be zero emission vehicles, from 2023 this will also be the case for small vans. Similar regulations are in the pipeline for ferries from 2024 and speed boats from 2025.

As a signatory to the Paris Agreement on Climate Change, Norway is committed to reducing its greenhouse gas emissions by 50–55 per cent by 2030, compared to 1990 levels. The aim is to be a low emission country by 2050, as defined in the Norwegian Climate Change Act. The public sector must help ensure that we meet these targets.

A national action plan to increase the proportion of green public procurement and green innovation was launched 9th September 2021. The action plan was prepared by the Norwegian Agency for Public and Financial Management (DFØ) in close collaboration with the Norwegian Environmental Agency. The objective of the action plan is to increase the proportion of green public procurement and green innovation during the period leading up to 2030. The action plan will help achieve this objective by clarifying governing priorities for contracting authorities and by advising which actions and measures to implement. A list of priority public procurement categories is provided where the contracting authorities should generally include environmental requirements or criteria to help minimize environmental impact and promote zero and low emission solutions and a circular economy:

- transport
- building, construction and property (BCP)
- food and catering services
- plastic products and products containing plastics
- ICT/electrical and electronic products
- batteries
- furniture
- textiles

The Norwegian Agency for Public and Financial Management (DFØ) is responsible for implementing several of the actions in the action plan, including a program for a green competence boost for procurements in Norway, including development of green public procurement criteria, a help desk and a regional task force; continue and strengthening management development programs with a focus on green procurement and innovation culture; continuing to improve access to statistics and data on green and innovative public procurement; as well as a program to include technology start-ups in the procurement process, run by DFØ, the Norwegian Digitalisation Agency and LUP in cooperation with market actors.

9.5 Resource and information centres

The state-owned enterprise Enova contributes to reduced greenhouse gas emissions and development of climate and energy technology, mainly by providing grants for projects in businesses, households and as well as local and regional governments. Enova also provides advisory services for both business and individuals. For individuals, there is a focus on the need to acquire information at an early stage in the decision making proses, as well as assistance with the actual application process. The advisory services are provided through a dedicated website and through the Ask Enova service. Ask Enova received almost 35 000 inquiries in 2021.

9.6 Participation in international activities

Both Norwegian governmental and non-governmental organisations engage in activities at international level which contributes to the enhanced, collective ability of Parties to implement the Convention and the Paris Agreement. These activities and the support provided for these activities, are described in the various chapters, and in particular in chapter 7 of this report.

9.7 Involvement of the public and non-governmental organisations

Norway aims to have a high degree of transparency and broad involvement in environmental policymaking and implementation of regulations. Norwegian environmental authorities have a long tradition of including the civil society in environmental policymaking. For example, Norway provides annual financial support to a number of non-governmental organisations (NGOs) listed in the Government's annual budget.

Norway included Civil Society Assessment of national progress on the Sustainable Development Goals, in the Voluntary National Review to the UN in 2021.

Legal proposals (laws and regulations) are generally subject to open hearings where civil society can voice their opinion. Civil society can also interact with the government and the Parliament in relation to other policy tools, such as budget proposals and white papers. In 2021 the government appointed an official committee to investigate which choices Norway faces in order to achieve the goal of becoming a low-emission society by 2050. The committee has organized webinars and invited views as a basis for the committee's further work. The committee will deliver it's report before November 2023.

Norway also has a tradition of involving NGOs in the preparations before COP-meetings and when developing new climate policies. For example in relation to the follow up on the Glasgow Climate Pacts call for parties to assess whether their NDC are aligned with the Paris Agreements temperature goal the Minister for Climate and Environment invited NGOs, children and youth and scientists to give their input. Before COP-meetings the Minister of Climate and Environments also invites NGOs and children and youth to provide their views on what Norwegian priorities in the climate negotiations should be.

The Ministry of Climate and Environment also provides financial support for NGOs to participate in different international meetings. Norway also aims to involve the NGOs in the preparations for such meetings, and to give them the possibilities to contribute actively during the meetings. NGOs are represented in the official Norwegian delegation under UN Climate Negotiations, and under UNEP's board meetings.

European legislation through the EEA is an important pillar in Norwegian environmental policy, including on climate change. Norway also has an EEA environment reference group, where civil society is represented, together with governmental organisations. The purpose is to let the organisations participate in the consultation process before EEA environmental legislation is implemented in the EEA Agreement.

The National Communication is a description of the situation, policies and instruments related to climate change, and the public is therefore not involved in the preparation of this report.

9.8 Monitoring, review and evaluation of the implementation of article 6 of the convention

Norway has no formal monitoring, review and evaluation process in place for assessing the implementation of Article 6 of the UNFCCC. However, implementation of Article 6 is taken into account as part of other commitments related to mitigation, adaptation and international cooperation.

10 ANNEX

10.1 Annex I. Summary tables on emission trends

This Annex contains 5 tables summarising the results of the latest greenhouse gas inventories for Norway 1990–2020. The tables are drawn from the annual submission under the Climate Convention and the Kyoto Protocol from 08.04.2022.[104]

CRF TABLE 10S1: NORWAY'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES DURING THE PERIOD 1990–2020

CRF TABLE 10S2: NORWAY'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) DURING THE PERIOD 1990–2020

CRF TABLE 10S3: NORWAY'S EMISSIONS OF METHANE (CH_4) DURING THE PERIOD 1990–2020

CRF TABLE 10S4: NORWAY'S EMISSIONS OF NITROUS OXIDE (N_2O) DURING THE PERIOD 1990–2020

CRF TABLE 10S5: NORWAY'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HCFS, PFCS AND SF_6) DURING THE PERIOD 1990–2020

Note references in the tables:

(1) The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

(2) Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(3) In accordance with the UNFCCC reporting guidelines, for Parties that decide to report indirect CO_2 the national totals shall be provided with and without indirect CO_2.

(4) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

(5) Includes net CO_2, CH_4 and N_2O from LULUCF.

[104] The complete set of CRF tables are found at: *https://unfccc.int/ghg-inventories-annex-i-parties/2022*. The CRF tables 10S1-10s5 are also reported as CTF table 1 together with Norway's fifth Biennial Report.

Table AI-1 CRF TABLE 10S1: NORWAY’S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES DURING THE PERIOD 1990–2020.

	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	(kt CO2 equivalents)													
Total (net emissions)(2)	40889,89	40889,89	36694,92	35626,76	36060,62	40038,24	36187,88	39999,55	41329,80	39120,60	38580,12	36281,48	35586,04	33305,60
1. Energy	28840,36	28840,36	27785,10	28909,88	30061,15	31670,41	32140,63	35198,99	35026,57	34933,57	35922,10	35049,61	36808,89	36539,99
A. Fuel combustion (sectoral approach)	25430,37	25430,37	24974,56	25685,73	26569,42	28020,25	28582,84	31138,67	31120,49	30908,70	31299,77	30142,36	32205,74	32540,92
1. Energy industries	7267,07	7267,07	7614,55	8173,95	8444,14	9162,19	9069,78	9946,19	10316,49	10000,03	9949,35	10866,61	12082,28	12346,94
2. Manufacturing industries and construction	3421,34	3421,34	3163,06	3231,18	3452,30	4060,49	3949,67	4405,95	4167,38	4143,91	3877,47	3485,42	3543,38	3404,55
3. Transport	10055,82	10055,82	9800,95	10022,29	10325,14	10285,98	10998,72	11524,98	11791,94	12093,48	12760,50	11951,22	12290,04	12190,18
4. Other sectors	4331,00	4331,00	4075,61	3938,14	4098,15	4106,86	4090,49	4809,37	4416,69	4296,41	4298,61	3648,77	3986,84	4129,33
5. Other	355,14	355,14	320,38	320,17	249,69	404,72	474,18	452,18	427,99	374,86	413,83	190,35	303,21	469,92
B. Fugitive emissions from fuels	3409,99	3409,99	2810,54	3224,14	3491,73	3650,17	3557,79	3978,31	3876,08	4019,68	4612,22	4897,92	4599,09	3990,49
1. Solid fuels	183,85	183,85	179,64	159,50	162,18	158,28	154,12	153,12	141,38	142,08	159,88	166,55	156,01	147,93
2. Oil and natural gas and other emissions from energy production	3226,14	3226,14	2630,89	3064,65	3329,55	3491,88	3403,67	3825,19	3734,69	3877,60	4452,34	4731,38	4443,08	3842,56
C. CO_2 transport and storage	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	82,01	30,01	5,20	10,11	9,32	4,06	8,57
2. Industrial Processes	15376,57	15376,57	14189,03	11457,62	12267,90	12569,25	12436,00	12309,98	12598,05	12894,48	12959,63	13220,28	12827,43	12026,65
A. Mineral industry	727,69	727,69	680,89	739,68	925,03	943,44	990,33	991,84	1056,44	1035,21	1002,25	1013,11	982,34	992,09
B. Chemical industry	4129,28	4129,28	3921,71	3253,88	3529,50	3678,60	3648,09	3724,38	3944,78	3896,02	3806,68	4023,48	4018,89	4039,48
C. Metal industry	10113,29	10113,29	9186,33	7058,77	7360,75	7464,77	7285,46	7034,63	6923,59	7250,53	7373,19	7353,86	6911,18	6090,67
D. Non-energy products from fuels and solvent use	287,45	287,45	265,05	263,68	268,07	265,66	235,72	247,97	247,80	222,64	218,73	207,19	204,72	203,76
E. Electronic industry	NO	NO	NO	NO	NO	NO	1,03	1,03	1,03	1,03	1,14	1,14	1,14	1,14
F. Product uses as ODS substitutes	0,04	0,04	1,31	2,82	35,80	54,08	97,84	129,54	195,34	258,37	322,89	369,28	466,71	503,95
G. Other product manufacture and use	87,53	87,53	90,80	97,56	105,61	119,90	130,57	133,83	172,76	174,98	177,95	189,46	171,30	121,67
H. Other	31,27	31,27	42,95	41,23	43,14	42,79	46,97	46,77	56,33	55,70	56,80	62,76	71,16	73,90
3. Agriculture	4812,30	4812,30	4746,21	4713,47	4706,88	4708,86	4749,19	4783,40	4727,23	4719,51	4737,74	4586,37	4536,26	4519,38
A. Enteric fermentation	2414,60	2414,60	2388,50	2403,61	2389,40	2428,97	2429,73	2446,93	2407,51	2408,89	2445,24	2339,18	2321,30	2313,31
B. Manure management	486,25	486,25	490,87	496,49	481,08	486,15	484,52	494,84	484,97	488,27	495,25	472,99	480,13	478,70
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	1644,39	1644,39	1637,71	1631,96	1621,56	1604,93	1622,41	1640,79	1639,45	1646,31	1624,35	1622,23	1583,65	1582,59
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	35,53	35,53	27,93	15,20	21,01	15,08	18,69	20,39	14,67	15,41	13,84	14,75	11,63	8,71
G. Liming	230,97	230,97	200,64	165,65	193,27	173,17	193,31	179,91	180,07	160,07	158,51	137,11	139,48	135,64
H. Urea application	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,11	0,07	0,43
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry(2)	-10541,90	-10541,90	-12330,13	-11740,85	-13271,17	-11197,81	-15443,54	-14511,88	-13203,30	-15440,22	-17002,74	-18640,90	-20606,62	-21704,18
A. Forest land	-13254,69	-13254,69	-15077,69	-14832,06	-16419,82	-14159,53	-18415,58	-17839,51	-17111,66	-19229,74	-20697,25	-22675,50	-24706,37	-25854,70
B. Cropland	2003,68	2003,68	1996,24	1992,66	1992,21	1996,17	2064,27	2041,31	2167,41	2171,17	2141,59	2105,12	2204,05	2112,79
C. Grassland	-250,31	-250,31	-248,50	-245,45	-240,70	-235,53	-189,15	-55,68	9,04	-18,08	3,74	-27,60	-124,21	-137,54
D. Wetlands	258,40	258,40	256,31	266,95	256,51	254,56	263,78	268,98	306,29	301,39	295,42	293,36	294,88	271,84
E. Settlements	1665,65	1665,65	1629,81	1632,29	1600,37	1639,89	1806,30	1858,95	2031,37	2003,01	2076,41	2156,77	2212,88	2206,98
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products	-999,88	-999,88	-921,73	-590,44	-494,47	-727,71	-1007,91	-821,64	-644,16	-708,29	-865,23	-536,89	-532,35	-348,13
H. Other	31,15	31,15	30,79	30,44	30,08	29,73	30,14	31,19	33,25	35,32	37,30	38,50	39,08	38,76
5. Waste	2402,56	2402,56	2304,71	2286,65	2295,87	2287,53	2305,60	2219,05	2181,25	2013,26	1963,40	2066,13	2020,08	1923,76
A. Solid waste disposal	2061,76	2061,76	1965,15	1934,42	1941,50	1936,51	1948,15	1867,39	1825,08	1664,25	1582,57	1634,76	1565,57	1491,84
B. Biological treatment of solid waste	5,22	5,22	5,24	7,34	9,51	12,06	19,67	21,53	25,44	29,32	42,02	53,29	64,99	63,63
C. Incineration and open burning of waste	16,03	16,03	23,82	23,63	29,21	25,31	23,71	26,63	27,19	29,23	45,33	91,12	101,07	99,65
D. Waste water treatment and discharge	319,55	319,55	310,50	321,26	315,64	313,65	314,07	303,50	303,53	290,45	293,48	286,95	288,45	268,63
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in summary 1.A)														
Memo items:														
International bunkers	3034,96	3034,96	2671,21	2866,89	2854,08	2769,59	2945,72	3349,12	3989,83	4027,31	3940,66	3830,01	3688,80	3089,48
Aviation	653,20	653,20	592,36	635,33	644,18	626,54	572,03	678,52	757,79	809,85	932,21	899,73	816,48	717,52
Navigation	2381,76	2381,76	2078,86	2231,56	2209,89	2143,05	2373,69	2670,60	3232,04	3217,46	3008,45	2930,28	2872,32	2371,96
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 emissions from biomass	4488,51	4488,51	4394,37	4115,19	4428,84	4759,57	4854,02	4863,41	5035,57	4677,61	4854,73	4712,58	5111,91	5198,28
CO2 captured	NO	NO	NO	NO	NO	NO	NO	152,01	695,01	847,20	981,11	942,32	1013,06	963,57
Long-term storage of C in waste disposal sites	18073,68	18073,68	18694,48	19290,03	19860,46	20405,76	20926,78	21441,28	21940,08	22429,89	22871,69	23289,12	23660,81	24033,31
Indirect N2O	280,46	280,46	270,61	275,82	284,35	291,20	308,83	323,30	336,18	338,98	329,54	312,43	310,60	301,65
Indirect CO2 (3)	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE
Total CO2 equivalent emissions without land use, land-use change and forestry	51431,79	51431,79	49025,05	47367,61	49331,79	51236,05	51631,42	54511,43	54533,10	54560,82	55582,86	54922,38	56192,66	55009,78
Total CO2 equivalent emissions with land use, land-use change and forestry	40889,89	40889,89	36694,92	35626,76	36060,62	40038,24	36187,88	39999,55	41329,80	39120,60	38580,12	36281,48	35586,04	33305,60
Total CO2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total CO2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Change from base to latest reported year
																		%
32296,20	33020,24	34615,98	32650,63	34234,94	31431,61	25553,22	31222,87	28976,22	32050,38	31794,10	35943,02	41387,37	40749,35	38977,60	38269,63	34650,02	28940,24	-29,22
37755,12	37435,06	36909,95	37710,43	39423,80	38136,41	38167,71	39687,40	38569,40	38138,03	38252,66	38529,64	38991,21	38129,77	37502,87	37519,82	35927,08	34187,76	18,54
33908,72	33773,45	33391,76	34346,17	34664,77	34164,30	34874,49	36220,93	35127,58	34729,54	34894,05	35568,72	35755,04	35060,84	34667,41	34794,79	33744,94	32142,28	26,39
13095,08	13179,41	13428,56	13387,33	13720,02	13750,60	14740,39	14889,79	14465,55	14170,62	14215,63	14904,89	15402,93	14 939,65	15 328,83	15 156,19	15 001,66	14 305,42	96,85
3599,18	3425,61	3252,90	3561,80	3486,17	3425,62	3118,75	3419,08	3236,73	3093,95	3228,85	3013,30	3003,25	2 955,23	3 062,04	3 167,48	2 983,40	2 904,30	-15,11
12748,37	12968,23	12998,23	13512,02	13835,43	13622,06	13405,70	14040,86	14104,22	14247,80	14283,05	14642,93	14343,32	13 841,88	13 048,53	13 241,61	12 723,93	11 929,48	18,63
4292,00	3868,58	3457,67	3648,85	3451,52	3236,63	3423,63	3670,29	3106,02	3018,15	2956,99	2793,21	2822,87	3 140,41	3 038,42	3 080,40	2 922,01	2 903,80	-32,95
174,09	331,62	254,40	236,17	171,63	129,38	186,02	200,91	215,07	199,01	209,53	214,39	182,67	183,67	189,60	149,12	113,95	99,28	-72,04
3821,48	3639,23	3510,99	3360,78	4681,11	3863,12	3236,80	3369,69	3350,64	3345,58	3325,07	2916,90	3194,21	3058,29	2827,82	2711,04	2170,87	2041,84	-40,12
190,06	144,18	122,41	118,63	151,27	122,46	107,95	101,96	111,42	95,53	119,84	117,46	98,83	92,66	81,16	80,84	79,80	78,55	-57,28
3631,42	3495,05	3388,58	3242,16	4529,84	3740,66	3128,85	3267,73	3239,23	3250,05	3205,23	2799,44	3095,38	2 965,62	2 746,66	2 630,20	2 091,07	1 963,29	-39,14
24,92	22,38	7,20	3,48	77,92	108,98	56,42	96,79	91,17	62,91	33,53	44,02	41,97	10,64	7,64	13,99	11,26	3,64	100,00
11378,90	12126,94	11669,30	10930,93	10905,25	10805,53	8371,14	9102,44	9239,83	9169,56	9302,04	9311,46	9317,41	9263,06	9245,55	9296,03	9258,97	9224,44	-40,01
1045,77	858,67	920,73	957,28	1017,33	1043,31	1011,17	1023,11	1013,81	998,18	1055,06	1055,67	987,09	971,60	1 025,33	992,22	999,89	963,76	32,44
3927,44	4185,46	3936,18	3847,90	3411,74	3118,14	2385,55	2462,84	2421,99	2355,06	2225,78	2115,29	2323,36	2 064,43	1 944,70	2 103,95	2 028,09	2 013,72	-51,23
5515,04	6143,93	5872,16	5108,87	5401,04	5518,43	3792,72	4322,55	4438,99	4393,30	4497,23	4666,20	4640,44	4 805,02	4 838,78	4 791,51	4 912,45	5 002,55	-50,53
209,59	211,75	204,23	194,81	206,46	204,75	190,09	208,09	218,43	211,42	222,44	221,08	203,87	218,13	216,36	217,40	187,40	226,88	-21,07
1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	1,14	100,00
515,84	544,11	548,74	620,27	683,96	739,40	819,05	894,24	965,82	1028,35	1118,12	1081,09	963,35	1 005,48	1 029,18	996,54	933,97	809,97	1845045,27
79,05	93,53	93,60	114,78	94,35	90,01	87,34	95,52	79,10	77,50	81,17	71,10	89,61	81,67	76,47	71,51	82,36	86,84	-0,79
85,03	88,35	92,53	85,88	89,23	90,35	84,08	94,94	100,54	104,61	101,11	99,89	108,55	115,59	113,60	121,77	113,68	119,58	282,38
4596,68	4562,11	4569,38	4482,33	4475,16	4459,17	4441,93	4360,57	4332,80	4352,23	4402,74	4473,25	4537,83	4587,46	4563,77	4541,64	4518,01	4509,62	-6,29
2347,93	2316,47	2323,33	2270,22	2249,14	2249,08	2281,14	2261,57	2202,00	2207,34	2229,76	2246,90	2282,98	2 330,98	2 323,97	2 307,24	2 242,72	2 232,70	-7,53
498,88	498,42	504,73	501,41	506,04	508,82	517,53	521,90	510,63	517,16	524,41	525,10	529,65	535,88	532,48	532,64	519,24	516,80	6,28
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
1618,61	1627,55	1625,15	1601,03	1615,87	1599,78	1551,01	1494,66	1538,80	1544,34	1563,82	1608,74	1631,20	1 628,09	1 609,82	1 596,49	1 637,71	1 628,95	-0,94
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
7,32	8,21	6,89	5,75	5,46	5,77	3,98	4,11	3,11	3,29	2,92	3,74	4,11	4,01	3,96	2,25	3,94	3,77	-89,40
123,87	110,25	109,18	103,80	97,48	94,83	86,92	78,01	77,93	79,87	81,67	88,61	89,68	88,31	93,44	102,91	114,30	127,32	-44,88
0,07	1,22	0,10	0,12	1,17	0,89	1,35	0,32	0,33	0,23	0,16	0,16	0,22	0,19	0,09	0,10	0,10	0,08	-85,20
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
-23317,02	-22993,76	-20329,21	-22283,16	-22369,97	-23699,42	-27118,89	-23715,80	-25014,59	-21362,33	-21877,45	-18097,56	-13100,88	-12836,43	-13862,74	-14601,45	-16436,02	-20332,31	92,87
-27452,64	-26985,81	-24134,54	-26217,01	-26339,05	-28192,79	-32060,89	-29570,18	-30071,04	-26537,42	-26879,43	-23381,93	-18567,71	-17 884,67	-18 644,80	-19 423,09	-21 070,33	-24 503,77	84,87
2106,35	2101,96	2105,15	2172,99	2169,13	2191,34	2199,22	2296,02	2237,21	2277,48	2272,74	2224,01	2287,91	2 238,30	2 222,13	2 223,12	2 264,55	2 235,30	11,56
-79,79	-137,81	95,93	194,08	287,01	426,81	577,32	458,06	501,73	396,51	193,06	30,63	97,12	-40,24	40,43	134,05	215,39	167,94	-167,09
311,03	314,05	335,07	329,65	307,17	351,98	330,39	319,37	319,94	315,78	287,23	289,13	281,68	278,25	297,22	316,72	312,20	308,93	19,56
1885,67	1867,23	1705,45	1613,88	1521,68	1722,95	1724,45	2057,32	1864,56	1971,11	1792,51	2143,46	2537,19	2 434,51	2 404,87	2 477,32	2 264,58	1 857,43	11,51
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
-132,28	-197,53	-480,90	-422,09	-361,64	-246,68	62,60	674,05	82,86	163,74	405,96	546,73	211,94	83,81	-235,98	-381,69	-473,57	-449,25	-55,07
38,60	38,75	39,01	39,70	40,69	41,50	42,02	42,99	43,53	43,66	43,91	44,53	45,01	45,49	45,16	44,77	44,20	43,69	40,29
1882,51	1889,90	1796,57	1810,09	1800,70	1729,93	1691,32	1788,27	1848,79	1752,89	1714,11	1726,23	1641,79	1605,49	1528,16	1513,59	1381,98	1350,73	-43,78
1474,28	1462,12	1374,01	1392,57	1362,95	1302,66	1317,49	1291,12	1276,29	1234,01	1197,53	1169,30	1103,23	1 038,91	978,22	940,59	877,22	843,24	-59,10
62,88	74,75	72,46	72,98	89,92	88,09	81,47	83,10	72,87	90,16	97,89	78,30	79,71	87,41	73,47	84,24	67,16	64,94	1143,33
68,61	78,96	78,25	72,77	75,03	69,97	19,79	129,94	175,97	157,29	153,42	212,77	183,61	195,46	200,96	213,66	165,56	167,92	947,69
276,75	274,07	271,84	271,77	272,80	269,20	272,58	284,10	323,67	271,43	265,27	265,87	275,25	283,71	275,51	275,10	272,05	274,63	-14,06
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
2967,40	3030,76	3610,39	3572,99	3667,38	3431,73	3306,51	3039,25	3120,20	3179,13	3164,95	2887,37	2816,48	2581,28	2758,93	2974,36	2827,70	1584,34	-47,80
732,99	823,32	924,48	1111,86	1150,90	1139,00	1101,39	1309,32	1378,43	1529,29	1622,10	1705,29	1649,87	1 612,63	1 696,21	1 777,31	1 708,55	539,27	-17,44
2234,41	2207,44	2685,91	2461,13	2516,48	2292,73	2205,12	1729,93	1741,77	1649,85	1542,84	1182,08	1166,61	968,65	1 062,72	1 197,04	1 119,15	1 045,07	-56,12
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
5329,15	5109,54	5249,77	5358,74	5592,87	5841,39	5257,07	6461,52	6207,52	5667,04	4980,86	3672,28	4012,28	4 440,09	5 272,02	4 971,62	5 422,82	5 019,82	11,84
938,92	772,38	865,35	823,08	998,94	1120,19	1224,16	1299,73	1423,51	1394,61	1243,34	1289,12	1428,62	1 392,77	1 367,38	1 374,84	1 380,68	1 086,03	100,00
24390,81	24758,01	25105,84	25468,15	25838,57	26191,49	26426,48	26543,30	26595,16	26602,20	26602,93	26603,94	26607,81	26 612,02	26 615,34	26 621,70	26 628,07	26 611,68	47,24
303,80	301,68	302,19	303,08	307,49	298,41	282,42	289,01	285,33	280,03	274,28	271,06	258,78	245,72	238,85	234,43	223,78	208,80	-25,55
NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,IE,NA	NE,IE,NA	NE,IE,NA	NE,IE,NA	NE,IE,NA	NE,IE,NA	0,00
55613,21	56014,00	54945,19	54933,79	56604,91	55131,03	52672,11	54938,67	53990,82	53412,71	53671,56	54040,58	54488,25	53585,78	52840,35	52871,07	51086,03	49272,55	-4,20
32296,20	33020,24	34615,98	32650,63	34234,94	31431,61	25553,22	31222,87	28976,22	32050,38	31794,10	35943,02	41387,37	40749,35	38977,60	38269,63	34650,02	28940,24	-29,22
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

Table AI-2 CRF TABLE 10S2: NORWAY'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) DURING THE PERIOD 1990–2020.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt)													
1. Energy	27584,55	27584,55	26528,01	27554,82	28539,79	30082,51	30562,92	33538,40	33250,84	33225,89	34226,73	33296,51	34983,36	34740,01
A. Fuel combustion (sectoral approach)	24707,26	24707,26	24293,25	25005,13	25830,16	27244,52	27811,77	30326,58	30280,75	30103,26	30498,36	29354,12	31403,06	31701,12
1. Energy industries	7200,38	7200,38	7543,07	8096,92	8366,01	9080,58	8986,95	9857,85	10223,66	9909,91	9864,29	10776,09	11982,91	12243,18
2. Manufacturing industries and construction	3382,13	3382,13	3125,62	3192,31	3411,81	4016,76	3904,09	4357,29	4116,08	4095,43	3827,84	3439,92	3495,81	3358,11
3. Transport	9887,80	9887,80	9635,93	9856,96	10155,17	10114,64	10824,51	11350,56	11613,17	11918,36	12586,16	11784,97	12125,11	12028,57
4. Other sectors	3884,93	3884,93	3671,02	3541,63	3649,59	3631,46	3626,45	4312,91	3903,80	3808,26	3810,04	3164,49	3498,69	3605,64
5. Other	352,02	352,02	317,60	317,32	247,58	401,08	469,76	447,97	424,05	371,29	410,03	188,66	300,54	465,62
B. Fugitive emissions from fuels	2877,29	2877,29	2234,76	2549,69	2709,63	2837,99	2751,15	3129,81	2940,09	3117,43	3718,26	3933,06	3576,25	3030,32
1. Solid fuels	20,43	20,43	20,15	17,75	18,24	17,84	17,40	17,35	15,90	16,06	18,38	19,27	17,92	16,90
2. Oil and natural gas and other emissions from energy production	2856,87	2856,87	2214,61	2531,94	2691,39	2820,14	2733,76	3112,46	2924,19	3101,37	3699,87	3913,79	3558,34	3013,42
C. CO2 transport and storage	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	82,01	30,01	5,20	10,11	9,32	4,06	8,57
2. Industrial processes	7265,19	7265,19	6783,70	6712,33	7239,19	7623,17	7728,96	7827,68	8277,41	8456,82	8207,84	8627,66	8307,05	7621,62
A. Mineral industry	727,69	727,69	680,89	739,68	925,03	943,44	990,33	991,84	1056,44	1035,21	1002,25	1013,11	982,34	992,09
B. Chemical industry	2051,70	2051,70	1997,10	1860,51	1929,15	2010,35	1977,09	2072,19	2300,98	2167,77	1856,45	2254,31	2291,27	2060,82
C. Metal industry	4167,07	4167,07	3797,71	3807,23	4073,79	4360,92	4478,86	4468,91	4615,87	4975,50	5073,60	5090,29	4757,56	4291,05
D. Non-energy products from fuels and solvent use	287,45	287,45	265,05	263,68	268,07	265,66	235,72	247,97	247,80	222,64	218,73	207,19	204,72	203,76
E. Electronic industry														
F. Product uses as ODS substitutes														
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	31,27	31,27	42,95	41,23	43,14	42,79	46,97	46,77	56,33	55,70	56,80	62,76	71,16	73,90
3. Agriculture	231,52	231,52	201,20	166,20	193,82	173,72	193,86	180,46	180,63	160,63	159,06	137,22	139,56	136,07
A. Enteric fermentation														
B. Manure management														
C. Rice cultivation														
D. Agricultural soils														
E. Prescribed burning of savannas														
F. Field burning of agricultural residues														
G. Liming	230,97	230,97	200,64	165,65	193,27	173,17	193,31	179,91	180,07	160,07	158,51	137,11	139,48	135,64
H. Urea application	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,11	0,07	0,43
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry (2)	-10948,30	-10948,30	-12739,44	-12150,84	-13679,79	-11606,76	-15853,19	-14923,02	-13619,59	-15859,81	-17424,50	-19064,03	-21031,07	-22130,48
A. Forest land	-13477,41	-13477,41	-15302,08	-15056,56	-16642,85	-14382,96	-18639,11	-18063,76	-17336,23	-19455,61	-20921,66	-22898,58	-24928,67	-26077,22
B. Cropland	1916,04	1916,04	1908,48	1904,79	1904,22	1908,07	1976,02	1952,68	2078,13	2081,25	2051,03	2013,94	2112,17	2020,65
C. Grassland	-261,25	-261,25	-259,24	-255,98	-251,02	-245,65	-199,07	-65,39	-0,89	-27,79	-6,03	-37,94	-134,86	-148,29
D. Wetlands	219,25	219,25	216,73	226,94	216,07	213,69	222,77	228,13	265,44	260,53	254,50	252,38	253,45	230,12
E. Settlements	1654,96	1654,96	1618,40	1620,40	1588,27	1627,80	1794,10	1846,97	2018,11	1990,11	2062,90	2143,07	2199,19	2192,39
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products	-999,88	-999,88	-921,73	-590,44	-494,47	-727,71	-1007,91	-821,64	-644,16	-708,29	-865,23	-536,89	-532,35	-348,13
H. Other	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE
5. Waste	15,36	15,36	22,84	22,64	28,00	24,28	22,74	25,51	26,04	27,96	43,39	87,42	97,00	95,66
A. Solid waste disposal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Biological treatment of solid waste														
C. Incineration and open burning of waste	15,36	15,36	22,84	22,64	28,00	24,28	22,74	25,51	26,04	27,96	43,39	87,42	97,00	95,66
D. Waste water treatment and discharge														
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in summary 1.A)														
Memo items:														
International bunkers	2944,71	2944,71	2592,09	2781,90	2769,76	2687,73	2857,21	3248,40	3868,58	3905,78	3825,01	3716,26	3578,16	2998,15
Aviation	642,93	642,93	583,04	625,34	634,05	616,69	563,03	667,85	745,87	797,11	917,55	885,58	803,64	706,24
Navigation	2301,78	2301,78	2009,05	2156,55	2135,70	2071,04	2294,18	2580,55	3122,71	3108,67	2907,46	2830,68	2774,52	2291,92
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 emissions from biomass	4488,51	4488,51	4394,37	4115,19	4428,84	4759,57	4854,02	4863,41	5035,57	4677,61	4854,73	4712,58	5111,91	5198,28
CO2 captured	NO	NO	NO	NO	NO	NO	NO	152,01	695,01	847,20	981,11	942,32	1013,06	963,57
Long-term storage of C in waste disposal sites	18073,68	18073,68	18694,48	19290,03	19860,46	20405,76	20926,78	21441,28	21940,08	22429,89	22871,69	23289,12	23660,81	24033,31
Indirect N2O														
Indirect CO2 (3)	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE
Total CO2 equivalent emissions without land use, land-use change and forestry	35096,63	35096,63	33535,74	34455,99	36000,79	37903,67	38508,48	41572,05	41734,92	41871,29	42637,01	42148,81	43526,97	42593,35
Total CO2 equivalent emissions with land use, land-use change and forestry	24148,33	24148,33	20796,30	22305,15	22321,01	26296,91	22655,28	26649,03	28115,33	26011,48	25212,51	23084,77	22495,90	20462,88
Total CO2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total CO2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Change from base to latest reported year
																		%
36010,09	35769,26	35339,41	36241,16	37820,68	36623,44	36663,68	38143,30	37096,00	36671,43	36852,77	37168,60	37612,49	36835,27	36254,24	36295,94	34729,92	32979,39	19,56
33091,09	33026,95	32658,80	33624,96	33923,22	33421,79	34122,16	35411,23	34365,54	33942,76	34175,95	34866,23	35029,07	34363,27	33948,46	34097,73	33064,42	31456,89	27,32
12981,28	13064,88	13315,51	13277,46	13605,98	13628,70	14605,33	14746,31	14330,14	14032,54	14082,09	14759,91	15248,01	14 793,89	15 179,83	15 007,35	14 850,22	14 159,61	96,65
3549,91	3378,20	3203,16	3510,48	3432,51	3372,79	3071,60	3366,27	3183,97	3045,21	3176,01	2966,32	2955,03	2 910,68	3 015,67	3 117,48	2 935,60	2 857,07	-15,52
12579,37	12800,62	12855,53	13369,71	13662,36	13440,78	13220,32	13845,11	13894,94	14019,03	14044,40	14390,71	14088,07	13 595,57	12 792,54	13 005,08	12 486,97	11 707,63	18,40
3807,83	3454,61	3032,52	3233,29	3052,30	2851,28	3040,56	3254,43	2743,40	2648,80	2665,84	2536,91	2557,00	2 881,19	2 772,60	2 820,10	2 678,76	2 634,25	-32,19
172,71	328,64	252,07	234,01	170,07	128,24	184,35	199,11	213,08	197,18	207,62	212,39	180,96	181,95	187,83	147,72	112,87	98,33	-72,07
2894,08	2719,93	2673,42	2612,73	3819,54	3092,66	2485,09	2635,28	2639,29	2665,76	2643,29	2258,35	2541,45	2461,35	2298,15	2184,23	1654,24	1518,86	-47,21
22,29	16,45	14,86	13,26	17,39	13,76	11,96	11,25	12,50	10,49	13,60	13,30	10,99	10,23	8,81	8,78	8,67	8,52	-58,26
2871,79	2703,48	2658,56	2599,47	3802,14	3078,91	2473,14	2624,03	2626,78	2655,27	2629,69	2245,05	2530,46	2 451,12	2 289,34	2 175,44	1 645,57	1 510,34	-47,13
24,92	22,38	7,20	3,48	77,92	108,98	56,42	96,79	91,17	62,91	33,53	44,02	41,97	10,64	7,64	13,99	11,26	3,64	100,00
7779,40	8351,78	7817,82	7511,82	7674,47	8008,37	6453,93	7344,72	7448,41	7393,35	7504,65	7584,13	7711,69	7652,84	7702,24	7788,48	7781,46	7928,98	9,14
1045,77	858,67	920,73	957,28	1017,33	1043,31	1011,17	1023,11	1013,81	998,18	1055,06	1055,67	987,09	971,60	1 025,33	992,22	999,89	963,76	32,44
2144,48	2268,24	1917,80	2142,16	1915,14	2052,14	1818,77	1940,72	1945,06	1891,99	1815,18	1726,28	1923,81	1 734,45	1 644,76	1 819,20	1 748,83	1 783,54	-13,07
4294,53	4924,77	4682,53	4131,70	4446,31	4617,83	3349,82	4077,86	4170,57	4187,15	4310,87	4481,21	4488,37	4 613,07	4 702,19	4 637,89	4 731,66	4 835,21	16,03
209,59	211,75	204,23	194,81	206,46	204,75	190,09	208,09	218,43	211,42	222,44	221,08	203,87	218,13	216,36	217,40	187,40	226,88	-21,07
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
85,03	88,35	92,53	85,88	89,23	90,35	84,08	94,94	100,54	104,61	101,11	99,89	108,55	115,59	113,60	121,77	113,68	119,58	282,38
123,95	111,46	109,28	103,93	98,65	95,72	88,27	78,33	78,26	80,10	81,83	88,77	89,89	88,50	93,53	103,01	114,41	127,40	-44,97
123,87	110,25	109,18	103,80	97,48	94,83	86,92	78,01	77,93	79,87	81,67	88,61	89,68	88,31	93,44	102,91	114,30	127,32	-44,88
0,07	1,22	0,10	0,12	1,17	0,89	1,35	0,32	0,33	0,23	0,16	0,16	0,22	0,19	0,09	0,10	0,10	0,08	-85,20
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
-23744,95	-23419,68	-20756,92	-22715,37	-22797,73	-24135,82	-27552,95	-24155,48	-25453,99	-21803,33	-22317,81	-18537,63	-13541,77	-13285,08	-14311,28	-15049,04	-16881,59	-20778,65	89,79
-27675,14	-27207,33	-24356,05	-26442,21	-26560,94	-28421,14	-32284,64	-29795,13	-30294,45	-26761,63	-27103,87	-23606,80	-18792,13	-18 113,01	-18 873,40	-19 651,79	-21 297,94	-24 731,60	83,50
2013,97	2009,11	2011,83	2080,00	2076,42	2098,85	2107,10	2204,13	2144,78	2184,62	2179,47	2130,18	2193,53	2 143,58	2 127,09	2 127,76	2 168,92	2 139,42	11,66
-90,75	-148,93	84,65	182,60	275,09	414,47	564,42	442,40	486,10	381,13	178,21	15,85	82,17	-55,28	25,59	118,54	200,10	153,14	-158,62
269,03	271,76	292,50	287,07	264,59	309,41	287,81	276,51	277,08	272,92	244,37	246,27	238,82	235,39	254,65	274,43	270,20	267,22	21,88
1870,23	1853,25	1691,05	1599,27	1508,75	1709,27	1709,76	2042,57	1849,64	1955,88	1778,04	2130,14	2523,89	2 420,43	2 390,78	2 463,72	2 250,69	1 842,43	11,33
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
-132,28	-197,53	-480,90	-422,09	-361,64	-246,68	62,60	674,05	82,86	163,74	405,96	546,73	211,94	83,81	-235,98	-381,69	-473,57	-449,25	-55,07
NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	0,00
65,84	75,79	75,11	69,83	72,01	67,12	18,90	124,66	168,72	151,07	147,38	204,26	176,24	187,58	192,83	205,01	158,76	160,98	947,85
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
65,84	75,79	75,11	69,83	72,01	67,12	18,90	124,66	168,72	151,07	147,38	204,26	176,24	187,58	192,83	205,01	158,76	160,98	947,85
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
2880,89	2944,01	3506,73	3474,22	3567,15	3340,21	3219,53	2964,94	3045,21	3105,30	3093,53	2825,79	2725,58	2486,20	2663,95	2869,18	2724,26	1497,67	-49,14
721,46	810,37	909,95	1094,38	1132,80	1121,09	1084,07	1288,73	1356,61	1504,96	1596,17	1677,96	1623,22	1 586,70	1 668,59	1 748,29	1 680,63	530,40	-17,50
2159,42	2133,64	2596,78	2379,85	2434,34	2219,12	2135,45	1676,20	1688,59	1600,34	1497,37	1147,83	1102,36	899,49	995,36	1 120,88	1 043,63	967,27	-57,98
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
5329,15	5109,54	5249,77	5358,74	5592,87	5841,39	5257,07	6461,52	6207,52	5667,04	4980,86	3672,28	4012,28	4 440,09	5 272,02	4 971,62	5 422,82	5 019,82	11,84
938,92	772,38		823,08	998,94	1120,19	1224,16	1299,73	1423,51	1394,61	1243,34	1289,12	1428,62	1 392,77	1 367,38	1 374,84	1 380,68	1 086,03	100,00
24390,81	24758,01	25105,84	25468,15	25838,57	26191,49	26426,48	26543,30	26595,16	26602,20	26602,93	26603,94	26607,81	26 612,02	26 615,34	26 621,70	26 628,07	26 611,68	47,24
NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,NA,IE	NE,IE,NA	NE,IE,NA	NE,IE,NA	NE,IE,NA	NE,IE,NA	NE,IE,NA	0,00
43979,27	44308,29	43341,62	43926,74	45665,81	44794,65	43224,78	45691,01	44791,39	44295,95	44586,63	45045,76	45590,31	44764,20	44242,84	44392,44	42784,54	41196,76	17,38
20234,32	20888,61	22584,70	21211,37	22868,08	20658,84	15671,82	21535,54	19337,41	22492,62	22268,82	26508,13	32048,54	31479,11	29931,56	29343,41	25902,95	20418,11	-15,45
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

Table AI-3 CRF TABLE 10S3: NORWAY'S EMISSIONS OF METHANE (CH_4) DURING THE PERIOD 1990–2020.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt)													
1. Energy	43,60	43,60	43,68	47,36	53,68	55,95	55,34	58,17	62,51	59,83	59,26	62,19	64,87	63,81
A. Fuel combustion (sectoral approach)	22,49	22,49	20,79	20,54	22,56	23,64	23,24	24,42	25,24	23,91	23,71	23,79	24,13	25,54
1. Energy industries	2,13	2,13	2,24	2,42	2,52	2,61	2,63	2,82	3,01	2,88	2,67	3,05	3,40	3,54
2. Manufacturing industries and construction	0,42	0,42	0,39	0,41	0,42	0,46	0,47	0,51	0,55	0,51	0,54	0,50	0,51	0,50
3. Transport	3,33	3,33	3,14	3,02	2,95	2,83	2,84	2,65	2,57	2,40	2,28	2,10	1,99	1,91
4. Other sectors	16,60	16,60	15,00	14,68	16,65	17,72	17,28	18,42	19,09	18,10	18,22	18,13	18,20	19,56
5. Other	0,02	0,02	0,01	0,01	0,01	0,01	0,02	0,03	0,02	0,02	0,02	0,01	0,02	0,02
B. Fugitive emissions from fuels	21,11	21,11	22,89	26,82	31,12	32,31	32,10	33,75	37,26	35,92	35,54	38,40	40,74	38,27
1. Solid fuels	6,54	6,54	6,38	5,67	5,76	5,62	5,47	5,43	5,02	5,04	5,66	5,89	5,52	5,24
2. Oil and natural gas and other emissions from energy production	14,57	14,57	16,51	21,15	25,36	26,70	26,63	28,32	32,24	30,88	29,88	32,51	35,22	33,03
C. CO_2 transport and storage														
2. Industrial processes	1,09	1,09	0,92	0,95	0,96	1,04	1,10	1,07	1,30	1,51	1,37	1,34	1,46	1,45
A. Mineral industry														
B. Chemical industry	1,04	1,04	0,87	0,91	0,91	0,99	1,05	1,01	1,24	1,45	1,31	1,28	1,41	1,40
C. Metal industry	0,05	0,05	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronic industry														
F. Product uses as ODS substitutes														
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	111,20	111,20	110,03	110,43	109,81	111,38	111,46	112,49	110,47	110,60	112,13	107,16	106,54	106,06
A. Enteric fermentation	96,58	96,58	95,54	96,14	95,58	97,16	97,19	97,88	96,30	96,36	97,81	93,57	92,85	92,53
B. Manure management	13,53	13,53	13,63	13,82	13,59	13,76	13,70	13,99	13,72	13,77	13,90	13,15	13,33	13,26
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	1,09	1,09	0,85	0,46	0,64	0,46	0,57	0,62	0,45	0,47	0,42	0,45	0,36	0,27
G. Liming														
H. Urea application														
I. Other carbon-containing fertilizers														
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	6,77	6,77	6,79	6,78	6,75	6,75	6,75	6,80	6,87	6,92	6,96	7,00	7,03	7,04
A. Forest land	2,03	2,03	2,05	2,05	2,02	2,02	2,02	2,04	2,04	2,04	2,03	2,02	2,01	2,01
B. Cropland	3,38	3,38	3,39	3,40	3,40	3,41	3,42	3,44	3,46	3,49	3,51	3,54	3,56	3,58
C. Grassland	0,44	0,44	0,43	0,42	0,41	0,40	0,40	0,39	0,39	0,39	0,39	0,39	0,39	0,39
D. Wetlands	0,33	0,33	0,33	0,33	0,33	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products														
H. Other	0,60	0,60	0,59	0,59	0,58	0,57	0,58	0,60	0,63	0,67	0,70	0,72	0,72	0,72
5. Waste	93,54	93,54	89,31	88,62	88,70	88,19	88,89	85,29	83,66	76,78	73,92	76,35	73,74	70,01
A. Solid waste disposal	82,47	82,47	78,61	77,38	77,66	77,46	77,93	74,70	73,00	66,57	63,30	65,39	62,62	59,67
B. Biological treatment of solid waste	0,13	0,13	0,13	0,21	0,26	0,33	0,59	0,64	0,73	0,82	1,14	1,43	1,73	1,69
C. Incineration and open burning of waste	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,06	0,07	0,06
D. Waste water treatment and discharge	10,93	10,93	10,57	11,02	10,76	10,38	10,35	9,94	9,91	9,36	9,45	9,47	9,32	8,58
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in summary 1.A)														
Total CH_4 emissions without CH_4 from LULUCF	249,44	249,44	243,93	247,37	253,15	256,55	256,78	257,02	257,95	248,72	246,69	247,04	246,61	241,33
Total CH_4 emissions with CH_4 from LULUCF	256,20	256,20	250,72	254,16	259,89	263,30	263,54	263,82	264,81	255,64	253,65	254,04	253,64	248,37
Memo items:														
International bunkers	0,17	0,17	0,15	0,16	0,16	0,16	0,17	0,19	0,23	0,23	0,22	0,21	0,21	0,17
Aviation	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Navigation	0,17	0,17	0,15	0,16	0,15	0,15	0,17	0,19	0,23	0,22	0,21	0,20	0,20	0,17
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 emissions from biomass														
CO2 captured														
Long-term storage of C in waste disposal sites														
Indirect N2O														
Indirect CO2 (3)														

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Change from base to latest reported year
																		%
61,52	58,65	55,81	51,58	56,59	52,98	52,80	53,98	51,04	50,48	47,71	46,29	46,78	43,29	41,17	39,84	38,79	39,72	-8,89
24,54	22,01	22,43	21,78	22,40	22,39	22,87	24,74	22,72	23,42	20,56	20,07	20,78	19,54	20,08	18,86	18,20	18,88	-16,06
3,84	4,01	3,96	3,81	4,01	4,21	4,65	4,97	4,66	4,63	4,39	4,84	5,17	4,80	4,88	4,83	4,89	4,72	121,62
0,54	0,52	0,55	0,55	0,56	0,55	0,50	0,55	0,54	0,49	0,54	0,50	0,50	0,46	0,48	0,52	0,51	0,50	19,41
2,15	2,22	2,19	2,14	3,20	3,50	3,73	4,01	4,33	4,86	5,22	5,64	5,69	5,23	5,41	4,49	4,46	4,28	28,62
18,00	15,26	15,73	15,27	14,62	14,12	13,99	15,20	13,17	13,43	10,41	9,08	9,41	9,04	9,30	9,02	8,34	9,38	-43,51
0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	-88,79
36,97	36,64	33,38	29,80	34,20	30,58	29,93	29,23	28,33	27,07	27,14	26,22	26,00	23,76	21,09	20,98	20,59	20,85	-1,25
6,71	5,11	4,30	4,21	5,36	4,35	3,84	3,63	3,96	3,40	4,25	4,17	3,51	3,30	2,89	2,88	2,85	2,80	-57,15
30,26	31,53	29,08	25,59	28,84	26,23	26,09	25,60	24,37	23,67	22,89	22,06	22,48	20,46	18,19	18,10	17,74	18,05	23,83
1,15	1,09	1,09	1,00	0,87	1,03	0,88	1,01	1,03	0,94	0,90	0,89	0,92	0,87	0,89	0,92	0,85	0,84	-23,30
1,10	1,04	1,04	0,98	0,84	0,99	0,84	0,95	0,98	0,89	0,84	0,84	0,87	0,82	0,84	0,88	0,80	0,79	-24,62
0,04	0,05	0,04	0,03	0,03	0,04	0,04	0,06	0,05	0,05	0,05	0,06	0,05	0,05	0,05	0,05	0,05	0,05	4,61
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
107,95	106,76	107,20	104,95	104,25	104,32	105,83	105,22	102,51	102,94	104,00	104,74	106,34	108,45	108,08	107,36	104,45	103,99	-6,48
93,92	92,66	92,93	90,81	89,97	89,96	91,25	90,46	88,08	88,29	89,19	89,88	91,32	93,24	92,96	92,29	89,71	89,31	-7,53
13,81	13,85	14,06	13,96	14,12	14,18	14,46	14,63	14,33	14,54	14,72	14,75	14,90	15,09	15,00	15,00	14,62	14,57	7,65
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
0,22	0,25	0,21	0,18	0,17	0,18	0,12	0,13	0,09	0,10	0,09	0,11	0,13	0,12	0,12	0,07	0,12	0,12	-89,40
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
7,06	7,07	7,11	7,21	7,15	7,32	7,21	7,25	7,25	7,26	7,28	7,34	7,36	7,40	7,42	7,48	7,48	7,47	10,40
2,02	2,01	2,01	2,10	2,01	2,16	2,04	2,06	2,02	2,03	2,03	2,05	2,03	2,04	2,04	2,08	2,07	2,05	1,22
3,59	3,61	3,63	3,62	3,61	3,60	3,58	3,56	3,57	3,58	3,59	3,60	3,61	3,62	3,63	3,64	3,65	3,65	8,05
0,39	0,39	0,39	0,39	0,40	0,40	0,41	0,42	0,43	0,43	0,43	0,44	0,45	0,46	0,47	0,48	0,48	0,49	11,53
0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,34	5,50
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
0,72	0,73	0,74	0,76	0,79	0,81	0,83	0,86	0,87	0,88	0,88	0,90	0,91	0,93	0,93	0,94	0,94	0,94	56,72
69,58	69,19	65,54	66,29	65,47	62,85	63,32	62,83	63,58	60,13	58,64	57,02	54,71	52,66	49,50	48,36	45,31	43,91	-53,05
58,97	58,48	54,96	55,70	54,52	52,11	52,70	51,64	51,05	49,36	47,90	46,77	44,13	41,56	39,13	37,62	35,09	33,73	-59,10
1,68	1,97	1,94	1,97	2,38	2,35	2,20	2,26	2,03	2,41	2,61	2,15	2,26	2,43	2,12	2,43	2,04	1,95	1451,74
0,05	0,05	0,05	0,05	0,05	0,05	0,02	0,08	0,11	0,10	0,09	0,13	0,12	0,12	0,13	0,14	0,11	0,11	999,69
8,88	8,69	8,58	8,57	8,53	8,34	8,40	8,84	10,39	8,26	8,03	7,96	8,21	8,55	8,13	8,17	8,08	8,13	-25,66
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
240,19	235,70	229,63	223,82	227,19	221,17	222,83	223,03	218,17	214,49	211,24	208,94	208,76	205,28	199,65	196,49	189,40	188,47	-24,44
247,25	242,77	236,75	231,03	234,34	228,50	230,04	230,28	225,41	221,76	218,52	216,28	216,12	212,68	207,07	203,97	196,88	195,94	-23,52
0,16	0,16	0,20	0,18	0,19	0,17	0,16	0,13	0,13	0,13	0,12	0,10	1,41	1,88	1,74	2,01	2,10	2,30	1220,62
0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	-35,95
0,16	0,15	0,19	0,17	0,18	0,16	0,15	0,12	0,12	0,12	0,11	0,08	1,40	1,87	1,73	2,00	2,09	2,29	1277,36
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00

Table AI-4	CRF TABLE 10S4: NORWAY'S EMISSIONS OF NITROUS OXIDE (N_2O) DURING THE PERIOD 1990–2020.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt)													
1. Energy	0,56	0,56	0,55	0,57	0,60	0,63	0,65	0,69	0,72	0,71	0,72	0,67	0,68	0,69
A. Fuel combustion (sectoral approach)	0,54	0,54	0,54	0,56	0,59	0,62	0,64	0,68	0,70	0,70	0,70	0,65	0,67	0,68
1. Energy industries	0,05	0,05	0,05	0,06	0,05	0,05	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05
2. Manufacturing industries and construction	0,10	0,10	0,09	0,10	0,10	0,11	0,11	0,12	0,13	0,12	0,12	0,11	0,12	0,11
3. Transport	0,28	0,28	0,29	0,30	0,32	0,34	0,35	0,36	0,38	0,39	0,39	0,38	0,39	0,38
4. Other sectors	0,10	0,10	0,10	0,10	0,11	0,11	0,11	0,12	0,12	0,12	0,11	0,10	0,11	0,12
5. Other	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,01	0,01
B. Fugitive emissions from fuels	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,02	0,01	0,01	0,02	0,02	0,01	0,01
1. Solid fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and natural gas and other emissions from energy production	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,02	0,01	0,01	0,02	0,02	0,01	0,01
C. CO_2 transport and storage														
2. Industrial processes	7,02	7,02	6,51	4,73	5,43	5,66	5,66	5,61	5,56	5,83	6,58	5,97	5,81	6,64
A. Mineral industry														
B. Chemical industry	6,88	6,88	6,39	4,60	5,29	5,52	5,52	5,46	5,41	5,68	6,43	5,83	5,68	6,52
C. Metal industry	0,02	0,02	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronic industry														
F. Product uses as ODS substitutes														
G. Other product manufacture and use	0,11	0,11	0,11	0,11	0,12	0,12	0,13	0,13	0,13	0,13	0,13	0,12	0,11	0,10
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	6,04	6,04	6,02	5,99	5,93	5,87	5,94	6,01	5,99	6,02	5,96	5,94	5,82	5,81
A. Enteric fermentation														
B. Manure management	0,50	0,50	0,50	0,51	0,47	0,48	0,48	0,49	0,48	0,48	0,50	0,48	0,49	0,49
C. Rice cultivation														
D. Agricultural soils	5,52	5,52	5,50	5,48	5,44	5,39	5,44	5,51	5,50	5,52	5,45	5,44	5,31	5,31
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	0,03	0,03	0,02	0,01	0,02	0,01	0,01	0,02	0,01	0,01	0,01	0,01	0,01	0,01
G. Liming														
H. Urea application														
I. Other carbon containing fertlizers														
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	0,80	0,80	0,80	0,81	0,81	0,81	0,81	0,81	0,82	0,83	0,83	0,83	0,83	0,84
A. Forest land	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,59	0,58	0,58	0,58	0,58
B. Cropland	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0,00	NE,NO	0,00	0,00	0,00	0,00
D. Wetlands	0,10	0,10	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
E. Settlements	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,05
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products														
H. Other	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,07
5. Waste	0,16	0,16	0,16	0,16	0,17	0,20	0,20	0,21	0,21	0,22	0,24	0,23	0,27	0,26
A. Solid waste disposal														
B. Biological treatment of solid waste	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,03	0,05	0,06	0,07	0,07
C. Incineration and open burning of waste	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01
D. Waste water treatment and discharge	0,16	0,16	0,16	0,15	0,16	0,18	0,19	0,18	0,19	0,19	0,19	0,17	0,19	0,18
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in summary 1.A)														
Total direct N2O emissions without N2O from LULUCF	13,78	13,78	13,25	11,46	12,13	12,36	12,46	12,51	12,48	12,78	13,50	12,81	12,58	13,40
Total direct N2O emissions with N2O from LULUCF	14,57	14,57	14,06	12,27	12,93	13,17	13,26	13,32	13,30	13,61	14,33	13,65	13,41	14,24
Memo items:														
International bunkers	0,29	0,29	0,25	0,27	0,27	0,26	0,28	0,32	0,39	0,39	0,37	0,36	0,35	0,29
Aviation	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,04	0,04
Navigation	0,25	0,25	0,22	0,24	0,24	0,23	0,25	0,29	0,35	0,35	0,32	0,32	0,31	0,25
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 emissions from biomass														
CO2 captured														
Long-term storage of C in waste disposal sites														
Indirect N2O	0,94	0,94	0,91	0,93	0,95	0,98	1,04	1,08	1,13	1,14	1,11	1,05	1,04	1,01
Indirect CO2 (3)														

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Change from base to latest reported year
																			%
	0,69	0,67	0,59	0,60	0,63	0,63	0,62	0,65	0,66	0,69	0,70	0,68	0,70	0,71	0,74	0,76	0,76	0,72	29,82
	0,68	0,66	0,58	0,59	0,61	0,61	0,61	0,64	0,65	0,68	0,68	0,67	0,69	0,70	0,73	0,76	0,76	0,72	32,68
	0,06	0,05	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,08	0,08	0,09	0,09	0,09	0,09	0,10	0,09	106,80
	0,12	0,12	0,12	0,13	0,13	0,13	0,12	0,13	0,13	0,12	0,13	0,12	0,12	0,11	0,12	0,12	0,12	0,12	20,80
	0,39	0,38	0,30	0,30	0,31	0,31	0,31	0,32	0,34	0,36	0,36	0,37	0,38	0,39	0,41	0,42	0,42	0,39	35,40
	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,12	0,11	0,11	0,10	0,10	0,10	0,11	0,11	0,12	0,12	0,12	12,94
	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	-66,77
	0,01	0,01	0,01	0,01	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	-63,97
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	0,01	0,01	0,01	0,01	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	-63,97
	6,00	6,46	6,79	5,75	5,04	3,61	1,95	1,78	1,62	1,58	1,41	1,33	1,36	1,13	1,02	0,96	0,94	0,77	-89,03
	5,89	6,35	6,69	5,64	4,95	3,49	1,83	1,67	1,52	1,48	1,31	1,24	1,27	1,04	0,94	0,88	0,87	0,71	-89,74
	0,01	0,02	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,01	0,01	0,02	0,01	0,02	0,01	0,01	0,01	0,02	-8,24
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
	0,10	0,10	0,09	0,09	0,08	0,10	0,11	0,09	0,09	0,09	0,09	0,08	0,08	0,07	0,07	0,06	0,05	0,05	-58,25
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
	5,95	5,98	5,97	5,89	5,94	5,89	5,73	5,54	5,68	5,70	5,77	5,93	6,00	6,00	5,93	5,89	6,01	5,98	-1,02
	0,52	0,51	0,51	0,51	0,51	0,52	0,52	0,52	0,51	0,52	0,52	0,52	0,53	0,53	0,53	0,53	0,52	0,51	3,15
	5,43	5,46	5,45	5,37	5,42	5,37	5,20	5,02	5,16	5,18	5,25	5,40	5,47	5,46	5,40	5,36	5,50	5,47	-0,94
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-89,40
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
	0,84	0,84	0,84	0,85	0,84	0,85	0,85	0,87	0,87	0,87	0,87	0,86	0,86	0,88	0,88	0,87	0,87	0,87	9,42
	0,58	0,58	0,57	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,59	0,60	0,59	0,59	0,59	2,61
	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,02	45,44
	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	100,00
	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	6,83
	0,05	0,05	0,05	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,05	0,05	0,05	0,05	0,05	40,35
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	25,15
	0,26	0,28	0,28	0,28	0,31	0,31	0,30	0,31	0,30	0,33	0,34	0,32	0,33	0,34	0,33	0,33	0,30	0,31	88,71
	0,07	0,09	0,08	0,08	0,10	0,10	0,09	0,09	0,07	0,10	0,11	0,08	0,08	0,09	0,07	0,08	0,05	0,05	680,35
	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,01	0,01	0,01	0,01	0,02	0,01	0,02	0,02	0,02	0,01	0,01	910,26
	0,18	0,19	0,19	0,19	0,20	0,20	0,21	0,21	0,21	0,22	0,22	0,22	0,24	0,23	0,24	0,24	0,24	0,24	54,59
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
	12,91	13,39	13,63	12,52	11,92	10,44	8,60	8,29	8,27	8,30	8,22	8,26	8,39	8,18	8,02	7,95	8,02	7,78	-43,52
	13,75	14,23	14,47	13,36	12,76	11,29	9,45	9,16	9,13	9,17	9,09	9,12	9,26	9,06	8,90	8,82	8,89	8,65	-40,63
	0,28	0,28	0,33	0,32	0,32	0,29	0,28	0,24	0,24	0,24	0,23	0,20	0,19	0,16	0,17	0,18	0,17	0,10	-65,92
	0,04	0,04	0,05	0,06	0,06	0,06	0,06	0,07	0,07	0,08	0,09	0,09	0,09	0,09	0,09	0,10	0,09	0,03	-13,22
	0,24	0,23	0,28	0,26	0,26	0,23	0,22	0,17	0,17	0,16	0,14	0,11	0,10	0,08	0,08	0,09	0,08	0,07	-72,93
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
	1,02	1,01	1,01	1,02	1,03	1,00	0,95	0,97	0,96	0,94	0,92	0,91	0,87	0,82	0,80	0,79	0,75	0,70	-25,55

Table AI-5 CRF TABLE 10S5: NORWAY'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HCFS, PFCS AND SF_6) DURING THE PERIOD 1990–2020.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(kt)														
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	3894,84	3894,84	3458,01	2640,05	2684,07	2396,61	2411,89	2237,16	2078,04	1970,35	1922,85	1887,73	1997,97	2162,74	1566,94
Emissions of HFCs - (kt CO_2 equivalent)	0,04	0,04	1,31	2,82	35,80	54,08	97,84	129,54	195,34	258,37	322,89	369,28	466,71	503,95	515,84
HFC-23	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-32	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-125	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00	0,01	0,01	0,02	0,02	0,03	0,03	0,04	0,05	0,05
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	NO,IE,NA	NO,IE,NA	0,00	0,00	0,02	0,03	0,04	0,04	0,05	0,07	0,08	0,07	0,08	0,08	0,08
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00	0,00	0,01	0,01	0,02	0,02	0,03	0,04	0,04	0,04
HFC-152	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-152a	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-161	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-227ea	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
HFC-236cb	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-236ea	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-365mfc	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of HFCs[4] - (kt CO_2 equivalent)	0,00	0,00	0,00	0,00	0,29	0,52	2,58	3,99	9,04	13,82	19,17	21,54	24,05	28,45	27,86
Emissions of PFCs - (kt CO_2 equivalent)	3894,80	3894,80	3456,70	2637,22	2648,27	2342,53	2314,05	2107,62	1882,70	1711,98	1599,97	1518,45	1531,26	1658,79	1051,11
CF_4	0,47	0,47	0,42	0,32	0,32	0,29	0,28	0,26	0,23	0,21	0,20	0,19	0,19	0,20	0,13
C_2F_6	0,04	0,04	0,03	0,02	0,02	0,02	0,02	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01
C_3F_8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_4F_{10}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
$c\text{-}C_4F_8$	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
$C_{10}F_{18}$	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
$c\text{-}C_3F_6$	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of PFCs[4] - (kt CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of SF_6 - (kt CO_2 equivalent)	2098,54	2098,54	1983,46	672,58	703,76	837,57	579,80	547,63	553,11	693,20	833,63	891,28	754,64	227,16	215,65
SF_6	0,09	0,09	0,09	0,03	0,03	0,04	0,03	0,02	0,02	0,03	0,04	0,04	0,03	0,01	0,01
Emissions of NF3 - (kt CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
NF_3	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Change from base to latest reported year
																		%
	1560,85	1504,06	1479,35	1635,15	1635,39	1257,40	1132,57	1228,40	1228,79	1299,14	1260,01	1109,74	1191,65	1160,13	1144,62	1109,03	971,40	-75,06
	544,11	548,74	620,27	683,96	739,40	819,05	894,22	965,80	1028,32	1118,11	1081,09	963,35	1005,48	1029,18	996,54	933,97	809,97	1845045,27
	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
	0,00	0,00	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,05	100,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	0,05	0,05	0,06	0,06	0,06	0,07	0,08	0,08	0,09	0,09	0,09	0,08	0,08	0,08	0,09	0,09	0,07	100,00
	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,01	100,00
	0,10	0,12	0,14	0,16	0,18	0,20	0,23	0,25	0,27	0,28	0,29	0,29	0,31	0,31	0,30	0,30	0,29	100,00
	NA,NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	NO,NA	NO,NA	0,00
	0,04	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,07	0,06	0,04	0,04	0,04	0,04	0,03	0,01	100,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	108,46
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	30,18	33,53	32,19	32,82	31,77	31,94	33,58	52,90	65,57	63,92	61,26	48,67	52,43	73,07	38,47	34,50	40,70	2727947572,36
	1016,75	955,32	859,08	951,19	895,99	438,35	238,35	262,60	200,47	181,03	178,92	146,39	186,17	130,96	148,08	175,07	161,42	-95,86
	0,12	0,12	0,10	0,11	0,10	0,05	0,03	0,03	0,02	0,02	0,02	0,02	0,02	0,01	0,02	0,02	0,02	-96,08
	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-94,09
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00	0,00	0,00	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	261,34	296,86	202,51	71,20	60,77	56,18	68,50	53,62	52,63	55,44	48,84	67,59	61,17	56,28	53,85	67,98	73,72	-96,49
	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-96,49
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00

10.2 Annex II. Summary of reporting of supplementary information under Article 7, paragraph 2, of the Kyoto Protocol.

Table A2-1 Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC8.

Information reported under Article 7, paragraph 2	Chapter
National systems in accordance with Article 5, paragraph 1	NC chapter 3.3
National registries	NC chapter 3.4
Information on base year, assigned amount and total greenhouse gas emission trend under the Kyoto Protocol	Base year: BR chapter 3 Assigned amount: BR chapter 4.4.2 Emission trend: NC chapter 3, Annex I and CTF table 1.
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	5.7
Policies and measures in accordance with Article 2	4.3
Legislative arrangements and enforcement and administrative procedures	4.2
Information under Article 10: Art 10a (programmes to improve the quality of local emission factors, activity data and/or models which reflect the socio-economic conditions of each Party for the preparation and periodic updating of national inventories) Art 10b (measures to mitigate climate change and measures to facilitate adequate adaptation to climate change) Art 10c (transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries) Art 10d (maintenance and the development of systematic observation systems and development of data archives to reduce uncertainties related to the climate system etc.) Art 10e (the development and implementation of education and training programmes)	Art. 10a: 3.3 Art. 10b: 6.4 Art. 10c: 7.2 Art. 10d: 8 Art. 10e: 9
Financial resources	7

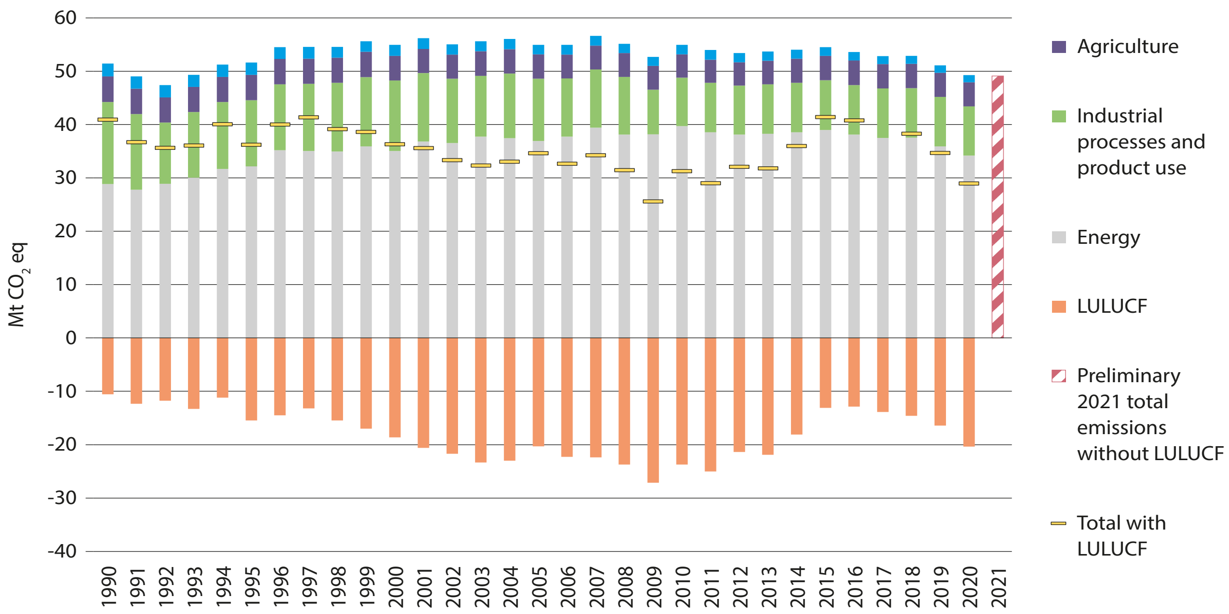
10.3 Annex III. Norway's fifth Biennial Report under the Framework Convention on Climate Change

1 Introduction

This report is Norway's fifth biennial report related to climate change under the Framework Convention on Climate Change (UNFCCC). The latest National Inventory Report (NIR) for greenhouse gases was submitted in April 2022. 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 fifth Biennial Report (BR5) 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 decisions 19/CP.18 and 9/CP.21.

Figure A3-1 Total emissions of greenhouse gases by sources and removals from LULUCF in Norway 1990–2020 (Million tonnes CO_2 equivalents). 2021 estimate is preliminary.



Source: Statistics Norway/Norwegian Environment Agency/ Norwegian Institute of Bioeconomy Research

This BR5 is submitted in conjunction with Norway's eighth National Communication (NC8) and will in some cases refer to information reported in the NC8. The BR5 focuses on the implementation and achievement of Norway's 2020 target, as operationalised through the Kyoto Protocol's second commitment period, and provision of support since what was reported in BR4.

2 Information on greenhouse gas emissions and trends

2.1 Emission 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 1990–2020 was submitted to the UNFCCC Secretariat 8 April 2022.

Chapter 2 of Norway's 2022 NIR and chapter 3 of Norway's eighth National Communication provide 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 1990–2020 is included here in BR5. Norway's inventory includes indirect emissions of CO_2 from non-combustion sources originating from the fossil part of CH_4 and NMVOC. If not specified otherwise, emission figures include indirect CO_2 emissions, but not LULUCF.

In 2020, total greenhouse gas (GHG) emissions in Norway were 49.3 million tonnes of carbon dioxide equivalents, which is a decrease of 1.8 million tonnes compared to 2019. Preliminary figures for 2021 show 48.9 Mt. Emissions reached their peak at 56.6 million tonnes in 2007. They have since decreased by 13 per cent, and were in 2020 2.2 million tonnes, or 4.2 per cent, lower than in 1990. The net greenhouse gas emissions, including all sources and sinks, were 28.9 million tonnes of CO_2 equivalents in 2020 as compared to 40.9 Mt in 1990. The total emissions distribution among the main CRF categories from 1990 to 2020 is illustrated in Figure 2.1.

Table 2.1 presents the total emissions including indirect CO_2 emissions and its distribution among the main CRF categories from 1990 to 2020, and a preliminary estimate of the total for 2021. The total indirect CO_2 emissions are also presented in this table.

Table A3-1 **Total emissions of greenhouse gases by sources and removals from LULUCF in Norway 1990–2020. 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	28.8	15.4	4.8	-10.5	2.4	51.4	40.9	0.6
1995	32.1	12.4	4.7	-15.4	2.3	51.6	36.2	0.9
2000	35.0	13.2	4.6	-18.6	2.1	54.9	36.3	1.0
2005	36.9	11.7	4.6	-20.3	1.8	54.9	34.6	0.5
2010	39.7	9.1	4.4	-23.7	1.8	54.9	31.2	0.3
2011	38.6	9.2	4.3	-25.0	1.8	54.0	29.0	0.3
2012	38.1	9.2	4.4	-21.4	1.8	53.4	32.1	0.3
2013	38.3	9.3	4.4	-21.9	1.7	53.7	31.8	0.3
2014	38.5	9.3	4.5	-18.1	1.7	54.0	35.9	0.3
2015	39.0	9.3	4.5	-13.1	1.6	54.5	41.4	0.3
2016	38.1	9.3	4.6	-12.8	1.6	53.6	40.7	0.3
2017	37.5	9.2	4.6	-13.9	1.5	52.8	39.0	0.3
2018	37.5	9.3	4.5	-14.6	1.5	52.9	38.3	0.3
2019	35.9	9.3	4.5	-16.4	1.4	51.1	34.7	0.3
2020	34.2	9.2	4.5	-20.3	1.4	49.3	28.9	0.3
2021*						48.9		

Source: Statistics Norway/Norwegian Environment Agency/ Norwegian Institute of Bioeconomy Research.
*2021 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 overall growth in CO_2 has been offset by reductions in other gases and sectors.

In 2020, the net greenhouse gas removals in the LULUCF sector was 20.3 million tonnes CO_2 equivalents, which corresponds to about 41 per cent of the national greenhouse gas emissions (from all other sectors than LULUCF) that year. The average annual net sequestration from the LULUCF sector was about 18.0 million tonnes of CO_2 equivalents for the period 1990–2020. It should be noted, however, that only a small portion of this can be accounted for under the Kyoto Protocol. The calculated changes in carbon stocks depend upon several factors such as growing conditions, harvest levels, management practices 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 and are also found as Annex I to the NC8 report.

2.2 National inventory arrangements and changes

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 emissions and removals from Land Use and Land Use Change and Forestry (LULUCF). Chapter 3.3 in NC8 describes the Norwegian national system for greenhouse gas inventory. For a complete description of the national inventory arrangements, see chapter 1.2 of the 2022 NIR. For comprehensive information regarding the national system under the Kyoto Protocol, see Annex V of the NIR. There have been no changes to the national inventory arrangements since Norway's fourth Biennial Report was reported.

3 Quantified economy-wide emission reduction target

Norway's climate targets are described in detail in chapter 4 of Norway's eighth National Communication. In this BR5, Norway reports on the target for the period through 2020. By 2020, Norway was committed to reduce global emissions of greenhouse gases equivalent by 30 per cent relative to Norway's emission level in 1990. The target was set by the Government in 2007, agreed by the Norwegian Parliament and set 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 per cent of the 1990 level. Norway ratified the Doha amendments 12 June 2014. Thus, compliance with the commitment under KP was also implied that the 30 per cent 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[105] and in the subsequent presentation to the AWG KP on the 16th of May[106].

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

[105] FCCC/KP/AWG/2012/MISC.1 at http://unfccc.int/resource/docs/2012/awg17/eng/misc01.pdf

[106] *http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_norway_ppt.pdf*

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.[107] The initial report has been reviewed and in 2021 Norway issued its assigned amount in its registry.

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

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 has continued 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 elected to include emissions and removals from the voluntary activities Cropland Management and Grazing land Management under Article 3.4 for the second period. Norway accounted 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 market-based mechanisms to demonstrate compliance. This includes AAUs reflecting net transfers under the European ETS from the EU to Norway and CERs acquired through the procurement program. Norway will also use about 9 million Kyoto units that were 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 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 of this BR.

107 For the initial report and the report of the review of the initial report, see *https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-kyoto-protocol/second-commitment-period/initial-reports*.

Table A3-2 (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	

Table A3-3 **(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.

Table A3-4 **(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

Table A3-5 **(CTF table 2d). Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector**

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

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

Table A3-6 (CTF table 2(e)I). Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention [a]

Possible scale of contributions (estimated kt CO_2 equivalents)	73 484
CERs	8 905
ERUs	738
AAUs [b]	63 841 [1]
Carry-over units [c]	IE [2]
Other mechanism units under the Convention (specify) [d]	NA

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.

[1] The number of AAUs are in addition to the AAUs issued to Norway.

[2] Carry-over units are included in CERs, ERU and AAUs. The carry-over includes 2.25 million CERs and 0.74 million ERUs to Norway's party holding account and 5.98 million AAUs pertaining to a swap of CERs/ERUs used for compliance in the EU ETS in 2013–2014.

Table A3-7 (CTF table 2(e)II). Description of quantified economy-wide emission reduction target: other market-based mechanisms

Possible scale of contributions (estimated kt CO_2 equivalents)	
NA	Norway will not use other market mechanisms than those eligible for meeting Norway's commitment under the Kyoto Protocol.

Table A3-8 (CTF table 2(f). Description of quantified economy-wide emission reduction target: any other information.

Target for 2020 under the Convention is made operational through the commitment to reduce emissions by 16 per cent for the period 2013–2020 (see BR chapter 4).

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

4.1 Mitigation actions and their effects

Norway has over the years introduced several policies and measures that have reduced the GHG emissions. Chapter 4 and section 5.3 of Norway's eighth National Communication (NC8), to which this BR5 is annexed, describe these policies and measures and estimate the effects these have had or will have on the historical and projected emissions. The descriptions of individual policies and measures are not repeated in this BR5, but CTF table 3 is included (see table 4.1).

There are considerable methodological difficulties in calculating the effects of policies and measures ex post, including establishing a hypothetical baseline and obtaining relevant data. There is also uncertainty related to such estimates. Nevertheless, effects are estimated for a number of policies and measures. According to the estimates, the historical GHG emissions (without LULUCF) in 2020 would have been about 23.4 million tonnes of CO_2 equivalents higher than observed, if these policies and measures had not been implemented. Similarly, projected GHG emissions (without LULUCF) would be about 34.9 million tonnes higher in 2030. The total estimates prepared for the NC8 are illustrated in Figure 4.1. The figure also shows the historical GHG emissions without LULUCF for 1990–2020 together with the projections in the with existing measures (WEM) scenario.

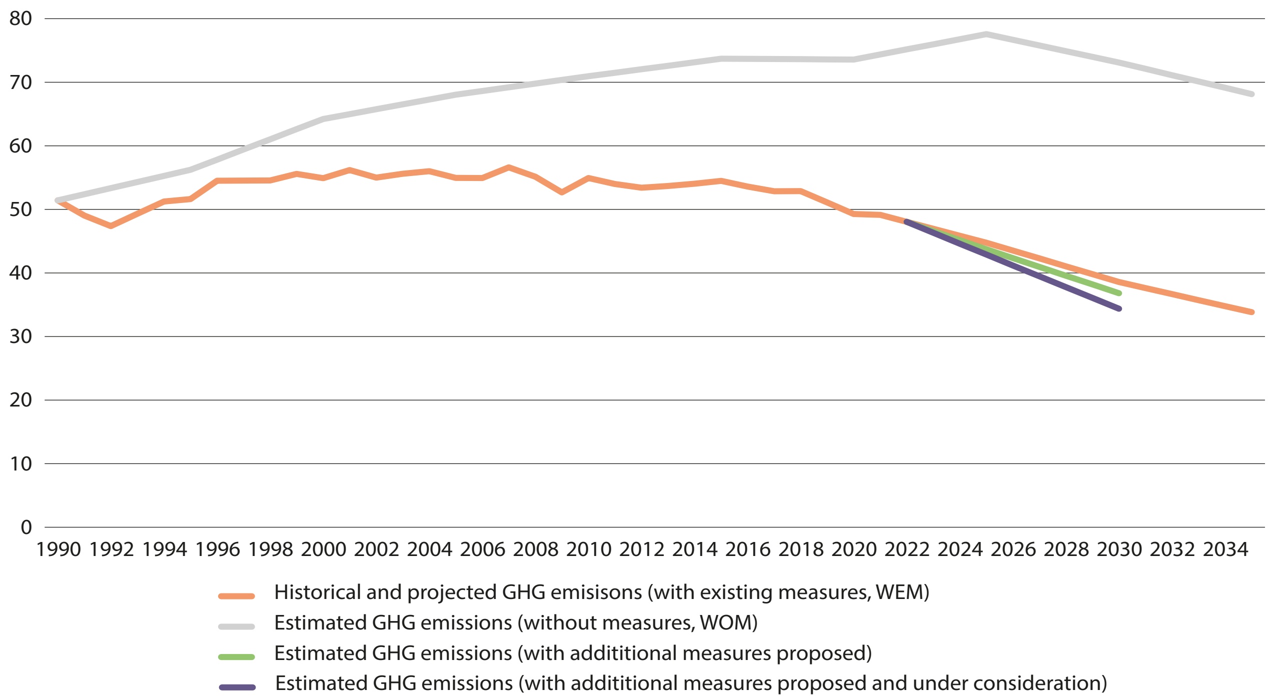
To arrive at a total, the estimated effects of each significant policy and measure are aggregated. The estimated and expected effects of the individual policies and measures which are addressed in chapter 4 of the NC8 are based on the work of several agencies and ministries. The effects for 1995, 2000, 2005, 2010 and 2015 are from the estimates in the seventh National Communication. The effects for 2020, 2025, 2030 and 2035 are from the estimates of the eighth National Communication.

Figure 4.1 also shows the potential emission reduction that can come as a result of proposed climate measures and policies and measures that are under consideration, see box 4.2 in the NC8. It is estimated that measures proposed in the budget in aggregate can reduce the ESR emissions by 9.3–9.9 million tonnes of CO_2-equivalents in the period 2021–2030. The potential effect for 2025 and 2030 are about 1 and 1.7 million tonnes CO_2 equivalents respectively and is illustrated by the green line in the figure. A further 10.4 to 11 million tonnes of CO_2 equivalents in the period 2021–2030 can come from policies and measures that are under consideration. The potential effect for 2025 and 2030 are about 0.8 and 2.4 million tonnes CO_2 equivalents respectively and the incremental effect of this is illustrated by the purple line in the figure. Estimates have only been considered up to 2030.

The UNFCCC biennial reporting guidelines 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. In CTF table 3, Norway therefore includes the policies and measures reported in the sectoral tables in chapter 4 of the NC8 and their estimated effects in 2020 and 2030. The policies and measures are organized by sector and by gas both in CTF table 3 and in the NC8. In order to avoid duplication, reference is made to the description of the mitigation actions in chapter 4 of the NC8.

For some of the policies and measures in CTF table 3 the impact in terms of GHG reductions are not estimated (NE). In chapter 4 of the NC8 the reasons are explained to the extent possible. 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.

Figure A3.2 Emissions with and without measures (mill. tonnes CO_2 equivalents).



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

Table A3-9 (CTF table 3). Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action[a]	Sector(s) affected[b]	GHG(s) affected	Objective and/or activity affected	Type of instrument[c]
The Norwegian tax scheme on emissions of GHGs under the ESR (excluding road transport) (1)*	Cross-cutting	CO_2, HFC	Cost-effective reductions of emissions	Fiscal
Tax on waste incineration*	Energy	CO_2	Cost-effective reductions of emissions	Fiscal
Tax and reimbursement scheme on HFC and PFC*	Industry/industrial processes	HFC	Improved control of fugitive emissions from industrial processes	Economic
Emissions trading (2008–2012) onshore*	Industry/industrial processes, Energy	CO_2, N_2O	Reduce emissions	Economic
Emissions trading (2013-) onshore (2)*	Industrial processes, Energy	CO_2, N_2O, PFC	Reduce emissions	Economic
Regulation by the Pollution Control Act*	Industrial Processes; Energy	CO_2, HFC, CH_4, N_2O, PFC, SF_6	Reduce pollution	Regulatory
The Planning and Building Act*	Cross-cutting	CO_2	Energy consumption	Regulatory
Enova*	Transport, Industry/industrial processes, Energy	CO_2	Efficiency improvements of buildings; Efficiency improvement in industrial end-use sectors; Demand management/reduction; Low carbon fuels; Electric road transport; Reduce emissions from international air or maritime transport; Installation of abatement technologies	Economic, Information
Klimasats*	Cross-cutting	CO_2, HFC, CH_4, N_2O, PFC, SF_6	Reduce emissions	Economic

Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents) 2020	2030 [f]
Implemented	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	1991	Ministry of Finance	1 000.00	1 000.00
Implemented	Introduced in 2022. Incentivizes reduced inceneration of fossil materials, increased recycling of plastics and the implementation of CCS technology.	2022	Ministry of Finance	NA	IE
Implemented	Has resulted in better maintenance and improved routines during discharge of old equipment.	2003	Directorate of Customs and Excise, Norwegian Environmental Agency	IE	IE
Implemented	Part of the EU Emissions Trading Scheme, see text for further details.	2008	Norwegian Environment Agency	300.00	300.00
Implemented	Part of the EU Emissions Trading Scheme, see text for further details.	2013	Norwegian Environment Agency	IE	IE
Implemented	The Act lays down a general prohibition against pollution. Pollution is prohibited unless one has a specific permission.	1983	Norwegian Environment Agency	NE	NE
Implemented	State act regulating the management of land use in Norway. Planning pursuant to the act shall ensure sustainable development and take climate into account. The PaM "Energy requirements in the building code" follows the planning- and building act.	1985	Ministry of Local Government and Regional Development	NE	NE
Implemented	Financial support to climate projects aiming for technology development or early market diffusion.	2002	Ministry of Climate and Environment	959.00	2 629.00
Implemented	Reduce emissions at local level and contribute to the transition to a low carbon society.	2016	Norwegian Environment Agency	NE	NE

Name of mitigation action[a]	Sector(s) affected[b]	GHG(s) affected	Objective and/or activity affected	Type of instrument[c]	
The environmental technology scheme – Innovation Norway*	Cross-cutting	CO_2	Contribute to sustainable business development in Norway and realize Norway's environmental goals	Research	
Nysnø Klimainvesteringer AS (Nysnø)*	Cross-cutting	CO_2	Contribute to reducing greenhouse gas emissions through investments with such an effect directly or indirectly.	Economic	
Climate policies that affect the petroleum sector*	Energy	CO_2	Reduce emissions	Regulatory	
Indirect CO_2 emissions from offshore NMVOC regulation *	Energy	CO_2, CH_4	Reduce indirect CO_2 emissions from offshore oil and gas production	Regulatory	
Indirect CO_2 emissions from onshore NMVOC regulation *	Energy	CO_2, CH_4	Reduce indirect CO_2 emissions from offshore oil and gas industries	Regulatory	
Carbon capture and storage (CCS) (3)*	Industry/industrial processes, Waste management/waste	CO_2	Reduce emissions	Economic, Research	
Electricity tax *	Cross-cutting	CO_2	Reduce electricity consumption	Fiscal	
Base tax on mineral oils etc*	Cross-cutting	CO_2	Increase in renewable energy	Fiscal	
Electricity Certificate Act*	Energy	CO_2	Increase in renewable energy	Economic	
Energy requirements in the building code*	Energy	CO_2	Efficiency improvements of buildings	Regulatory	
Ban on the use of mineral oil for heating of buildings from 2020 and house construction sites from 2022*	Energy	CO_2	Efficiency improvements of buildings	Regulatory	
Renewable Scheme*	Energy	CO_2	Replace fossil energy with bioenergy	Economic	
Taxes and regulations on emissions from road transportation*	Transport	CO_2	Reduce emissions from road transport	See below	

	Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)	
					2020	2030 [f]
	Implemented	The Environmental Technology Scheme offers grants and other support for development and investments in pilot and demonstration projects for new Norwegian environmental technology.	2010	Norwegian Ministry of Trade, Industry and Fisheries	NE	NE
	Implemented	Nysnø invests in non-listed companies and funds aimed at non-listed companies that have operations in Norway. It focuses on early-stage companies and invests primarily in the transition from technology development to commercialisation.	2018	Norwegian Ministry of Trade, Industry and Fisheries	NE	NE
	Implemented	Coverage and rates changed since 1991, see text for further details.	1991	Ministry of Finance, Norwegian Environment Agency	7 000.00	10 000.00
	Implemented	Phase in of vapour recovery units technology, see text for further details.	2002	Norwegian Environment Agency	96.00	104.00
	Implemented	Installation of vapour recovery units.	1996	Norwegian Environment Agency	55.00	55.00
	Adopted	CCS is a key tool for reducing global greenhouse gas emissions. Work in this field is focusing on the development of technology and ways of reducing costs. The government supports a full-scale CCS demonstration project, which consist of two capture sites in Norway, and transport and storage of CO_2 at the continental shelf.	2005	Ministry of Petroleum and Energy	0.00	800.00
	Implemented	Tax on electricity consumption	1951	Ministry of Finance	NE	NE
	Implemented	Excise duty on mineral oils	2000	Ministry of Finance	40.00	40.00
	Implemented	Norway and Sweden will increase their renewable electricity generation by 28.4 TWh from 2012 to the end of 2020 (an average of 3.2 TWh yr.)	2012	Ministry of Petroleum and Energy	NE	NE
	Implemented	Energy requirements in buildings to ensure more energy efficient buildings.	2007	Ministry of Local Government and Regional Development	NE	NE
	Implemented	The ban covers the use of mineral oil for both main heating (base load) and additional heating (peak load), in residential buildings, public buildings, commercial buildings, and for temporary heating og drying of materials in buildings under construction or alteration.	2020	Ministry of Climate and Environment, Ministry of Petroleum and Energy	400.00	380.00
	Implemented	Monetary support schemes for converting to bioenergy.	2003	Ministry of Agriculture and Food	100.00	175.00
	Implemented	Several policies affecting road traffic	See below	Ministry of Finance	4 000.00	6 800.00

Name of mitigation action[a]	Sector(s) affected[b]	GHG(s) affected	Objective and/or activity affected	Type of instrument[c]
The Norwegian tax scheme on emissions of GHGs under the ESR (road transport only) (4)*	Transport	CO_2	Cost-effective reducti-ons of emissions	Fiscal
Road usage tax *	Transport	CO_2	Besides creating revenue, the intention is to price the external costs of road transport, except emissions of CO_2	Fiscal
One-off registration tax based on CO_2-emissions and with special rules for plug-in hybrid cars*	Transport	CO_2	Reduce emissions from new cars	Economic
Tax advantages for electric vehicles*	Transport	CO_2	Reduce emissions from new cars	Economic, regulatory
Biofuel requirement in road transport*	Transport	CO_2	Reduce emissions from road transport	Regulatory
CO_2 tax on domestic aviation (ETS)*	Transport	CO_2	Cost-effective reducti-ons of emissions	Fiscal
Blending mandate for advan-ced jet biofuel in aviation*	Transport	CO_2	Reduced emissions from aviation	Regulatory
Pilot projects for fossil free construction sites*	Transport	CO_2	Reduces emissions from construction machinery	Economic
Urban growth agreements and reward scheemes for public transport*	Transport	CO_2	Modal shift to public transport or non-moto-rized transport, demand management/reduction	Economic, Voluntary Agreement
Maximum CO_2-emissions from the coastal service Bergen-Kirkenes*	Transport	CO_2	Reduce emissions	Regulatory
Requirements for zero and low-emission technology in tenders for public ferries*	Transport	CO_2	Reduce emissions from ferries	Economic, regulatory
Aid Scheme for Short Sea Shipping*	Transport	CO_2	Reduce emission from freight transport	Economic

Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)	
				2020	2030 [f]
Implemented	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	1991	Ministry of Finance	IE	IE
Implemented	The road usage tax applies to petrol, mineral oil, biodiesel, bioethanol, natural gas and LPG	1931	Ministry of Finance	IE	IE
Implemented	Registration tax is based on CO_2 emissions, NO_x emissions and weight. CO_2 emissions included in 2007 – increasingly emphasised. Additional weight rebates for plug-in hybrids in the registration tax.	2007	Ministry of Finance	IE	IE
Implemented	Excemption from registration tax and VAT for EVs. Reduced rate in annual motor vehicle tax. Other user advantages as free or low charges for toll roads, ferries and public parking.	2001	Ministry of Finance	IE	IE
Implemented	From January 1st 2021, the requirement is that 24.5 % of total fuel sold to road traffic is biofuel, with a sub require-ment that 9 % should be advanced biofuel. Advanced biofuel is double counted wit-hin the overall requirement.	2009	Ministry of Climate and Environment	IE	IE
Implemented	Mineral oil for domestic aviation under the ETS is also subject to the CO_2-tax on mineral products.	1999	Ministry of Finance	10.00	10.00
Implemented	From January 1st 2020, 0.5 % of total fuel sales in aviation is required to be advanced biofuel.	2020	Ministry of Climate and Environment	6.00	6.00
Implemented	Support scheme for increased use of zero emission equip-ment on construction sites for public transport infra-structure	2022	Ministry of transport and communication	NE	NE
Implemented	The 9 largest urban areas eit-her have urban environment agreements, urban growth agreements or a reward scheme for public transport, which all share the same common goal of zero growth in passenger traffic by car.	2012	Ministry of transport and communication	NE	60.00
Implemented	Requirements for maximum CO_2-emissions from the coas-tal route Bergen to Kirkenes.	2016	Ministry of transport and communication	NE	60.00
Implemented, plan-ned	Low- and zero emission criteria for ferries from 2023 where suitable	2015	Ministry of transport and communication	100.00	200.00
Implemented, Plan-ned	Shipowners may receive financial aid for operational costs or for investments costs over a three-year period in order to establish a sustain-able maritime transport route.	2017	Ministry of Trade, Industry and Fisheries	23.00	24.00

Name of mitigation action[a]	Sector(s) affected[b]	GHG(s) affected	Objective and/or activity affected	Type of instrument[c]
Green Shipping Programme*	Transport	CO_2	Reduce emission from freight transport	Economic
Risk loan scheme for Norwegian short sea vessels*	Transport	CO_2	Reduce emission from freight transport	Economic
Recycling scheme for Norwegian short sea vessels and offshore vessels*	Transport	CO_2	Reduce emission from freight transport	Economic
High speed passenger ferries scheme*	Transport	CO_2	Reduce emission from freight transport	Economic
Maritime Zero 2050*	Transport	CO_2	Reduce emission from freight transport	Economic
Investments in railways*	Transport	CO_2	Reduce emission from transport	Economic
Grant funding to transport freight by rail*	Transport	CO_2	Reduce emission from freight transport	Economic
Arrangement to reduce emissions in the processing industry, 2004 (5)*	Industrial processes	CO_2, HFC, CH_4, N_2O, PFC, SF_6	Reduce emissions	Voluntary/negotiated agreements
Arrangement to reduce emissions in the processing industry, 2009*	Industrial processes	CO_2, HFC, CH_4, N_2O, PFC, SF_6	Reduce emissions	Voluntary/negotiated agreements
CO_2 compensation scheme*	Industrial processes	NA	Prevent carbon leakage	Voluntary
Use of bio carbon in the production of cement and ferroalloys*	Industrial processes	CO_2	Reduce emissions	Voluntary/negotiated agreements
N_2O reduction, production and nitric acid*	Industrial processes	N_2O	Reduce emissions	Voluntary/negotiated agreements

Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)	
				2020	2030 [f]
Implemented, Planned	The Green Shipping Programme (GSP) is a public-private partnership working to reduce barriers for the introduction of low and zero emission solutions within the maritime sector. The program has initiated 28 green pilot projects since its beginning in 2015, and completed 8 of them. Since 2019, the programme has had a special focus on fleet renewal within the short shipping segments.	2019	Ministry of Trade, Industry and Fisheries	NA	360.00
Implemented	The national risk loan scheme for short sea shipping and fisheries will contribute to a more climate and environmentally friendly short sea shipping and fishing fleet by providing loans for investments in low and zero emission vessels.	2020	Ministry of Trade, Industry and Fisheries	NE	NE
Implemented	Established with the aim of fomenting fleet renewal in a segment with little ability or incentives for green fleet renewal.	2020	Ministry of Trade, Industry and Fisheries	NE	NE
Implemented	Financial support scheme dedicated to projects in county councils aiming at reducing emissions for high speed passenger vessels.	2019	Ministry of Climate and Environment	NA	12.00
Implemented	Directed towards development of zero emission solutions for large ships sailing long distances.	2022	Ministry of Trade, Industry and Fisheries	NA	NE
Implemented, planned	1) Investment in railway infrastructure in the larger capital area, the so called InterCity-project. 2) Investment in specific infrastructure measures for freight transport.	2011	Ministry of transport and communication	NE	41.00
Implemented	To improve conditions for rail freight operators, and to facilitate a shift from road to rail.	2019	Ministry of transport and communication	NE	NE
Implemented	The Ministry of Climate and Environment entered into an arrangement with the processing industry.	2004	Ministry of Climate and Environment	IE	IE
Implemented	The Ministry of Climate and Environment entered into an agreement with the processing industry that was not covered by the EU ETS.	2009	Ministry of Climate and Environment	200.00	200.00
Implemented	The purpose of this compensation scheme is to prevent carbon leakage from Europe resulting from increased electricity prices due to the EU Emissions Trading System (EU ETS).	2013	Ministry of Climate and Environment	NA	NA
Implemented	The producers have voluntarily replaced some of the coal consumption with bio carbon	1990s (cement), 2000 (ferroalloys)		500.00	500.00
Implemented	The producers have voluntarily restructured production	1992	Ministry of Climate and Environment	2 833.00	2 985.00

Name of mitigation action[a]	Sector(s) affected[b]	GHG(s) affected	Objective and/or activity affected	Type of instrument[c]	
Agreement with the aluminium industry*	Industrial processes	PFC	Reduce emissions	Voluntary/negotiated agreements	
Agreement on SF_6 reduction from use and production of GIS*	Industrial processes	SF_6	Reduce emissions	Voluntary/negotiated agreements	
F-gas regulation and the Kigali Amendment to the Montreal Protocol*	Industrial processes	HFC, SF_6	Reduce emissions	Regulatory	
Regional agri-environmental programme*	Agriculture, LULUCF	CO_2, CH_4, N_2O	Reduce emissions and leaching from agricul-ture	Economic, regulatory	
Requirements and support for livestock on pasture*	Agriculture, LULUCF	CH_4, N_2O	Increase the time on pasture to improve resource use and ani-mal welfare	Economic, regulatory	
Support scheme for Special Environmental Measures in Agriculture*	Agriculture	CH_4, N_2O	Improved animal waste management systems	Economic	
Drainage of agricultural soils*	Agriculture	N_2O	Improve the drainage of fields to improve productivity, climate adaptation and reduce emissions from soils	Economic	
Project Climate Smart Agriculture*	Agriculture, LULUCF	CO_2, CH_4, N_2O	Data collection, councel-ling, sharing knowledge	Information	
Climate and environment programme*	Agriculture, LULUCF	CO_2, CH_4, N_2O	Develop knowledge	Information	
Delivery of manure for production of biogas*	Agriculture, Transport	CH_4, N_2O	Reduce emissons from storage of manure	Economic	
Restrictions on cultivation of peatlands*	LULUCF, Agriculture	N_2O	Reduce emissions from cultivated organic soils	Regulatory	
Higher seedling densities in existing areas of forest land*	LULUCF	CO_2	Enhancing production in existing forests	Economic	
Genetical improvement, plant breeding*	LULUCF	CO_2	Enhanced forest mana-gement	Economic	
Fertilization of forests as a climate mitigation measure *	LULUCF	CO_2, CH_4, N_2O	Enhancing production in existing forests	Economic	
Afforestation	LULUCF	CO_2	Enhancing production in existing forests	Economic	
Tending of juvenile stands	LULUCF	CO_2	Enhancing production in existing forests	Economic	

Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)	
				2020	2030 [f]
Implemented	The major aluminium producers signed an agreement with the Ministry of Climate and Environment to reduce emissions.	1997	Ministry of Climate and Environment	5 830.00	6 300.00
Implemented	Agreement between the Ministry of Climate and Environment and the business organisations representing most users of gas-insulated switchgear (GIS) and the single producer.	2002	Ministry of Climate and Environment	56.00	67.00
Implemented	Implementation of the revised EU regulation No. 517/2014 and the Kigali Amendment to the Montreal Protocol.	2019	Norwegian Environmental Agency	154.00	600.00
Implemented	Several support schemes. Differs between regions. No-autumn tillage implemented in 2003 will be strengthened in 2023. Environmentally friendly spreading of manure implemented in 2012.	2003, 2012	Ministry of Agriculture and Food	13.00	13.00
Implemented	Various requirements and support schemes differentiated between livestock category and pasture category.	1990	Ministry of Agriculture and Food	NE	NE
Implemented	Several support schemes, of which storage of manure is mostly targeted to climate mitigation	2017	Ministry of Agriculture and Food	NE	NE
Implemented	National support scheme	2013	Ministry of Agriculture and Food	NE	NE
Implemented	Project to develop and maintain tools to quantify greenhouse gas emissions from farms	2017	Ministry of Agriculture and Food	NE	NE
Implemented	Develop knowledge which, among others, will contribute to reduced emissions on farm level	2013	Ministry of Agriculture and Food	NE	NE
Implemented	Support scheme for delivery of manure. The goal is to increase the utilization of livestock manure to biogas production.	2015	Ministry of Agriculture and Food	0.90	0.90
Implemented	Avoid conversion of peatland into cropland	2020	Ministry of Agriculture and Food	0.00	5.00
Implemented	Increase the number of plants to an optimum level from a climate perspective to enhance net carbon sequestration	2016	Ministry of Agriculture and Food	0.00	0.00
Implemented	Genetically improvement means to single out robust plants which can improve growth and quality.	2016	Ministry of Agriculture and Food	0.00	100.00
Implemented	Fertilization can sustain or improve carbon sequestration where nitrogen scarcity in existing forest areas limits plant growth.	2016	Ministry of Agriculture and Food	0.00	270.00
Planned	Planting trees on new areas to increase the carbon uptake		Ministry of Climate and Environment	NA	0.00
Planned	Tending of young stands is to select the most adapted tree species and optimize growth.		Ministry of Agriculture and Food	NA	500.00

Name of mitigation action[a]	Sector(s) affected[b]	GHG(s) affected	Objective and/or activity affected	Type of instrument[c]
Measures to reduce damage from root-rot	LULUCF	CO_2	Enhancing production in existing forests	Economic
Regeneration with proper tree-species	LULUCF	CO_2	Enhancing production in existing forests	Regulatory
Threshold for tree-stand age by harvesting	LULUCF	CO_2	Enhancing production in existing forests	Regulatory
Reduced emissions from peatlands and bogs*	LULUCF	CO_2	Conservation of carbon in existing forests, prevention of drainage or rewetting of wetlands.	Regulatory
Requirement to collect landfill gas*	Waste	CH_4	Reduce emissions from landfills	Regulatory
Ban on depositing biodegradable waste in landfills*	Waste	CH_4	Reduce emissions from landfills	Regulatory
Other measures in the waste sector*	Waste	CO_2, CH_4, N_2O	Reduce emissions, increase recycling and reduce the quantities of waste	Regulatory, fiscal, voluntary

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available).
Abbreviations: GHG = greenhouse gas; LULUCF = land use, land-use change and forestry.
[a] Parties should use an asterisk (*) to indicate that a mitigation action is included in the 'with measures' projection.
[b] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors, cross-cutting, as appropriate.
[c] To the extent possible, the following types of instrument should be used: economic, fiscal, voluntary agreement, regulatory, information, education, research, other.
[d] To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted, planned.
[e] Additional information may be provided on the cost of the mitigation actions and the relevant timescale.
[f] Optional year or years deemed relevant by the Party.
Custom footnotes:
[1.] The effects of the taxes on HFCs and waste incineration are included in the effect of the Norwegian tax scheme on emissions of GHGs under the ESR.
[2.] The ETS may have contributed to some of the estimated effects reported for industry.
[3.] Under construction. Existing CCS-projects in the petroleum sector are included in the table for petroleum.
[4.] The effects of the Norwegian tax scheme on emissions of GHGs under the ESR (road transport only), road usage tax, one-off registration tax based on CO_2 emissions and with special rules for plug-in hybrid cars, tax advantages for electric vehicles and biofuel requirement in road transport are included in the effects of taxes and regulations on emissions from road transportation.
[5.] The effect is included under N_2O reduction, production of nitric acid.

Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO_2 equivalents)	
				2020	2030 [f]
Planned	Treating stumbs after harvest to reduces the spread of tree rot to increase growth.		Ministry of Agriculture and Food	NA	0.00
Planned	Regeneration with the tree species that gives the highest growth		Ministry of Agriculture and Food	NA	100.00
Planned	Regulate the minimum harve-sting age		Ministry of Agriculture and Food	NA	300.00
Implemented	Avoid conversion of peatland into cropland	2020	Ministry of Agriculture and Food	4.00	60.00
Implemented	All landfills with biodegradable waste must have a system for extracting landfill gas	2002	Ministry of Climate and Environment, Ministry of Agriculture and Food	153.00	94.00
Implemented	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	2002	Ministry of Climate and Environment, Ministry of Agriculture and Food	461.00	699.00
Implemented	Agreements primarily to ensure that waste is collected and sent to approved treat-ment. Waste regulations for a number of waste fractions and a tax on beverage packa-ging. Tax on incineration up to 2010 and for landfills up to 2015.	1995	Ministry of Finance and Ministry of Climate and Environ-ment	NE	NE

4.2 Changes in domestic institutional arrangements

Chapters 4.1.3 and 4.2 of Norway's eighth National Communication contains information relevant for the current domestic institutional arrangements. There have not been any significant changes to these arrangements since Norway reported its fourth Biennial Report.

4.3 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. This information is found in chapter 4.1.4 in the NC8.

4.4 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

4.4.1 General Information

Chapter 4 of Norway's eighth National Communication and CTF table 3 in this BR5 describe policies and measures that have reduced or will reduce Norway's national emissions. Chapter 4.4.2 below describes how Norway will demonstrate achievement of its target under the Kyoto Protocol's second commitment period (2013–2020).

4.4.2 The Kyoto Protocol's second commitment period (2013–2020)

As explained in chapter 3 of this BR5, 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 per cent of the 1990 level. Table 4.2 below (CTF Table 4) 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, table 4.2 is supplemented by Table 4.3.

The annual emissions excluding LULUCF for the years 2013–2020 are shown in table 4.2 The contribution from LULUCF for the years 2013–2020 is in line with the information reported in CTF Table 4(a)II. The GHG emissions excluding LULUCF and the contribution from LULUCF are as reported to the UNFCCC in April 2022. Norway's GHG inventory was subject to the technical expert review in the second half of 2022 and the review report is expected early 2023. The numbers for the use of market-based mechanisms under the Convention is explained further in relation to Table 4.5. Information for the years of 2010–2012 is not reported here, since they are not relevant for the Kyoto Protocol's second commitment period and thus the Norwegian 2020 target.

Within the format of CTF table 4, it is not technically possible to present information on the issuance of AAUs. This is an essential aspect of the Kyoto Protocol, and a supplementary table is therefore necessary. Table 4.3 shows information for the period 2013–2020.

Table A3-10 (CTF table 4). Reporting on progress[a]

	Total emissions excluding LULUCF (1)	Contribution from LULUCF[d] (2)	Quantity of units from market based mechanisms under the Convention		Quantity of units from other market based mechanisms	
Year[c]	(kt CO_2 eq)	(kt CO_2 eq)	(number of units)	(kt CO_2 eq)	(number of units)	(kt CO_2 eq)
Base year/ period (1990)	51 192.77*	NA	NA	NA	NA	NA
2010	NA	NA	NA	NA	NA	NA
2011	NA	NA	NA	NA	NA	NA
2012	NA	NA	NA	NA	NA	NA
2013	53 671.56	-94.89	9 962 919	9 963	NA	NA
2014	54 040.58	-76.42	10 350 409	10 350	NA	NA
2015	54 488.25	406.35	11 280 852	11 281	NA	NA
2016	53 585.78	55.09	10 027 120	10 027	NA	NA
2017	52 840.35	76.99	9 303 592	9 304	NA	NA
2018	52 871.07	253.61	9 510 929	9 511	NA	NA
2019	51 086.03	216.96	7 689 242	7 689	NA	NA
2020	49 272.55	-294.44	5 364 364	5 364	NA	NA

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.
*1990 value as determined through the review of the initial report.
[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.

Table A3-11 Achieving the commitment under the Kyoto Protocol's second commitment period (mill. tonnes CO_2 equivalents)

Year	GHG emissions excluding LULUCF [a]) (Mt CO_2 eq)	Contribution of LULUCF [b]) (Mt CO_2 eq)	Use of units from market-based mechanisms [c]) (Mt CO_2 eq)	GHG emissions including LULUCF and marked-based mechanisms (Mt CO_2 eq)
1990	51.92	NA	NA	NA
2013	53.67	-0.09	9.96	43.61
2014	54.04	-0.08	10.35	43.61
2015	54.49	0.41	11.28	43.61
2016	53.59	0.06	10.03	43.61
2017	52.84	0.08	9.30	43.61
2018	52.87	0.25	9.51	43.61
2019	51.09	0.22	7.69	43.61
2020	49.27	-0.29	5.36	43.61
Cumulative 2013–2020	421.86	0.54	73.49	348.91
Assigned amount units (emissions budget) 2013–2020 (Mt CO_2 equivalents)				348.91

Notes
a) 1990 value as determined through the review of the initial report.
b) For LULUCF, a positive number here means net emissions and a negative number means net removals.
c) Units have not actually been used (retired) in 2013–2020, but will be used when accounting for the target under the Kyoto Protocol.

Norway issued a total of 348.9 million assigned amount units (AAUs) for the period 2013–2020, or on average 43.61 million AAUs annually. The number of issued AAUs was determined through the review process of Norway's initial report for the second commitment period.

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 accounts 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. Norway thus chose to account for the entire commitment period. CTF table 4(a) II is imported from the accounting table in the Common Reporting Format (CRF) table and is reported as part of the CTF tables. Table 4.4 below displays the contributions from the LULUCF sector as reported in CTF table 4(a)II and in tables 4.2 and 4.3 above.

Table A3-12 **Contribution from the LULUCF (mill. tonnes CO_2 equivalents)**

	Art. 3.3 AR	Art. 3.3 D	Art. 3.3 total	Art. 3.4 FM	Art. 3.4 CM	Art. 3.4 GL	Art. 3.4 total	Art. 3.3 and 3.4 total
2013	-0.95	2.59	1.64	-1.82	-0.02	0.11	-1.73	-0.09
2014	-0.98	2.64	1.66	-1.82	-0.02	0.11	-1.73	-0.08
2015	-1.01	3.14	2.13	-1.82	-0.02	0.11	-1.72	0.41
2016	-1.07	2.85	1.78	-1.82	-0.03	0.12	-1.73	0.06
2017	-1.07	2.89	1.82	-1.82	-0.04	0.11	-1.74	0.08
2018	-1.08	3.08	2.00	-1.82	-0.05	0.12	-1.74	0.25
2019	-1.09	3.05	1.96	-1.82	-0.05	0.12	-1.74	0.22
2020	-1.11	2.58	1.46	-1.82	-0.05	0.11	-1.76	-0.29
Total	-8.38	22.82	14.44	-14.54	-0.28	0.92	-13.90	0.54

Source: Norwegian Institute of Bioeconomy Research (NIBIO)

For LULUCF, a positive number here means net emissions and a negative number means net removals.

The emissions from deforestation (D) under Article 3.3 for the period 2013–2020 were about 22,8 mill tonnes CO_2 equivalents and were higher than the removals of about 8.4 million tonnes CO_2 equivalents from afforestation and reforestation (AR) under Article 3.3 in the same period. Activities under Article 3.3 therefore represent net emissions of about 14.4 million tonnes CO_2 equivalents for the period 2013–2020. The removals that can be accounted[108] from forest management (FM) is about 14.5 million tonnes CO_2 equivalents for the period 2013–2020. Cropland management (CM) resulted in net removals of about 0.3 million tonnes CO_2 equivalents as the reported emissions in the years 2013–2020 were lower than the base year value for the activity. Grazing land management (GM) results in net emissions of about 0.9 million tonnes CO_2 equivalents as the reported removals in the years 2013–2020 were higher than the base year value for the activity. Article 3.4 activities resulted in removals of about 13,9 million tonnes CO_2 equivalents As seen from table 4.4, activities under Article 3.3 and the volume that can be accounted for under 3.4 resulted in a figure showing net emissions of about 0.5 million tonnes CO_2 for the period 2013–2020. This LULUCF figure will be used in the accounting for achieving Norway's target.

[108] 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, see chapter 2 of this BR.

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

Market-based mechanisms under the Convention
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 will be about 73.5 million tonnes for the whole 2013–2020 period.

Within the framework of the Kyoto Protocol, Norway has long experience of using flexibility mechanisms. The major pillar is cooperation with the European Union on International Emissions Trading to reflect underlying participation in the European Emissions Trading system. For 2013–2020 Norway also pursued project-based cooperation in developing countries under the Clean Development Mechanism (CDM) to ensure compliance with the commitments and thus the 2020 target. 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.

The basis for the flow of Kyoto units between EU and Norway is the European registry regulation. For stationary installations in the EU ETS, the number of AAUs transferred from Europe to Norway for the period 2013–2020 was about 54.8 million units. An additional 3.1 million AAUs were acquired based on Norwegian companies' participation in the aviation ETS. In total, the participation in the EU ETS resulted in a transfer of about 57.9 million AAUs from the EU to Norway. This leaves a volume of about 15.1 mill units to be covered from other acquisitions.

The Norwegian Carbon Credit Procurement Program was set up in 2007 to ensure that Norway would be able to meet its target in the first commitment period of the Kyoto Protocol (2008–2012) and eventually overachievement of 10 percentage points. The responsibility for the program was initially assigned to the Ministry of Finance, but was transferred to the Ministry of Climate and Environment on 1 January 2014. In the second commitment period, the Ministry has had a mandate to procure CERs from new, not yet commissioned, projects and from vulnerable projects. Vulnerable projects are registered and commissioned projects that are either stranded or on the verge of shutting down due to the lack of revenues from the sales of emissions reductions. 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. The remaining volume contracted was contracted directly from the Ministry of Climate and Environment.

The procurement programme for Kyoto units for the second commitment period was early on authorized to acquire up to 60 million CERs under the CDM for the period 2013–2020. For details see www.carbonneutralnorway.no. Norway has had a contract volume close to 60 Mt under the procurement program. Of these 60 million CERs, some 29 Mt were contracted through the Nordic Environment Facility Cooperation (NEFCO) However, the actual volume delivered is significantly lower. The amount delivered as of 2022 was about 46 million units, including carry-over of 3 million. By the end of 2022, around 23 Mt were delivered through NEFCO. 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. Consequently, Norway has acquired more than enough units to cover its commitments under the Kyoto Protocol and thus meet the 2020 target.

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. For this BR5, the years to be reported are 2019 and 2020. Norway's accounting for the whole 2013–2020 period is likely to be finalized in 2023 following ia. completion of the review process. Consequently, no units have so far been surrendered pursuant to our commitment under the Kyoto Protocol. In table 4.5 (CTF Table 4b) Norway has therefore chosen to present estimates for the net use of units from the Kyoto mechanisms for 2019 and 2020 consistent with tables 4.3 and 4.4. A split between AAUs and CERs for individual years within the commitment period has not been carried out as Norway will account for the whole period 2013–2020. The total number of units from the various Kyoto Protocol mechanisms are reported in CTF table 2 (e)I.

The additional period for fulfilling commitments for the second commitment period (the true-up period) is foreseen to occur in 2023. During this true-up period, Norway will transfer a sufficient number of units to the retirement account to meet the commitment. Norway already has more than sufficient number of units in its registry and this will be shown through the reporting of the Standard Electronic Format (SEF) tables in April 2023. Upon expiration of the true-up period, Norway will provide a report containing the information required to be reported upon the expiration of the additional period and this report will then undergo a review.

Box 10.1 Projects for KP2 compliance under the Norwegian Carbon Credit Programme

Destruction of methane from landfill gas projects constitute more than half of the KP2 portfolio. Small scale programmes, like cook stoves and water purification, is the second largest group. The majority of the small-scale programmes are located in Africa, whereas the majority of the landfill projects are located in Latin America, especially in Brazil. Altogether, the Norwegian procurement program is involved in 62 projects in 25 countries (bilaterally and through carbon funds).

A vulnerable project is defined as at risk of closing down due to the lack of revenues to cover operational cost. With the help of revenues from Norway's purchase of emission reductions (CERs) the project has been upgraded from a flaring only project (left picture) to a project generating electricity from 21 generators with a total installed capacity of 29.4 MW. The project is expected to deliver more than 6 mill. CERs to Norway.

UN 0171 Caieiras landfill gas emission reduction project (Sao Paulo area):

UN 7997 Improved cook stove programme (Kenya, Uganda and India):

A relatively advanced cook stove where the heat from the flame is converted into electricity through a thermoelectric generator. This electricity powers an internal fan, which force-feeds oxygen into the flame, eliminating the smoke, and leading to the near complete and clean combustion of the fuel. The stove generates surplus electricity – enough to charge a mobile phone and provide an evening's worth of LED light. Compared to a traditional "three stone" stove (left picture) this cook stove reduces the use of firewood by 50 per cent. This is the basis for crediting of emission reductions. Important co-benefits include the reduction of smoke by 90 per cent (particular matters and carbon monoxide), health benefits and reduced deforestation. The programme is expected to deliver up to 1.75 mill emissions reductions (CERs) to Norway.

Table A3-13 (CTF table 4(b)). Reporting on progress. [a, b, c]

Units of market based mechanisms			Year 2019	2020
Kyoto Protocol units[d]	Kyoto Protocol units	*(number of units)*	7 689 242	5 364 364
		(kt CO_2 equivalents)	7 689	5 364
	AAUs	*(number of units)*	NE	NE
		(kt CO_2 equivalents)	NE	NE
	ERUs	*(number of units)*	NE	NE
		(kt CO_2 equivalents)	NE	NE
	CERs	*(number of units)*	NE	NE
		(kt CO_2 equivalents)	NE	NE
	tCERs	*(number of units)*	NE	NE
		(kt CO_2 equivalents)	NE	NE
	lCERs	*(number of units)*	NE	NE
		(kt CO_2 equivalents)	NE	NE
Other units [d]	Units from market-based mechanisms under the Convention	*(number of units)*	NA	NA
		(kt CO_2 equivalents)	NA	NA
		(number of units)	NA	NA
		(kt CO_2 equivalents)	NA	N
	Units from other market-based mechanisms	*(number of units)*	NA	NA
		(kt CO_2 equivalents)	NA	NA
		(number of units)	NA	NA
		(kt CO_2 equivalents)	NA	NA
Total		*(number of units)*	7 689 242	5 364 364
		(kt CO_2 equivalents)	7 689	5 364

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

[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

Since the fourth Biennial Report (BR4) was reported, new projections have been prepared for the years 2025, 2030 and 2035. In line with the UNFCCC reporting guidelines for National Communications and Biennial Report, it is a "with measures" (WEM) projection, based on policies and measures implemented as of midyear 2022. The WEM projections are shown in figure 4.1. The projections, methodologies and assumptions for the projections, changes since the previously reported projections are presented in detail in chapter of Norway's eighth National Communication (NC8). Since the BR and NC overlap, only a brief summary is presented in this chapter.

Greenhouse gas emissions are estimated to decline from 49.1 million tonnes CO_2 equivalents in 2021 to 33.8 million tonnes in 2035. Emissions will in such case be close to 15 million tonnes of CO_2 equivalents lower in 2035 than in 2021. A little more than half of the reduction is expected to occur in the ESR sectors. About half of this reduction is expected within road traffic – mostly due to a strong increase in the share of zero-emission vehicles.

New projections of removals and emissions from the LULUCF sector were published by the Norwegian Institute of Bioeconomy Research (NIBIO) in October 2022. The projections cover removals and emissions of all greenhouse gases in the LULUCF sector from 2021 to 2100 based on the Climate Convention and the LULUCF regulation under the EU climate and energy 2030 framework, respectively. 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 a skewed age class structure of the Norwegian forest with 43 per cent mature stands. Due to ageing forests and higher harvesting rates, the annual increment and removals will inevitably decline between 2030 and 2050.

Table A3-14 CTF Table 6(a): Information on updated greenhouse gas projections.

	GHG emissions and removals[b]									GHG emission projections		
	(kt CO_2 equivalents)									(kt CO_2 equivalents)		
	Base year (1990)	1990	1995	2000	2005	2010	2015	2019	2020	2025	2030	2035
Sector[d,e]												
Energy	18 785	18 785	21 142	23 098	23 912	25 647	24 648	23 203	22 258	19 778	15 937	13 438
Transport	10 056	10 056	10 999	11 951	12 998	14 041	14 343	12 724	11 929	10 628	8 591	6 735
Industry/industrial processes	15 377	15 377	12 436	13 220	11 669	9 102	9 317	9 259	9 224	8 749	8 469	8 166
Agriculture	4 812	4 812	4 749	4 586	4 569	4 361	4 538	4 518	4 510	4 599	4 711	4 733
Forestry/ LULUCF	-10 542	-10 542	-15 444	-18 641	-20 329	-23 716	-13 101	-16 436	-20 332	-15 876	-16 540	-13 605
Waste management/waste	2 403	2 403	2 306	2 066	1 797	1 788	1 642	1 382	1 351	1 005	865	758
Other (specify)												
Gas												
CO_2 emissions including net CO_2 from LULUCF	24 148	24 148	22 655	23 085	22 585	21 536	32 049	25 903	20 418	20 829	14 344	12 777
CO_2 emissions excluding net CO_2 from LULUCF	35 097	35 097	38 508	42 149	43 342	45 691	45 590	42 785	41 197	37 111	31 294	26 805
CH_4 emissions including CH_4 from LULUCF	6 405	6 405	6 588	6 351	5 919	5 757	5 403	4 922	4 899	4 622	4 440	4 266
CH_4 emissions excluding CH_4 from LULUCF	6 236	6 236	6 420	6 176	5 741	5 576	5 219	4 735	4 712	4 452	4 271	4 091
N_2O emissions including N_2O from LULUCF	4 343	4 343	3 952	4 067	4 312	2 729	2 759	2 648	2 579	2 610	2 636	2 639
N_2O emissions excluding N_2O from LULUCF	4 106	4 106	3 712	3 819	4 062	2 471	2 502	2 390	2 319	2 373	2 395	2 391
HFCs	0	0	98	369	549	894	963	934	810	587	364	329
PFCs	3 895	3 895	2 314	1 518	955	238	146	175	161	173	175	173
SF_6	2 099	2 099	580	891	297	69	68	68	74	63	74	42
NF_3												
Other (specify)												
Total with LULUCF[f]	40 890	40 890	36 188	36 281	34 616	31 223	41 387	34 650	28 940	28 883	22 032	20 225
Total without LULUCF	51 432	51 432	51 631	54 922	54 945	54 939	54 488	51 086	49 273	44 759	38 572	33 830

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

Note that the table above is consistent with the projections table in chapter 5 of the National Communication. The actual CTF-table 6a does only allow projections for the year 2030 and the numbers reported for 2020 in CTF table 6a and in the table above are historical values. For full set of footnotes, see below CTF table 5. Also note that indirect CO_2 emissions are included in the historical GHG emissions and in the GHG emission projections.

Table A3-15 Greenhouse gas emissions in Norway by EU-ETS and ESR. Million tonnes CO_2 equivalents.

	1990	2005	2021	2025	2030	2035
GHG emissions in Norway	51.4	54.9	49.1	44.8	38.6	33.8
EU-ETS emissions	23.2	27.7	23.8	22.2	19.0	16.6
– Oil and gas extraction	7.2	12.9	11.5	10.8	8.0	6.3
– Manufacturing industries and mining	15.3	13.7	10.7	10.2	9.8	9.1
– Other sources[1]	0.7	1.1	1.5	1.2	1.2	1.2
ESR emissions	28.2	27.2	25.4	22.6	19.5	17.2
– Transport[2]	12.0	15.0	15.4	13.5	10.9	8.9
Of this. road traffic	7.4	9.5	8.7	7.1	5.3	3.9
– Agriculture	4.8	4.6	4.6	4.6	4.7	4.7
– Other sources[3]	11.4	7.6	5.4	4.8	3.9	3.6
LULUCF	-10.5	-20.3	-14.0	-15.9	-16.5	-13.6
Emissions including LULUCF	40.9	34.6	35.1	28.9	22.1	20.2
Mainland Norway	43.2	40.9	37.0	33.3	30.0	27.1

[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.

The projections of emissions (not for LULUCF) use Statistics Norway's general equilibrium model SNOW and table 5.3 lists the key macroeconomic projections underpinning the Norwegian emission projections. Table 5.5 and chapter 5.1.5 in the NC8 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.

For the methods and assumptions for the projections of the LULUCF sector, see chapter 5.4 of the NC8.

Table A3-16 (CTF Table 5). Summary of key variables and assumptions used in the projections analysis [a]

Key underlying assumptions		Historical[b]							Projected		
Assumption	Unit	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Gross domestic product	*billion NOK. Fixed 2015-prices*	1 701.4	2 044.2	2 442.3	2 723.0	2 855.6	3 111.2	3 254.3	3 682.7	3 885.1	4 059.5
Of which mainland Norway	billion NOK. Fixed 2015-prices	1 303.0	1 492.9	1 790.4	2 059.7	2 331.9	2 614.1	2 740.5	3 101.9	3 399.2	3 661.1
Of which petroleum activities and ocean transport	Billion NOK. Fixed 2015-prices	398.3	551.3	651.9	663.4	523.7	497.1	513.8	580.8	485.9	398.4
Consumption	billion NOK. Fixed 2015-prices	609.2	697.5	849.8	1 016.3	1 186.0	1 354.3	1 343.3	1 568.5	1 756.7	1 970.4
Gross fixed capital formation	billion NOK. Fixed 2015-prices	329.6	368.1	477.0	585.0	630.2	741.5	835.6	898.5	961.7	1 031.0
Of which mainland Norway	billion NOK. Fixed 2015-prices	235.0	262.5	349.9	441.1	464.7	540.7	655.0	728.1	817.1	833.1
Of which petroluem activities and ocean transport	billion NOK. Fixed 2015-prices	94.6	105.5	127.1	143.9	165.6	200.8	180.6	170.4	144.6	197.8
Population	Thousands	4 249.8	4 370.0	4 503.4	4 640.2	4 920.3	5 214.0	5 391.4	5 559.8	5 685.5	5 803.5
Number of persons employed	Thousands	2 047.8	2 112.4	2 314.9	2 319.3	2 552.3	2 709.6	2 792.4	2 949.2	2 994.9	3 003.1
Oil price *	USD per barrel	23.7	17.0	26.2	55.1	80.3	53.4	43.4			
Gas price	*USD per MMBtu*	2.3	2.3	3.0	5.1	6.9	6.3	3.0			

Sources: Statistics Norway and Ministry of Finance.

For the full set of footnotes, see below CTF table 5.
Custom footnote. Prices for oil and gas for 2025, 2030 and 2035 are equal to those used in National budget 2023. But since these assumptions are not published in the budget proposal it is not appropriate to publish them here either.

6 Provision of financial, technological and capacity-building support to developing country parties

6.1 Introduction

The impacts of climate change are increasingly visible and felt around the world, especially in developing countries who are the most severely affected and the least equipped to respond to its consequences. The poorest and most vulnerable communities are experiencing the effects of climate change through extreme weather events such as floods, drought, hurricanes and sea level rise. Climate change has the potential to reverse significant development gains made in developing countries. Norway recognises the critical need for support to developing countries with respect to both climate mitigation and adaptation. In the period 2019–2020 Norway has continued to provide a wide range of financial, technological, and capacity-building support to developing country Parties in order to build their capacity to reduce carbon emissions and to support adaptation to take action against the negative effects of climate change.

Table A3-17 Provision of public financial support, 2019–2020.

	2019		2020	
Type of assistance	NOK mill	USD mill	NOK mill	USD mill
Earmarked contributions				
Adaptation only	464	53	626	67
Mitigation only	4 205	478	3 513	373
Cross-cutting	453	51	468	50
Total earmarked contributions	**5 122**	**582**	**4 607**	**489**
Imputed multilateral contributions	**1 337**	**152**	**2 039**	**217**
Total	**6 459**	**734**	**6 646**	**706**

Table A3-17 presents total figures of Norwegian public climate finance. The Norwegian public climate finance amounted to USD 734 million (NOK 6 459 million) in 2019 and USD 706 million (NOK 6 646 million) in 2020.

The majority of Norwegian climate finance is earmarked support, including bilateral contributions and earmarked contributions through multilateral institutions. The earmarked contributions amounted to USD 582 million (NOK 5 122 million) in 2019 and USD 489 million (NOK 4 607 million) in 2020. The estimated climate specific share of core support to multilateral organisations (imputed multilateral core contributions) amounted to USD 152 million (NOK 1 337 million) and USD 217 million (NOK 2 039 million) in 2019 and 2020, respectively.

The earmarked contributions targeting climate change are separated into three categories: adaptation (only), mitigation (only) and cross-cutting (both adaptation and mitigation). In 2020, USD 67 million (NOK 626 million) was targeting climate change adaptation only (14 per cent of total earmarked support), USD 373 million (NOK 3 513 million) targeting climate change mitigation only (76 per cent of total earmarked support), and USD 50 million (NOK 468 million) was cross-cutting support (10 per cent of total earmarked support).

In addition to the public climate financing, these interventions mobilised private climate relevant investments in developing countries. The private finance mobilised amounted to USD 16 million (NOK 145 million) in 2019 and USD 33 million (NOK 313 million) in 2020.

Table A3-18 (CTF table 7). Provision of public financial support: summary information in 2019.

Allocation channels	2019				
	Norwegian krone – NOK				
		Climate-specific			
	Core/general	Mitigation	Adaptation	Cross-cutting	Other
Total contributions through multilateral channels:					1 336 682 352,02
Multilateral climate change funds					609 829 338,80
Other multilateral climate change funds					32 711 438,80
Multilateral financial institutions, including regional development banks					647 089 865,97
Specialised United Nations bodies					79 763 147,25
Total contributions through bilateral, regional and other channels		4 205 445 674,32	464 034 043,06	452 616 194,54	
Total		4 205 445 674,32	464 034 043,06	452 616 194,54	1 336 682 352,02

Table A3-19 (CTF table 7). Provision of public financial support: summary information in 2020.

Allocation channels	2020				
	Norwegian krone – NOK				
		Climate-specific			
	Core/ general	Mitigation	Adaptation	Cross-cutting	Other
Total contributions through multilateral channels:					2 039 302 466,66
Multilateral climate change funds					1 187 376 171,58
Other multilateral climate change funds					28 417 971,58
Multilateral financial institutions, including regional development banks					796 646 055,62
Specialised United Nations bodies					55 280 239,46
Total contributions through bilateral, regional and other channels		3 513 000 570,15	626 078 852,43	468 014 627,46	
Total		3 513 000 570,15	626 078 852,43	468 014 627,46	2 039 302 466,66

USD				
	Climate-specific			
Core/general	Mitigation	Adaptation	Cross-cutting	Other
				151 919 890,89
				69 309 815,06
				3 717 800,42
				73 544 639,60
				9 065 436,23
	477 967 594,20	52 739 531,64	51 441 842,40	
	477 967 594,20	52 739 531,64	51 441 842,40	151 919 890,89

USD				
	Climate-specific			
Core/ general	Mitigation	Adaptation	Cross-cutting	Other
				216 642 849,05
				126 139 481,96
				3 018 949,09
				84 630 737,22
				5 872 629,87
	373 199 397,67	66 510 735,18	49 718 972,02	
	373 199 397,67	66 510 735,18	49 718 972,02	216 642 849,05

6.2 National approach to tracking and reporting provision of support

6.2.1 Measuring public climate finance

The monitoring of Norwegian development finance targeting the objectives of the United Nations framework convention for climate change (UNFCCC) is based on the OECD Development Assistance Committee's (DAC) reporting system (CRS). We use DAC purpose codes for sector classifications. Norwegian development climate finance includes climate-related official development assistance (ODA) and other official flows (OOF).

The OOF activities are interventions by Norfund providing equity, loans and guarantees to companies operating in challenging markets in developing countries. Norfund's outflows are reported to the OECD DAC as OOF to avoid double counting as the funding that Norfund receives through the State budget is reported as ODA, in accordance with the institutional approach for ODA reporting of private sector instruments.

The tracking of Norwegian development finance targeting climate change is separated into earmarked contributions and imputed multilateral core contributions. Below, we describe these methodologies as well as the tracking of private climate finance mobilised by official development interventions.

The amounts reported are gross disbursements during the year reported for, meaning that inflows (e.g. repayments, sales) are not reported as negative disbursements. These negative disbursements amounted to USD 16.5 million in 2019 and USD 22.9 million in 2020. The amounts are reported in NOK and USD based on average exchange rates (NOK-USD): 2019: 8.7986 and 2020: 9.4132.

Earmarked contributions

Earmarked contributions are support through bilateral and multilateral channels. Norway monitors earmarked climate specific activities using the OECD DAC Rio Markers *Climate change adaptation* and *Climate change mitigation*. The Rio Markers identify development activities targeting climate change (adaptation and/or mitigation), and whether targeting climate change is a principal or significant objective.

Contributions to activities targeting climate change as a principal objective are reported as 100 per cent climate finance, and the full amount disbursed counted. As a conservative estimate, and in line with other major donors, 40 per cent of the support to activities with a significant climate change objective is reported as climate finance. Contributions to cross-cutting activities targeting both climate change adaptation and mitigation are reported as 40 per cent climate finance if neither adaptation nor mitigation are principal project objectives. Consequently, the earmarked contributions targeting climate change objectives are approximations.

All earmarked climate financing is reported in table A3-22 and A3-23, including earmarked contributions through multilateral institutions. The earmarked contributions through multilateral institutions are included in Table A3-22 and A3-23 (instead of Table A3-20 and A3-21) for transparency, as these contributions can be disaggregated by region/country and/or sector.

In table A3-22 and A3-23, we report aggregates by the type of support (adaptation/mitigation/ cross-cutting) for each recipient country/region to limit the table sizes printed in the report. The information on financial instruments is grouped into *grants* and *PSI* (a group of different types of private sector instruments). However, in the online CTF submission we report granular information for each in activity (including financial instrument), and we include the OECD CRS ID in the *Additional information* column to ensure full transparency on the connection between each development finance intervention reported to the OECD DAC and the reported public climate finance.

Norwegian climate-specific ODA to Ukraine is excluded from the reporting as Ukraine is an Annex 1 country.

When referring to support for specific programmes, partners and activities (outside the standardised tables), the amounts are total disbursements regardless of climate relevance (if not specified).

Imputed multilateral core contributions
We report estimates of Norwegian climate specific core contributions to multilateral institutions. These estimates – imputed climate-specific multilateral ODA – are calculated and published by the OECD. This methodology makes it possible to impute multilateral aid outflows targeting climate change back to the donors of multilateral core contributions. By using this methodology, only the estimated climate-specific shares of multilateral core contributions are reported as climate finance.

The OECD methodology for calculating imputed multilateral core support for climate change is a two-step procedure: 1) The percentage of each multilateral agency's total annual commitments to climate change objectives is calculated. This calculation is carried out only in respect of agencies' commitments of grants or concessional (ODA) loans from core resources only. 2) The calculated climate specific percentage is applied to the donor's core contribution in the same year to organization to estimate the imputed climate specific core contribution.

The imputed multilateral core contributions targeting climate change are not disaggregated by the type of support: adaptation, mitigation and cross-cutting. Therefore, the imputed multilateral core contributions are reported as *Type of support = Other* in Table A3-18 and A3-19. In table A3-20 and A3-21, these estimates are included in the column *climate-specific*, not in column *core/general*, as the estimate includes only the climate specific share of core contributions.

Imputed multilateral core support is not calculated for all multilateral institutions receiving core support, but for about 20 multilateral institutions per year. These agencies account for around 90 per cent of donor countries' multilateral core contributions. Core contributions to other multilateral institutions are not included in the reporting as there are no official climate shares available.

Private sector mobilisation
The OECD DAC is modernizing its statistical framework to better reflect the current development co-operation landscape in support of the 2030 agenda, including climate action. Over the last years, the OECD DAC has been working to establish an international standard for measuring resources mobilised from the private sector by official development finance interventions. Methodologies have been developed for a broad range of instruments: guarantees, syndicated loans, equity shares in collective investment vehicles, direct investment in companies, credit lines, simple co-financing arrangements and project finance schemes. The data collection is implemented on the activity level.

The methodologies follow several principles underpinning an international statistical system. In order to be realistic, feasible and to avoid double-counting, they strive to be conservative in terms of causality, fair in terms of attribution and pragmatic in terms of the point of measurement and data availability. The term "mobilisation" in this context refers to the direct mobilisation effect of official development finance interventions.

This OECD reporting framework is consistent with the outcome agreed by all countries of the UNFCCC COP 24 as regards the modalities for the accounting of financial resources provided and mobilised through public intervention.

6.2.2 New and additional finance

The overall objective of Norwegian development cooperation is to fight poverty, save lives and alleviate suffering, in accordance with the humanitarian imperative. The strong inter-linkages between climate change and development have been emphasised.

Norwegian total ODA has exceeded 0.7 per cent of Gross National Income (GNI) for many years, and oscillated around 1 per cent. All our climate finance from the ODA budget can be counted beyond the 0.7 per cent threshold. Moreover, Norway has steadily increased the volume of its ODA budget, as the economy has been growing.

6.3 Core contributions to multilateral institutions

Table A3-20 and A3-21 provides OECD estimates of Norwegian climate specific core contributions to multilateral institutions, in total USD 152 million (NOK 1 337 million) in in 2019 and USD 217 million (NOK 2 039 million) in 2020.

As described in methodology section 6.2.1, the imputed climate-specific core contributions reported does not give the total overview of Norwegian climate-specific core funding, as there are multilateral institutions where the climate-specific share of the core contributions is unknown. Examples of such multilateral institutions receiving core contributions from Norway are CGIAR (NOK 230 million in core contributions in 2019–2020), UNEP (NOK 27 million in core contributions in 2019–2020) and UNDP (NOK 1 110 million in core contributions in 2019–2020). Core contributions to these multilateral institutions are not included as climate financing. In table A3-20 and A3-21, we have included the World Bank Group in the predefined category *World bank*, except for the IFC reported in the predefined category *IFC*.

Table A3-22 and A3-23 provides a summary of public earmarked climate finance, in total NOK 5 112 million in 2019 and NOK 4 607 million in 2020. The methodology section 6.2.1 describes in detail the figures reported.

Table A3-20 **(CTF table 7(a)). Provision of public financial support: contribution through multilateral channels in 2019.**

Donor funding	Total amount – Core/general – Norwegian krone – NOK	Total amount – Core/general – USD	Total amount – Climate-specific – Norwegian krone – NOK	Total amount – Climate-specific – USD	Status	Funding source	Financial instru-ment	Type of support	Sector
Total contributions through multilateral channels			1 336 682 352,02	151 919 890,89					
Multilateral climate change funds			609 829 338,80	69 309 815,06					
1. Global Environment Facility			108 293 900,00	12 308 083,10	Disbursed	ODA	Grant	Other	Not applicable
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund			90 000 000,00	10 228 900,05	Disbursed	ODA	Grant	Other	Not applicable
5. Green Climate Fund			378 824 000,00	43 055 031,48	Disbursed	ODA	Grant	Other	Not applicable
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds			32 711 438,80	3 717 800,42					
SCF – Strategic Climate Fund									
GGGI – Global Green Growth Institute			14 516 902,80	1 649 910,53	Disbursed	ODA	Grant	Other	Not applicable
Multilateral Fund for the Implementation of the Montreal Protocol			18 194 536,00	2 067 889,89	Disbursed	ODA	Grant	Other	Not applicable
Multilateral financial institutions, including regional development banks			647 089 865,97	73 544 639,60					
1. World Bank			354 002 720,00	40 233 982,68	Disbursed	ODA	Grant	Other	Not applicable
2. International Finance Corporation									
3. African Development Bank			552 759,50	62 823,57	Disbursed	ODA	Grant	Other	Not applicable
4. Asian Development Bank									
5. European Bank for Reconstruction and Development									
6. Inter-American Development Bank									
7. Other			292 534 386,47	33 247 833,34					
AFDF – African Development Fund			231 036 560,69	26 258 332,09	Disbursed	ODA	Grant	Other	Not applicable
AIIB – Asian Infrastructure Investment Bank			58 098 870,38	6 603 194,87	Disbursed	ODA	Grant	Other	Not applicable

Donor funding	Total amount				Status	Funding source	Financial instru-ment	Type of support	Sector
	Core/general		Climate-specific						
	Norwegian krone – NOK	USD	Norwegian krone – NOK	USD					
IDB Invest			3 398 955,40	386 306,39	Disbursed	ODA	Grant	Other	Not applicable
Specialised United Nations bodies			79 763 147,25	9 065 436,23					
1. United Nations Development Program									
2. United Nations Environment Program									
3. Other			79 763 147,25	9 065 436,23					
IFAD – International Fund for Agricultural Development			44 295 600,00	5 034 391,84	Disbursed	ODA	Grant	Other	Not applicable
FAO – Food and Agriculture Organization			19 267 547,25	2 189 842,39	Disbursed	ODA	Grant	Other	Not appli-cable
UNFCCC – United Nations Framework Convention on Climate Change			16 200 000,00	1 841 202,01	Disbursed	ODA	Grant	Other	Not applicable
IPCC – Intergovernmental Panel on Climate Change									

Table A3-21 (CTF table 7(a)). Provision of public financial support: contribution through multilateral channels in 2020.

Donor funding	Total amount				Status	Funding source	Financial instru-ment	Type of support	Sector
	Core/general		Climate-specific						
	Norwegian krone – NOK	USD	Norwegian krone – NOK	USD					
Total contributions through multilateral channels			2 039 302 466,66	216 642 849,05					
Multilateral climate change funds			1 187 376 171,58	126 139 481,96					
1. Global Environment Facility			108 958 200,00	11 575 043,56	Disbursed	ODA	Grant	Other	Not applicable
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund			50 000 000,00	5 311 689,97	Disbursed	ODA	Grant	Other	Not applicable
5. Green Climate Fund			1 000 000 000,00	106 233 799,35	Disbursed	ODA	Grant	Other	Not applicable
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds			28 417 971,58	3 018 949,09					
SCF – Strategic Climate Fund									
GGGI – Global Green Growth Institute			9 865 472,70	1 048 046,65	Disbursed	ODA	Grant	Other	Not applicable
Multilateral Fund for the Implementation of the Montreal Protocol			18 552 498,88	1 970 902,44	Disbursed	ODA	Grant	Other	Not applicable

Donor funding	Total amount				Status	Funding source	Financial instrument	Type of support	Sector
	Core/general		Climate-specific						
	Norwegian krone – NOK	USD	Norwegian krone – NOK	USD					
Multilateral financial institutions, including regional development banks			796 646 055,62	84 630 737,22					
1. World Bank			450 968 810,60	47 908 130,14	Disbursed	ODA	Grant	Other	Not applicable
2. International Finance Corporation			19 090 560,00	2 028 062,72	Disbursed	ODA	Grant	Other	Not applicable
3. African Development Bank			31 614 682,33	3 358 547,82	Disbursed	ODA	Grant	Other	Not applicable
4. Asian Development Bank									
5. European Bank for Reconstruction and Development									
6. Inter-American Development Bank									
7. Other			294 972 002,69	31 335 996,55					
AFDF – African Development Fund			254 741 196,10	27 062 125,11	Disbursed	ODA	Grant	Other	Not applicable
AIIB – Asian Infrastructure Investment Bank			35 337 840,66	3 754 073,07	Disbursed	ODA	Grant	Other	Not applicable
IDB Invest			4 892 965,93	519 798,36	Disbursed	ODA	Grant	Other	Not applicable
Specialised United Nations bodies			55 280 239,46	5 872 629,87					
1. United Nations Development Program									
2. United Nations Environment Program									
3. Other			55 280 239,46	5 872 629,87					
IFAD – International Fund for Agricultural Development			43 714 800,00	4 643 989,29	Disbursed	ODA	Grant	Other	Not applicable
FAO – Food and Agriculture Organization									
UNFCCC – United Nations Framework Convention on Climate Change			11 065 439,46	1 175 523,68	Disbursed	ODA	Grant	Other	Not applicable
IPCC – Intergovernmental Panel on Climate Change			500 000,00	53 116,90	Disbursed	ODA	Grant	Other	Not applicable

6.4 Earmarked contributions

Table A3-22 and A3-23 provide a summary of public earmarked climate finance, in total USD 582 million in (NOK 5 122 million) 2019 and USD 489 million (NOK 4 607 million) in 2020. The methodology section 6.2.1 describes the methodology and figures included in the tables.

Table A3-22 (CTF table 7(b)). Provision of public financial support: contribution through bilateral, regional and other channels in 2019.

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Total	5 122 095 911,92	582 148 968,24					
Angola	3 323 250,00	377 702,13	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.02 NOK mill.); 151 – Government and civil society, general (0.64 NOK mill.); 430 – Other multisector (1.66 NOK mill.)
Angola	644 007,60	73 194,33	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Burundi	2 402 753,96	273 083,67	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (2.3 NOK mill.); 321 – Industry (0.11 NOK mill.)
Burundi	1 604 999,97	182 415,38	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Cameroon	1 123 333,20	127 671,81	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Cameroon	566 024,67	64 331,22	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.12 NOK mill.); 410 – General environmental protection (0.45 NOK mill.)
Congo, Dem. Rep.	3 895 331,00	442 721,68	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (1.03 NOK mill.); 311 – Agriculture (0.6 NOK mill.); 430 – Other multisector (2.26 NOK mill.)
Congo, Dem. Rep.	27 347 681,66	3 108 185,58	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (3.68 NOK mill.); 312 – Forestry (5.14 NOK mill.); 410 – General environmental protection (18.53 NOK mill.)
Congo, Dem. Rep.	885 046,00	100 589,41	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Congo, Rep.	840 000,00	95 469,73	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Egypt	22 901 628,00	2 602 871,82	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Ethiopia	99 866 038,64	11 350 219,20	Disbursed	ODA	Grants	Adaptation	112 – Basic education (0.77 NOK mill.); 114 – Post-secondary education (0.29 NOK mill.); 140 – Water and sanitation (3.66 NOK mill.); 151 – Government and civil society, general (0.12 NOK mill.); 240 – Banking and financial services (3.59 NOK mill.); 311 – Agriculture (6.77 NOK mill.); 410 – General environmental protection (0.25 NOK mill.); 430 – Other multisector (84.41 NOK mill.)
Ethiopia	215 386 654,60	24 479 650,69	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (0.02 NOK mill.); 410 – General environmental protection (215.37 NOK mill.)
Ethiopia	51 583 911,94	5 862 740,88	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (4.17 NOK mill.); 410 – General environmental protection (31.97 NOK mill.); 430 – Other multisector (15.44 NOK mill.)
Gabon	763 333,20	86 756,21	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ghana	2 455 706,40	279 101,95	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (0.32 NOK mill.); 410 – General environmental protection (2.14 NOK mill.)

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Ghana	114 279,60	12 988,38	Disbursed	ODA	Grants	Cross-cutting	321 – Industry
Kenya	6 691 861,20	760 559,77	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.01 NOK mill.); 313 – Fishing (3.59 NOK mill.); 410 – General environmental protection (3.09 NOK mill.)
Kenya	92 950 289,60	10 564 213,58	Disbursed	ODA (2.85 NOK mill.); OOF (90.1 NOK mill.)	Grants (2.85 NOK mill.); PSI (90.1 NOK mill.)	Mitigation	140 – Water and sanitation (0.22 NOK mill.); 232 – Energy generation, renewable sources (90.1 NOK mill.); 321 – Industry (2.62 NOK mill.)
Kenya	3 008 841,52	341 968,21	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Liberia	468 552,42	53 253,07	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified
Liberia	12 666 720,11	1 439 629,04	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.44 NOK mill.); 410 – General environmental protection (12.23 NOK mill.)
Madagascar	637 825,20	72 491,67	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.03 NOK mill.); 313 – Fishing (0.61 NOK mill.)
Madagascar	222 374,00	25 273,79	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation
Madagascar	6 070 177,03	689 902,60	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (0.41 NOK mill.); 410 – General environmental protection (5.66 NOK mill.)
Malawi	9 468 024,15	1 076 083,03	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (0.24 NOK mill.); 311 – Agriculture (4.5 NOK mill.); 430 – Other multisector (4.73 NOK mill.)
Malawi	3 035 660,00	345 016,25	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (1.12 NOK mill.); 311 – Agriculture (1.92 NOK mill.)
Malawi	16 475 274,85	1 872 488,22	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Mali	30 148 187,26	3 426 475,49	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (1.42 NOK mill.); 311 – Agriculture (26.59 NOK mill.); 410 – General environmental protection (2.14 NOK mill.)
Mali	684 478,80	77 794,06	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Mali	30 000 000,00	3 409 633,35	Disbursed	ODA	Grants	Cross-cutting	430 – Other multisector
Mozambique	26 817 988,78	3 047 983,63	Disbursed	ODA	Grants	Adaptation	160 – Other social infrastructure and services (19 NOK mill.); 311 – Agriculture (7.19 NOK mill.); 430 – Other multisector (0.63 NOK mill.)
Mozambique	23 186 994,60	2 635 305,00	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (22.33 NOK mill.); 321 – Industry (0.86 NOK mill.)
Mozambique	2 889 444,00	328 398,15	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Niger	35 400 000,00	4 023 367,35	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (14 NOK mill.); 430 – Other multisector (21.4 NOK mill.)
Niger	1 441 543,00	163 837,77	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nigeria	41 558 664,00	4 723 326,89	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Nigeria	22 296 502,00	2 534 096,56	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy (1.3 NOK mill.); 311 – Agriculture (21 NOK mill.)

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Somalia	13 999 980,66	1 591 160,03	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1 NOK mill.); 430 – Other multisector (9 NOK mill.); 720 – Emergency Response (4 NOK mill.)
South Africa	1 646 400,00	187 120,68	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection
South Africa	35 505 771,00	4 035 388,70	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South Sudan	2 662 916,40	302 652,29	Disbursed	ODA	Grants	Mitigation	114 – Post-secondary education
Sudan	520 000,00	59 100,31	Disbursed	ODA	Grants	Adaptation	152 – Conflict prevention and resolution, peace and security
Sudan	1 605 000,00	182 415,38	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation
Tanzania	14 028 270,93	1 594 375,35	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (2.64 NOK mill.); 311 – Agriculture (8.01 NOK mill.); 410 – General environmental protection (3.38 NOK mill.)
Tanzania	5 021 333,13	570 696,83	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (4.61 NOK mill.); 410 – General environmental protection (0.41 NOK mill.)
Tanzania	7 676 135,90	872 426,97	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (6.82 NOK mill.); 410 – General environmental protection (0.86 NOK mill.)
Togo	2 189 053,00	248 795,60	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Uganda	3 549 489,20	403 415,23	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (2.82 NOK mill.); 311 – Agriculture (0.73 NOK mill.)
Uganda	38 828 065,44	4 412 982,23	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (16 NOK mill.); 231 – Energy Policy (7.21 NOK mill.); 232 – Energy generation, renewable sources (8.36 NOK mill.); 236 – Heating, cooling and energy distribution (6.85 NOK mill.); 311 – Agriculture (0.18 NOK mill.); 410 – General environmental protection (0.23 NOK mill.)
Uganda	8 287 062,16	941 861,45	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (4.86 NOK mill.); 311 – Agriculture (2.53 NOK mill.); 410 – General environmental protection (0.9 NOK mill.)
Zambia	511 584,60	58 143,86	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.26 NOK mill.); 410 – General environmental protection (0.25 NOK mill.)
Zambia	3 478 241,60	395 317,62	Disbursed	ODA (0.24 NOK mill.); OOF (3.24 NOK mill.)	Grants (0.24 NOK mill.); PSI (3.24 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (0.24 NOK mill.); 232 – Energy generation, renewable sources (3.24 NOK mill.)
Zambia	1 163 648,00	132 253,77	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Zimbabwe	683 072,40	77 634,21	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Bolivia	895 084,12	101 730,29	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.63 NOK mill.); 410 – General environmental protection (0.26 NOK mill.)

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Brazil	74 120 425,44	8 424 115,82	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation (0.28 NOK mill.); 151 – Government and civil society, general (7.23 NOK mill.); 410 – General environmental protection (66.61 NOK mill.)
Brazil	1 058 193,24	120 268,36	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Colombia	226 026,00	25 688,86	Disbursed	ODA	Grants	Adaptation	313 – Fishing (0.08 NOK mill.); 410 – General environmental protection (0.1 NOK mill.); 430 – Other multisector (0.05 NOK mill.)
Colombia	221 382 797,83	25 161 139,02	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Colombia	6 836 964,75	777 051,43	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (1.55 NOK mill.); 410 – General environmental protection (5.29 NOK mill.)
Ecuador	113 428 711,00	12 891 677,20	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ecuador	35 000,00	3 977,91	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general
Guatemala	6 999 999,76	795 581,09	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Guyana	415 164 974,66	47 185 344,79	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Haiti	1 006 010,00	114 337,51	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation
Honduras	133 155 449,00	15 133 708,66	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Jamaica	19 200,00	2 182,17	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nicaragua	1 018 432,00	115 749,32	Disbursed	ODA	Grants	Adaptation	113 – Secondary education
Panama	1 451 296,00	164 946,24	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Paraguay	232 000,00	26 367,83	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
Peru	55 271 189,56	6 281 816,38	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (6.33 NOK mill.); 410 – General environmental protection (48.94 NOK mill.)
Peru	9 000 000,00	1 022 890,01	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Afghanistan	1 711 999,97	194 576,41	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation
Afghanistan	2 637 643,65	299 779,93	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Bangladesh	189 104,80	21 492,60	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.18 NOK mill.); 311 – Agriculture (0.01 NOK mill.)
Bangladesh	211 201,20	24 003,95	Disbursed	ODA	Grants	Mitigation	122 – Basic health (0.15 NOK mill.); 311 – Agriculture (0.06 NOK mill.)
Bangladesh	96 774,40	10 998,84	Disbursed	ODA	Grants	Cross-cutting	112 – Basic education
Cambodia	761 209,64	86 514,86	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (0.05 NOK mill.); 311 – Agriculture (0.64 NOK mill.); 430 – Other multisector (0.07 NOK mill.)
Cambodia	801 905,02	91 140,07	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (0.08 NOK mill.); 152 – Conflict prevention and resolution, peace and security (0.08 NOK mill.); 311 – Agriculture (0.46 NOK mill.); 410 – General environmental protection (0.19 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instrument	Type of support	Sector
China	1 923 142,80	218 573,73	Disbursed	ODA	Grants	Adaptation	313 – Fishing (0.81 NOK mill.); 410 – General environmental protection (1.11 NOK mill.)
China	29 015 582,88	3 297 749,97	Disbursed	ODA	Grants	Mitigation	160 – Other social infrastru-cture and services (0.92 NOK mill.); 231 – Energy Policy (0.2 NOK mill.); 250 – Business and other services (0.61 NOK mill.); 410 – General environ-mental protection (15.26 NOK mill.); 430 – Other multisector (12.02 NOK mill.)
China	2 062 960,00	234 464,57	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Georgia	12 853 134,96	1 460 815,92	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (11 NOK mill.); 232 – Energy genera-tion, renewable sources (1.85 NOK mill.)
India	6 216 895,45	706 577,80	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.15 NOK mill.); 311 – Agriculture (0.08 NOK mill.); 410 – General environmental protection (5.8 NOK mill.); 430 – Other multisector (0.18 NOK mill.)
India	9 544 715,40	1 084 799,33	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
India	31 033 821,06	3 527 131,71	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.31 NOK mill.); 321 – Industry (0.71 NOK mill.); 410 – General environmental protection (1.02 NOK mill.); 430 – Other multisector (29 NOK mill.)
Indonesia	335 002 954,75	38 074 574,90	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (7.42 NOK mill.); 232 – Energy genera-tion, renewable sources (0.68 NOK mill.); 410 – General environmental protection (326.91 NOK mill.)
Indonesia	7 546 472,80	857 690,18	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Laos	943 402,00	107 221,83	Disbursed	ODA (0.11 NOK mill.); OOF (0.83 NOK mill.)	Grants (0.11 NOK mill.); PSI (0.83 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (0.83 NOK mill.); 410 – General environ-mental protection (0.11 NOK mill.)
Malaysia	110 000,00	12 501,99	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Myanmar	104 879,00	11 919,96	Disbursed	ODA	Grants	Adaptation	232 – Energy generation, renewable sources
Myanmar	31 809 918,86	3 615 338,67	Disbursed	ODA (20.58 NOK mill.); OOF (11.23 NOK mill.)	Grants (20.58 NOK mill.); PSI (11.23 NOK mill.)	Mitigation	151 – Government and civil society, general (0.71 NOK mill.); 231 – Energy Policy (6.01 NOK mill.); 232 – Energy generation, renewable sources (11.23 NOK mill.); 410 – General environmental protection (13.86 NOK mill.)
Nepal	9 841 855,29	1 118 570,60	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary educa-tion (0.74 NOK mill.); 151 – Government and civil society, general (1.67 NOK mill.); 311 – Agriculture (0.82 NOK mill.); 430 – Other multisector (6.61 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instrument	Type of support	Sector
Nepal	28 335 883,20	3 220 499,08	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (7.2 NOK mill.); 232 – Energy generation, renewable sources (0.86 NOK mill.); 236 – Heating, cooling and energy distribution (20.28 NOK mill.)
Pakistan	1 230 499,98	139 851,79	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation
Sri Lanka	1 009 082,80	114 686,75	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (0.25 NOK mill.); 313 – Fishing (0.06 NOK mill.); 430 – Other multisector (0.7 NOK mill.)
Sri Lanka	1 978 917,28	224 912,75	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (1.18 NOK mill.); 232 – Energy generation, renewable sources (0.8 NOK mill.)
Thailand	106 666,80	12 123,16	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Viet Nam	5 436 058,44	617 832,21	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (0.58 NOK mill.); 114 – Post-secondary education (2.25 NOK mill.); 410 – General environmental protection (2.6 NOK mill.)
Viet Nam	4 902 401,39	557 179,71	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.68 NOK mill.); 240 – Banking and financial services (0.27 NOK mill.); 311 – Agriculture (0.8 NOK mill.); 410 – General environmental protection (3.16 NOK mill.)
Global Unspecified	110 454 989,25	12 553 700,50	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.6 NOK mill.); 311 – Agriculture (15.2 NOK mill.); 313 – Fishing (12.54 NOK mill.); 410 – General environmental protection (20.4 NOK mill.); 430 – Other multisector (60.2 NOK mill.); 740 – Disaster prevention and preparedness (0.51 NOK mill.)
Global Unspecified	1 547 763 469,24	175 910 198,13	Disbursed	ODA (1340.66 NOK mill.); OOF (207.1 NOK mill.)	Grants (1340.66 NOK mill.); PSI (207.1 NOK mill.)	Mitigation	140 – Water and sanitation (0.11 NOK mill.); 151 – Government and civil society, general (27.64 NOK mill.); 231 – Energy Policy (272.76 NOK mill.); 231 – Energy Policy (37.93 NOK mill.); 232 – Energy generation, renewable sources (70.75 NOK mill.); 232 – Energy generation, renewable sources (169.17 NOK mill.); 321 – Industry (0.56 NOK mill.); 322 – Mineral resources/ mining (0.01 NOK mill.); 410 – General environmental protection (964.63 NOK mill.); 430 – Other multisector (1.6 NOK mill.); 998 – Unallocated/ unspecified (2.6 NOK mill.)
Global Unspecified	219 031 531,87	24 893 907,20	Disbursed	ODA	Grants	Cross-cutting	112 – Basic education (0.56 NOK mill.); 151 – Government and civil society, general (2.89 NOK mill.); 312 – Forestry (0.58 NOK mill.); 410 – General environmental protection (214.79 NOK mill.); 720 – Emergency Response (0.21 NOK mill.)

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Papua New Guinea	9 608 000,00	1 091 991,91	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (4.38 NOK mill.); 410 – General environmental protection (5.22 NOK mill.)
Jordan	1 449 000,00	164 685,29	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Lebanon	1 520 000,00	172 754,76	Disbursed	ODA	Grants	Mitigation	313 – Fishing
Palestine	8 000 000,00	909 235,56	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Africa Regional	26 150 000,00	2 972 063,74	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (1.55 NOK mill.); 430 – Other multisector (24.6 NOK mill.)
Africa Regional	64 505 319,00	7 331 316,23	Disbursed	ODA (62 NOK mill.); OOF (2.51 NOK mill.)	Grants (62 NOK mill.); PSI (2.51 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (62 NOK mill.); 232 – Energy generation, renewable sources (2.51 NOK mill.)
Eastern Africa, regional	1 488 000,00	169 117,81	Disbursed	ODA	Grants	Adaptation	311 – Agriculture
Eastern Africa, regional	44 000 000,00	5 000 795,58	Disbursed	ODA	Grants	Mitigation	236 – Heating, cooling and energy distribution
Middle Africa regional	400 000 000,00	45 461 778,01	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
South of Sahara Regional	12 628 595,76	1 435 296,04	Disbursed	ODA	Grants	Adaptation	430 – Other multisector (4.63 NOK mill.); 740 – Disaster prevention and preparedness (8 NOK mill.)
South of Sahara Regional	45 447 776,00	5 165 341,76	Disbursed	ODA (0.55 NOK mill.); OOF (44.9 NOK mill.)	Grants (0.55 NOK mill.); PSI (44.9 NOK mill.)	Mitigation	231 – Energy Policy (10.92 NOK mill.); 232 – Energy generation, renewable sources (0.55 NOK mill.); 232 – Energy generation, renewable sources (31.49 NOK mill.); 250 – Business and other services (2.49 NOK mill.)
South of Sahara Regional	1 743 269,06	198 130,28	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Western Africa regional	7 416 667,00	842 937,17	Disbursed	ODA	Grants	Mitigation	311 – Agriculture (7 NOK mill.); 410 – General environmental protection (0.42 NOK mill.)
America Regional	1 690 576,00	192 141,48	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
America Regional	110 000,00	12 501,99	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Caribbean & Central America, regional	10 000 000,00	1 136 544,45	Disbursed	ODA	Grants	Adaptation	740 – Disaster prevention and preparedness
Caribbean & Central America, regional	3 662 802,00	416 293,73	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South America Regional	15 559 527,70	1 768 409,49	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Asia Regional	11 366 640,00	1 291 869,16	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Asia Regional	40 777 015,00	4 634 489,01	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (0.81 NOK mill.); 232 – Energy generation, renewable sources (30 NOK mill.); 410 – General environmental protection (9.96 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific		Status	Funding source	Financial instrument	Type of support	Sector
	Norwegian krone	USD					
Asia Regional	10 136 941,27	1 152 108,43	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Central Asia Regional	3 800 000,00	431 886,89	Disbursed	ODA	Grants	Cross-cutting	160 – Other social infrastructure and services
Far East Asia Regional	5 310 395,84	603 550,09	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
South Asia Regional	532 406,40	60 510,35	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Europe Regional	1 042 746,00	118 512,72	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
Oceania Regional	5 000 000,00	568 272,23	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy

Table A3-23 **(CTF table 7(b)). Provision of public financial support: contribution through bilateral, regional and other channels in 2020.**

Recipient country/ region	Total amount (NOK) Climate-specific		Status	Funding source	Financial instrument	Type of support	Sector
	Norwegian krone	USD					
Total	4 607 094 050,04	489 429 104,88					
Angola	4 012 500,00	426 263,12	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection
Angola	132 252,80	14 049,72	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Cameroon	594 921,25	63 200,74	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Cameroon	522 118,48	55 466,63	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.11 NOK mill.); 410 – General environmental protection (0.41 NOK mill.)
Congo, Dem. Rep.	7 524 946,52	799 403,66	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.71 NOK mill.); 140 – Water and sanitation (4 NOK mill.); 311 – Agriculture (0.54 NOK mill.); 430 – Other multisector (2.28 NOK mill.)
Congo, Dem. Rep.	22 098 786,44	2 347 638,04	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (2.88 NOK mill.); 312 – Forestry (4.86 NOK mill.); 410 – General environmental protection (14.36 NOK mill.)
Congo, Dem. Rep.	938 969,49	99 750,30	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Congo, Rep.	1 055 998,76	112 182,76	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Egypt	924 151,00	98 176,07	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Ethiopia	116 293 217,94	12 354 270,38	Disbursed	ODA	Grants	Adaptation	112 – Basic education (1.64 NOK mill.); 114 – Post-secondary education (0.81 NOK mill.); 140 – Water and sanitation (0.18 NOK mill.); 151 – Government and civil society, general (0.11 NOK mill.); 240 – Banking and financial services (3.56 NOK mill.); 311 – Agriculture (10.73 NOK mill.); 410 – General environmental protection (0.22 NOK mill.); 430 – Other multisector (99.06 NOK mill.)
Ethiopia	171 412 563,00	18 209 807,82	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Ethiopia	51 854 953,73	5 508 748,75	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (3 NOK mill.); 410 – General environmental protection (37.61 NOK mill.); 430 – Other multisector (11.24 NOK mill.)
Gabon	659 895,12	70 103,17	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ghana	1 265 909,60	134 482,39	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Ghana	354 252,00	37 633,54	Disbursed	ODA	Grants	Cross-cutting	321 – Industry
Kenya	4 130 817,73	438 832,46	Disbursed	ODA	Grants	Adaptation	313 – Fishing (1.04 NOK mill.); 410 – General environmental protection (3.09 NOK mill.)
Kenya	54 341 441,60	5 772 897,80	Disbursed	ODA (0.89 NOK mill.); OOF (53.46 NOK mill.)	Grants (0.89 NOK mill.); PSI (53.46 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (53.46 NOK mill.); 321 – Industry (0.89 NOK mill.)
Kenya	3 056 352,16	324 687,90	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (2.73 NOK mill.); 410 – General environmental protection (0.33 NOK mill.)
Liberia	115 091 257,78	12 226 581,59	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.56 NOK mill.); 410 – General environmental protection (114.53 NOK mill.)
Madagascar	1 462 863,60	155 405,56	Disbursed	ODA	Grants	Adaptation	313 – Fishing
Madagascar	5 840 517,20	620 460,33	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture (0.31 NOK mill.); 410 – General environmental protection (5.53 NOK mill.)
Malawi	31 609 693,61	3 358 017,85	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (18.9 NOK mill.); 430 – Other multisector (12.71 NOK mill.)
Malawi	4 175 032,00	443 529,51	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (0.58 NOK mill.); 311 – Agriculture (3.6 NOK mill.)
Mali	28 592 845,02	3 037 526,56	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (26.07 NOK mill.); 410 – General environmental protection (2.52 NOK mill.)
Mali	939 273,60	99 782,60	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Mali	7 312 317,00	776 815,22	Disbursed	ODA	Grants	Cross-cutting	430 – Other multisector
Mozambique	28 405 434,01	3 017 617,18	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (3.87 NOK mill.); 311 – Agriculture (13.91 NOK mill.); 430 – Other multisector (10.62 NOK mill.)
Mozambique	3 236 923,60	343 870,69	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (1.91 NOK mill.); 321 – Industry (1.1 NOK mill.); 410 – General environmental protection (0.23 NOK mill.)
Mozambique	2 940 511,54	312 381,71	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Niger	42 934 792,80	4 561 126,16	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (5.93 NOK mill.); 311 – Agriculture (14 NOK mill.); 430 – Other multisector (23 NOK mill.)
Niger	1 365 474,42	145 059,54	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instrument	Type of support	Sector
Nigeria	8 837 850,00	938 878,38	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Nigeria	22 279 374,80	2 366 822,63	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy (1.28 NOK mill.); 311 – Agriculture (21 NOK mill.)
Somalia	11 266 597,93	1 196 893,50	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (2.6 NOK mill.); 430 – Other multisector (8.66 NOK mill.)
South Africa	612 280,00	65 044,83	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection
South Africa	18 491 132,00	1 964 383,21	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South Sudan	12 000 000,00	1 274 805,59	Disbursed	ODA	Grants	Adaptation	311 – Agriculture
South Sudan	320 875,60	34 087,83	Disbursed	ODA	Grants	Mitigation	114 – Post-secondary education
Tanzania	11 781 647,80	1 251 609,21	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.36 NOK mill.); 311 – Agriculture (9.42 NOK mill.); 410 – General environmental protection (2 NOK mill.)
Tanzania	1 647 408,28	175 010,44	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Tanzania	9 400 150,14	998 613,66	Disbursed	ODA	Grants	Cross-cutting	240 – Banking and financial services (0.07 NOK mill.); 311 – Agriculture (3.97 NOK mill.); 312 – Forestry (0.31 NOK mill.); 410 – General environmental protection (5.05 NOK mill.)
Togo	2 155 113,66	228 945,91	Disbursed	ODA	Grants	Cross-cutting	231 – Energy Policy
Uganda	9 354 787,40	993 794,61	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.63 NOK mill.); 151 – Government and civil society, general (8 NOK mill.); 311 – Agriculture (0.72 NOK mill.)
Uganda	12 249 533,20	1 301 314,45	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (7.21 NOK mill.); 232 – Energy generation, renewable sources (4.02 NOK mill.); 236 – Heating, cooling and energy distribution (0.74 NOK mill.); 410 – General environmental protection (0.27 NOK mill.)
Uganda	9 182 444,03	975 485,92	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education (5.19 NOK mill.); 311 – Agriculture (2.83 NOK mill.); 410 – General environmental protection (1.16 NOK mill.)
Zambia	818 880,00	86 992,73	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.62 NOK mill.); 410 – General environmental protection (0.2 NOK mill.)
Zambia	635 604,00	67 522,63	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Zambia	989 577,48	105 126,57	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Zimbabwe	194 580,00	20 670,97	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Bolivia	590 868,44	62 770,20	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.42 NOK mill.); 410 – General environmental protection (0.17 NOK mill.)
Brazil	104 841 571,26	11 137 718,44	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation (0.21 NOK mill.); 151 – Government and civil society, general (21.94 NOK mill.); 410 – General environmental protection (82.69 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instrument	Type of support	Sector
Brazil	685 861,45	72 861,67	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Colombia	213 748,73	22 707,34	Disbursed	ODA	Grants	Adaptation	313 – Fishing (0.07 NOK mill.); 410 – General environmental protection (0.09 NOK mill.); 430 – Other multisector (0.05 NOK mill.)
Colombia	90 345 097,15	9 597 702,92	Disbursed	ODA	Grants	Mitigation	312 – Forestry (4.68 NOK mill.); 410 – General environmental protection (85.67 NOK mill.)
Colombia	29 601 007,20	3 144 627,46	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (1.6 NOK mill.); 410 – General environmental protection (28 NOK mill.)
Ecuador	1 069 974,00	113 667,40	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Guatemala	6 969 664,67	740 413,96	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Guyana	22 566 046,12	2 397 276,82	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Haiti	10 496 950,80	1 115 130,97	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.5 NOK mill.); 430 – Other multisector (9 NOK mill.)
Haiti	7 120 000,00	756 384,65	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (1.52 NOK mill.); 410 – General environmental protection (5.6 NOK mill.)
Nicaragua	1 009 025,60	107 192,62	Disbursed	ODA	Grants	Adaptation	113 – Secondary education
Panama	1 451 296,00	154 176,69	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
Peru	57 502 055,06	6 108 661,78	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (10.08 NOK mill.); 410 – General environmental protection (47.42 NOK mill.)
Peru	12 481 892,40	1 325 998,85	Disbursed	ODA	Grants	Cross-cutting	312 – Forestry
Afghanistan	12 972 262,80	1 378 092,76	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (10.37 NOK mill.); 152 – Conflict prevention and resolution, peace and security (2.6 NOK mill.)
Afghanistan	594 309,60	63 135,77	Disbursed	ODA	Grants	Mitigation	311 – Agriculture
Afghanistan	3 763 838,00	399 846,81	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Armenia	2 000 000,00	212 467,60	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Azerbaijan	2 000 000,00	212 467,60	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Bangladesh	6 014 991,20	638 995,37	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
Cambodia	444 281,06	47 197,66	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (0.06 NOK mill.); 311 – Agriculture (0.39 NOK mill.)
Cambodia	821 705,73	87 292,92	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (0.08 NOK mill.); 152 – Conflict prevention and resolution, peace and security (0.08 NOK mill.); 311 – Agriculture (0.46 NOK mill.); 410 – General environmental protection (0.2 NOK mill.)
China	955 939,20	101 553,05	Disbursed	ODA	Grants	Adaptation	313 – Fishing

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
China	39 348 277,62	4 180 117,03	Disbursed	ODA	Grants	Mitigation	160 – Other social infrastructure and services (0.81 NOK mill.); 231 – Energy Policy (1.12 NOK mill.); 410 – General environmental protection (25.69 NOK mill.); 430 – Other multisector (11.72 NOK mill.)
China	1 598 578,00	169 823,01	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Georgia	2 289 325,22	243 203,72	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources
India	6 860 178,80	728 782,86	Disbursed	ODA	Grants	Adaptation	410 – General environmental protection (6.67 NOK mill.); 430 – Other multisector (0.19 NOK mill.)
India	3 641 996,40	386 903,11	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
India	8 804 290,97	935 313,28	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (0.24 NOK mill.); 321 – Industry (0.55 NOK mill.); 410 – General environmental protection (0.79 NOK mill.); 430 – Other multisector (7.22 NOK mill.)
Indonesia	127 825,74	13 579,41	Disbursed	ODA	Grants	Adaptation	430 – Other multisector
Indonesia	450 872 175,10	47 897 864,18	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (9.54 NOK mill.); 232 – Energy generation, renewable sources (0.38 NOK mill.); 410 – General environmental protection (440.94 NOK mill.)
Indonesia	26 088 742,40	2 771 506,23	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Laos	1 953 993,00	207 580,10	Disbursed	ODA (0.72 NOK mill.); OOF (1.23 NOK mill.)	Grants (0.72 NOK mill.); PSI (1.23 NOK mill.)	Mitigation	232 – Energy generation, renewable sources (1.23 NOK mill.); 410 – General environmental protection (0.72 NOK mill.)
Malaysia	594 921,25	63 200,74	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Myanmar	47 965 734,89	5 095 582,26	Disbursed	ODA (24.6 NOK mill.); OOF (23.36 NOK mill.)	Grants (24.6 NOK mill.); PSI (23.36 NOK mill.)	Mitigation	151 – Government and civil society, general (1.5 NOK mill.); 231 – Energy Policy (5.48 NOK mill.); 232 – Energy generation, renewable sources (23.36 NOK mill.); 410 – General environmental protection (17.63 NOK mill.)
Myanmar	5 822 923,00	618 591,23	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Nepal	9 273 549,03	985 164,35	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education (0.31 NOK mill.); 151 – Government and civil society, general (1.67 NOK mill.); 311 – Agriculture (0.71 NOK mill.); 430 – Other multisector (6.58 NOK mill.)
Nepal	27 494 755,60	2 920 872,35	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (1.23 NOK mill.); 236 – Heating, cooling and energy distribution (26.26 NOK mill.)
Pakistan	3 719 503,40	395 136,98	Disbursed	ODA	Grants	Adaptation	140 – Water and sanitation (1.68 NOK mill.); 152 – Conflict prevention and resolution, peace and security (1.61 NOK mill.); 430 – Other multisector (0.43 NOK mill.)

Recipient country/ region	Total amount (NOK) Climate-specific Norwegian krone	USD	Status	Funding source	Financial instrument	Type of support	Sector
Pakistan	74 219,20	7 884,59	Disbursed	ODA	Grants	Cross-cutting	140 – Water and sanitation
Sri Lanka	930 389,59	98 838,82	Disbursed	ODA	Grants	Adaptation	151 – Government and civil society, general (0.28 NOK mill.); 313 – Fishing (0.45 NOK mill.); 430 – Other multisector (0.2 NOK mill.)
Sri Lanka	1 101 306,23	116 995,95	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Tajikistan	7 621 038,40	809 611,86	Disbursed	ODA	Grants	Mitigation	236 – Heating, cooling and energy distribution
Thailand	366 599,49	38 945,26	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Viet Nam	369 765,00	39 281,54	Disbursed	ODA	Grants	Adaptation	114 – Post-secondary education
Viet Nam	6 308 937,21	670 222,37	Disbursed	ODA	Grants	Mitigation	232 – Energy generation, renewable sources (3.42 NOK mill.); 240 – Banking and financial services (0.22 NOK mill.); 311 – Agriculture (0.57 NOK mill.); 410 – General environmental protection (2.1 NOK mill.)
Global Unspecified	208 606 392,40	22 161 049,63	Disbursed	ODA	Grants	Adaptation	121 – Health, general (13.6 NOK mill.); 151 – Government and civil society, general (0.7 NOK mill.); 311 – Agriculture (32 NOK mill.); 313 – Fishing (8.03 NOK mill.); 410 – General environmental protection (19.75 NOK mill.); 430 – Other multisector (128.94 NOK mill.); 720 – Emergency Response (0.1 NOK mill.); 740 – Disaster prevention and preparedness (5.5 NOK mill.)
Global Unspecified	1 427 373 251,12	151 635 283,55	Disbursed	ODA (1180.52 NOK mill.); OOF (246.85 NOK mill.)	Grants (1180.52 NOK mill.); PSI (246.85 NOK mill.)	Mitigation	151 – Government and civil society, general (36.08 NOK mill.); 231 – Energy Policy (172.08 NOK mill.); 231 – Energy Policy (40.61 NOK mill.); 232 – Energy generation, renewable sources (40 NOK mill.); 232 – Energy generation, renewable sources (206.24 NOK mill.); 321 – Industry (0.56 NOK mill.); 322 – Mineral resources/ mining (1.16 NOK mill.); 410 – General environmental protection (925.65 NOK mill.); 720 – Emergency Response (2.4 NOK mill.); 998 – Unallocated/ unspecified (2.6 NOK mill.)
Global Unspecified	246 110 222,10	26 145 223,95	Disbursed	ODA	Grants	Cross-cutting	151 – Government and civil society, general (2.78 NOK mill.); 250 – Business and other services (0.2 NOK mill.); 410 – General environmental protection (200.94 NOK mill.); 720 – Emergency Response (42.2 NOK mill.)
Papua New Guinea	8 538 201,59	907 045,59	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general (3.86 NOK mill.); 410 – General environmental protection (4.68 NOK mill.)
Jordan	2 000 000,00	212 467,60	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Lebanon	1 280 000,00	135 979,26	Disbursed	ODA	Grants	Mitigation	313 – Fishing

Recipient country/ region	Total amount (NOK) Climate-specific		Status	Funding source	Financial instrument	Type of support	Sector
	Norwegian krone	USD					
Africa Regional	27 454 427,60	2 916 588,15	Disbursed	ODA	Grants	Adaptation	111 – Education, level unspecified (4.93 NOK mill.); 430 – Other multisector (22.52 NOK mill.)
Africa Regional	131 405 958,00	13 959 754,17	Disbursed	ODA (40 NOK mill.); OOF (91.41 NOK mill.)	Grants (40 NOK mill.); PSI (91.41 NOK mill.)	Mitigation	231 – Energy Policy (10.69 NOK mill.); 232 – Energy generation, renewable sources (40 NOK mill.); 232 – Energy generation, renewable sources (80.71 NOK mill.)
Africa Regional	120 466,05	12 797,57	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Eastern Africa, regional	4 720 069,20	501 430,88	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.03 NOK mill.); 311 – Agriculture (4.69 NOK mill.)
Eastern Africa, regional	25 910 716,40	2 752 593,85	Disbursed	ODA	Grants	Mitigation	140 – Water and sanitation (0.91 NOK mill.); 236 – Heating, cooling and energy distribution (25 NOK mill.)
Middle Africa regional	400 000 000,00	42 493 519,74	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
South of Sahara Regional	12 980 917,00	1 379 012,13	Disbursed	ODA	Grants	Adaptation	430 – Other multisector (3.78 NOK mill.); 720 – Emergency Response (3.2 NOK mill.); 740 – Disaster prevention and preparedness (6 NOK mill.)
South of Sahara Regional	50 418 973,00	5 356 199,06	Disbursed	OOF	PSI	Mitigation	231 – Energy Policy (7.59 NOK mill.); 232 – Energy generation, renewable sources (42.83 NOK mill.)
South of Sahara Regional	1 158 560,50	123 078,28	Disbursed	ODA	Grants	Cross-cutting	311 – Agriculture
Western Africa regional	8 352 806,56	887 350,38	Disbursed	ODA	Grants	Mitigation	311 – Agriculture (8.31 NOK mill.); 410 – General environmental protection (0.05 NOK mill.)
America Regional	1 573 691,00	167 179,17	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Caribbean & Central America, regional	2 651 818,00	281 712,70	Disbursed	OOF	PSI	Mitigation	232 – Energy generation, renewable sources
South America Regional	6 552 536,94	696 100,89	Disbursed	ODA	Grants	Mitigation	410 – General environmental protection
Asia Regional	6 015 373,00	639 035,93	Disbursed	ODA	Grants	Adaptation	311 – Agriculture (0.02 NOK mill.); 313 – Fishing (4 NOK mill.); 430 – Other multisector (2 NOK mill.)
Asia Regional	50 229 232,00	5 336 042,15	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy (2.04 NOK mill.); 232 – Energy generation, renewable sources (2 NOK mill.); 410 – General environmental protection (46.19 NOK mill.)
Asia Regional	10 124 170,40	1 075 529,09	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection
Far East Asia Regional	5 801 329,00	616 297,22	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
South & Central Asia Regional	81 401 370,00	8 647 576,81	Disbursed	OOF	PSI	Mitigation	231 – Energy Policy
South Asia Regional	566 416,00	60 172,52	Disbursed	ODA	Grants	Adaptation	250 – Business and other services (0.43 NOK mill.); 311 – Agriculture (0.14 NOK mill.)
South Asia Regional	193 149,67	20 519,02	Disbursed	ODA	Grants	Cross-cutting	410 – General environmental protection

Recipient country/ region	Total amount (NOK)		Status	Funding source	Financial instrument	Type of support	Sector
	Climate-specific						
	Norwegian krone	USD					
Europe Regional	513 770,40	54 579,78	Disbursed	ODA	Grants	Mitigation	151 – Government and civil society, general
Oceania Regional	5 000 000,00	531 169,00	Disbursed	ODA	Grants	Mitigation	231 – Energy Policy
Oceania Regional	3 000 000,00	318 701,40	Disbursed	ODA	Grants	Cross-cutting	114 – Post-secondary education

6.5 Norwegian contributions in main areas

6.5.1 Norway's International Climate and Forest Initiative

Norway's International Climate and Forest Initiative (NICFI) has since 2008 supported global efforts that reduce greenhouse gas emissions from deforestation and forest degradation in developing countries (REDD+). Forest and land use emissions are a necessary part of the solution of the ambitious target of the Paris Agreement of limiting the global warming to well below 2 degrees Celsius. This is also among the most cost-effective ways to mitigate climate change, and contributes to most of the sustainable development goals.

The funds through NICFI are used to pay for verified emission reductions in partner countries, to finance efforts to build up global and national REDD frameworks, to support and create incentives for deforestation free supply chains, build satellite technology to monitor global forests, and to support civil society and indigenous peoples around the world.

Norway has taken steps to support development and enhancement of endogenous capacities and technologies of developing countries. For example, Norway supported the rights of indigenous peoples and forest-dependent communities to manage tropical forests in the order of USD 100 million between 2016 and 2020. A similar suite of country programming, support to indigenous peoples' organizations, supportive civil society organizations and specialized instruments is being scaled up to USD 150 million from 2021–2025. Examples include support for indigenous communes and a training programme on territorial management based on traditional knowledge in Colombia, land titling in in Peru, payment for indigenous peoples and forest dependent communities' forest management through Ecuador's *Socio Bosque* Programme, and a long-running programme for direct support to indigenous peoples in Brazil is being scaled up to more than USD 40 million towards 2025. The programme supports territorial management by indigenous peoples, the establishment of funds managed by indigenous peoples, and support to youth and inter-generational transfer of knowledge with the aim of reactivating traditional knowledge and cultural pride.

In Africa and Asia, support is provided through CSOs to map indigenous peoples' land tenure rights through community forestry in DRC and Indonesia. Norway also support specialised instruments to engender land use reforms such as the International Forest and Land Tenure Facility, in the order of USD 18 million towards 2025. Norway also supports the full and effective participation of indigenous peoples and local communities in the proceedings of the UNFCCC, through a platform established by decision 1/CP.21 adopting the Paris Agreement. Perhaps most importantly, Norway cooperates closely with other bilateral donors and a host of philanthropic foundations to follow up on the *Forest and Tenure Pledge* from COP 26 in Glasgow, in close dialogue with the *Global Alliance of Territorial Communities*, in order to enable more direct support, establish mutual accountability and recognize the forest guardianship of indigenous peoples and local communities.

Bilateral partnerships (USD 152 million in 2019 and USD 97 million in 2020):

At the climate summit in Paris in 2015, Germany, Norway and the UK announced a partnership with Colombia, to protect Colombia's rainforest. At the climate summit in Glasgow it was extended up to 2025. In 2019 Norway paid for 1.9 mill. tons reduced CO_2e in Colombia (USD 10 million). In 2019 Norway paid Guyana USD 45,5 million for 10.9 mill. CO_2e. The disbursement was the last under the partnership agreement, as it fulfilled the Norwegian pledge of paying Guyana NOK 1.5 billion (about USD 200 million). Through the

REDD Early Movers program Norway disbursed USD 12.8 million to Ecuador in 2019, paying for 2.4 mill. CO_2e. For several of Norway's bilateral forest partnerships payments were not for results (verified emissions reductions) in 2019–2020, but program support for REDD+ phase II investments. These include Indonesia (USD 33.3 million in 2019 and USD 43.6 million in 2020), Ethiopia (USD 27.2 million in 2019 and USD 21.5 million in 2020), Peru (USD 4.2 million in 2019 and USD 3.8 million in 2020), Liberia (USD 11.2 million in 2020) and Tanzania (USD 0.7 million in 2019–2020).

Multilateral support (USD 89.4 million in 2019 and USD 90.7 million in 2020):
The Congo basin is the world's second largest rainforest. Central African Forest Initiative (CAFI) was established in 2015. In 2019 and 2020 Norway disbursed USD 45 million to CAFI each year. The UN-REDD Programme is the United Nations Collaborative Initiative on Reducing Emissions from Deforestation and forest Degradation (REDD+) in developing countries. In 2019 Norway supported UN REDD with USD 9 million and in 2020 with USD 14.5 million. The World Bank's Forest Carbon Partnership Facility (FCPF) pays for verified emission reductions through the Carbon Fund. Norway disbursed USD 27.8 million to the Carbon Fund in 2019, and thereby concluded the Norwegian contribution to the fund. Norway contributed with USD 5.1 million to the World Bank's BioCarbon Fund in 2019 and with USD 32 million to the World Bank's Green Climate fund in 2020.

Other support (USD 115 million in 2019 and USD 139 million in 2020):
Since 2009 NICFI has contributed to a technology revolution that provides completely new opportunities for monitoring the forest. Satellite pictures have improved massively, and pictures are made available more frequently. The Global Forest Watch website is developed with support from Norway, providing forest countries with free data on forests, deforestation over time, forest fires etc. It is also a key priority to support the countries' own forest monitoring systems, so that they can better manage their resources. Access to information otherwise has increased and improved the framework conditions for civil society and indigenous peoples organisations. With the support of NICFI, they can report on illegalities, thus imposing responsibility for both authorities and private actors.

NICFIs targets of reduced deforestation cannot be reached if the market pressure on the tropical forests is not reduced. NICFI supports civil society, private sector initiatives, institutions and governments in their efforts to contribute to deforestation-free production of commodities.

6.5.2 Norwegian assistance to renewable energy
Norway has been supporting renewable energy projects in developing countries for many years. The funds are primarily used to support the generation of renewable energy, access to energy, including clean cooking, building of transmission and distribution systems, establishment of power pools and strengthening of institutions and increased capacity in the energy sector.

In 2020, Norwegian support to renewable energy amounted to USD 150 million (NOK 1 409 million), of which USD 77 million (NOK 729 million) was ODA and USD 72 million (NOK 680 million) was Norfund's investments (Other official flows). Renewable energy support reported as climate financing amounted to USD 101 million (NOK 952 million). Africa received 43 per cent and Asia 22 per cent, whereas 34 per cent was distributed globally through multilateral and regional organisations and initiatives, civil society, and commercial development. Furthermore, Norfund – which serves as the commercial investment instrument of Norway's development policy – invested NOK 680 million in renewable energy in 2020. Not all these projects are climate specific.

The focus in Norway's development cooperation on renewable energy has been measures that facilitate private and commercial investments, especially in generation of renewable energy. Key areas are policy dialogue and cooperation on reform, legislation, institution-building, planning and regional cooperation. Based on the private investments in new generation, access to electricity has been supported through development support to the extension of the grid as well as support to off grid solutions and clean cooking. Norfund is the primary vehicle to support large-scale projects for generation of renewable energy.

The only way to overcome the major challenges of ensuring global access to electricity services is to accelerate investment in long-term solutions making use of the renewable energy resources available in each country. Norway aims at leveraging funds for the reduction of energy poverty. Public and donor funds are not alone able to finance the significant amounts needed to boost energy sector development; thus Norwegian assistance for clean energy uses public sources to mobilise and incentivise commercial investments that lead to increased energy access and energy efficiency. Only by including the private sector is it realistic for renewable energy to become an important tool in the fight against global climate change.

6.5.3 Norwegian assistance to climate change adaptation

In 2020, USD 67 million in earmarked support was targeting climate change adaptation only (14 per cent of total earmarked support), and USD 50 million was cross-cutting support (10 per cent of total earmarked support). When focusing on total earmarked adaptation financing[109] (without excluding cross-cutting support), earmarked adaptation support amounted to USD 96 million in 2019 and USD 107 million in 2020.

This earmarked support for adaptation includes climate smart agriculture and food security, strengthening resilience and early warning systems. In 2020, the four largest areas for our earmarked climate adaptation support was Other multisector (NOK 363 million), General environmental protection (NOK 309 million), Agriculture (NOK 182 million) and Government and civil society (NOK 24 million).

Africa received the largest share of this support, about 46 per cent of the total adaptation budget in 2020. Among countries, Ethiopia, Niger and Mali received the highest amount of funding for climate change adaptation in 2020.

A large part of Norway's support for adaptation, however, is core support to multilateral institutions, amongst others the Adaptation fund and the GCF. As specified in section 6.2.1. we do not report climate specific multilateral core support to adaption. In line with the mandate of the GCF, about half of Norway's support to the GCF, NOK 1 400 million in the period 2019–2020, will go to adaptation with a floor of 50 per cent of the adaptation allocation for particularly vulnerable countries. Support to the GEF and United Nations Environment Programme (UNEP) also includes adaptation to climate change.

While a large part of total Norwegian climate finance is allocated to REDD+ and renewable energy programmes, both of which are classified as mitigation, several REDD projects may have strong adaptation components, since forest conservation in many cases will increase climate change resilience. Further, renewable energy projects may promote climate change adaptation.

[109] There are discrepancies between total earmarked support for adaptation and the sum of adaptation (only) and cross-cutting. This is because cross-cutting activities may have different scores (principal/significant) on the two Rio markers, and therefore different coefficients are applied 100/40 when calculating the climate finance amount.

6.6 Private finance mobilised

The private sector has a critical role in achieving the scale needed to transition to low-emissions and climate-resilient economies. Tracking climate-related private finance and investment is an important element to measure progress towards climate-related objectives and goals.

Under the UNFCCC, developed countries have committed to a collective goal of mobilising USD 100 billion per year by 2020 for climate action in developing countries. These funds are to come from a mix of public and private sources. Besides tracking public climate finance, making an assessment of progress towards this commitment also requires the measurement of private finance mobilised by developed countries' public interventions.

The private finance mobilised amounted by Norfund's interventions amounted to USD 16 million in 2019 and USD 33 million in 2020.

6.7 Activities related to transfer of technology and capacity building

Many of the elements already reported in this chapter also facilitate transfer of technology and capacity building. Transfer of technology and expertise in order to promote development, availability and efficiency of clean energy constitutes an important element of Norwegian ODA and has significant environmental co-benefits that are consistent with the promotion of the UNFCCC. In addition, Norway supports a wide range of other technology transfer efforts, of which a few are described in more detail below and in table A3-24 and A3-25.

With regards to how support responds to the existing and emerging capacity-building needs identified by non-Annex I Parties, an assessment is made of the relevance of the project or programme to the recipient country and/or the priorities and plans of the cooperation partner. This is based on the official guidance for the preparation and approval of Norwegian support. If the cooperation partner is not an authority of the grant recipient country, the guidance underlines that it might be relevant to assess the project's relevance to the target group and the needs of the recipient country. This procedure is also mandatory for capacity-building support.

6.7.1 Systemic change

The digital revolution is increasing access to information and services in all areas of society and is creating new opportunities for social development and economic growth. Digital capacity building is therefore essential and has since 2016 been seen as an integral part of all Norwegian development efforts (White paper 24 (2016–2017) Common Responsibility for Common Future). Norway's policy to integrate digitalisation in development policy to meet demands in developing countries was presented in a white paper on digitalisation and development policy in 2019 (White paper 11 (2019–2020). Norway promotes the use of digital technology and new means of communication both in long-term development cooperation and in humanitarian crises, including in interventions based on capacity development and technology transfer for climate mitigation and adaptation efforts. Norway has co-founded the Digital Public Goods Alliance, which collects, certifies and makes available digital solutions to support the SDGs. The Digital Public Good Registry now has 30 different open technologies with SDG 13 as their primary target SDG in various stages of certification and implementation.

6.7.2 The private sector

The private sector is a driver of development, innovation and deployment of technology. A well-functioning business sector is decisive for job creation and green growth and has been one of five priorities for Norwegian development assistance for the report period. The energy sector is the sector where Norway has traditionally had its largest and most important involvement in poor countries, both in the form of aid and through Norwegian business. Private Finance Advisory Network (PFAN), see the table below, is an example of how support to small and medium sized technology companies in developing countries contributes to innovation of endogenous technology and capacity.

6.7.3 *The Knowledge bank*

In many countries today there is greater demand for transfer of technology and knowledge than for aid funds. Revitalising and strengthening technical cooperation is therefore an important part of any forward-looking development policy. This is also vital for easing the transition from a relationship based on aid to more equal bilateral ties. In 2018, a Knowledge Bank was established to strengthen and coordinate the Norwegian technical cooperation. Norway has a long tradition of technical assistance and institutional cooperation, particularly in the energy sector. Public institutions such as The Norwegian Water Resources and Energy Directorate and the Norwegian Environmental Agency have been engaged in development cooperation for a number of years.

6.7.4 *Examples of activities that Norway supports*

The *Climate Technology Centre and Network (CTCN)* is the operational arm of the technology mechanism under the UNFCCC and serving the Paris Agreement. Norway has since the establishment of the CTCN been a major donor. Since the establishment of the CTCN, Norway has contributed financially to the CTCN with USD 9 488 850. Norway has also been a member of the Advisory Board of the CTCN in the period 2016–2019.

Norway is a member of the *Clean Energy Ministerial (CEM)*. CEM is a high-level global forum for promotion of policies and programmes that advance clean energy technology, for sharing lessons learned and best practices, and for encouraging the transition to a global clean energy economy. Norway has co-funded the Secretariat of the CEM with approximately USD 333 333 (NOK 3 000 000), and the secretariat of the CCUS initiative under the CEM with USD 100 000 for the period 2018–2022, and EUR 20 000 for the Hydrogen Initiative.

Norway has participated in *Mission Innovation* since the start of the initiative in November 2015. Today, 22 countries and the European Union participate in the initiative. Mission Innovation aims to reinvigorate and accelerate public and private global clean energy innovation with the objective to make clean energy widely affordable. Each participating country will seek to double its governmental and/or state-directed clean energy R&D investment over five years. Mission Innovation is an example of an initiative that will put the world on a faster route to the point where we can secure energy access for all, while at the same time curbing global emissions of greenhouse gases.

As an example of what works in the field of capacity building and renewable energy, Norway would like to highlight our cooperation with Germany, the UK and the EU in supporting GET FIT (Global Energy Transfer Feed-in Tariff) Program pilot in Uganda. Capacity building and regulatory changes facilitated by GET FiT have played a key role in attracting private investment to the energy sector in Uganda. The program started in 2010 and the last payment from Norway was in 2015. We are now harvesting results. By end of 2020, Get Fit Uganda has contributed to 122.4 MW renewable energy (commissioned projects). The corresponding energy generation was 380 GWh. The robust and conducive regulatory environment, supported by GET FiT, is being recognised internationally – in 2020 Uganda was ranked number one on the Electricity Regulatory Index for Africa by the African Development Bank – for the third time in a row.

Support to standardisation of legal documents such as bankable Power Purchase Agreements and Implementation Agreements have been particularly important in attracting investments. Norway considers the Global Energy Transfer Feed-in Tariff pilot programme to be a success story related to technology transfer.

Norway has no information to report on failure stories related to technology transfer.

Table A3-24 (CTF table 8). Provision of technology development and transfer support [a, b]

Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
Angola, Bhutan, Haiti, Liberia, Mozambique, Myanmar, Nepal, Palestine, China, Tanzania, Uganda	Mitigation	The Norwegian Clean Energy for Development Initiative supports development of low-carbon and energy sector strategies, strengthen technical and institutional capacity to support private sector investment in developing countries, and contributes to the international transfer of energy-related technology. Norway further supports investment in infrastructure and clean energy production capacity in the energy sector of developing countries. Such investment support is frequently supplemented by institutional and human resource development measures that improve the technological expertise of the recipient country (e.g. support to HydroLab in Nepal).	Renewable energy, Energy access, Energy efficiency	Public	Public	Implemented	
Focus on non-Annex 1 countries	Mitigation and adaptation	Norfund – Renewable Energy. Norfund is the development finance institution that serves as the commercial investment instrument of Norway's development policy. Through investment in profitable companies and the transfer of knowledge and technology, it contributes to reducing poverty and to economic progress in poor countries.	Clean energy, Energy efficiency, Energy access, Industry, Transport	Private and public	Private and public	Implemented	
Focus on non-Annex 1 countries	Mitigation	Norway is one of the contributors to the partnership Energising Development (EnDev). EnDev – is an impact-oriented initiative between the Netherlands, Germany, Norway, Australia, the United Kingdom and Switzerland. EnDev promotes the supply of modern energy technologies to households and small-scale businesses. The Partnership cooperates with 24 countries in Africa, Latin America and Asia. Since its start in 2005, EnDev has taken a leading role in promoting access to sustainable energy for all.	Renewable energy, Energy efficiency, Energy access, Industry	Public	Private and public	Implemented	

Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
Non-Annex I	Mitigation	Norway has been an active supporter of the International Renewable Energy Agency (IRENA) since the early planning stage, and signed the statutes in January 2009. We strive to involve our private sector companies and our technological institutions as much as possible in the endeavour to promote the widespread use of renewable energy. Norway has contributed to the Global Renewable Energy Atlas and Renewable Energy Roadmap, as well as a range of other products and resources IRENA is developing to support developing countries develop their own renewable energy resources and industries.	Renewable energy, Energy Access	Public	Private and public	Implemented	
Both Annex-I and non-Annex-I	Mitigation	Norway is a member of the Clean Energy Ministerial (CEM). CEM is a high-level global forum to promote policies and programmes that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Initiatives are based on areas of common interest among participating governments and other stakeholders.	Renewable energy, Energy efficiency, Energy access	Public	Public and Private	Implemented	The CEM is focused on three global climate and energy policy goals: i) Improve energy efficiency worldwide, ii) Enhance clean energy supply, iii) Expand clean energy access. The main objective is improving policies and enhanced deployment of clean energy technologies.
Non Annex-I	Mitigation and adaptation	Private Finance Advisory Network, UNIDO. The Private Financing Advisory Network (PFAN) is a multilateral public private partnership initiated by the Climate Technology Initiative and the United Nations Framework Convention on Climate Change (UNFCCC). It identifies and nurtures promising, innovative clean and renewable energy projects by bridging the gap between investors, clean energy entrepreneurs and project developers.	Renewable energy, Energy efficiency, Energy access	Private and Public	Private and public	Implemented	Capacitate small and medium sized businesses to develop bankable projects.

Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
Non Annex-I	Mitigation and adaptation	Clean Technology Center and Network. The Climate Technology Centre and Network facilitates the provision of information, training and support to build and/or strengthen the capacity of developing countries to identify technology options, make technology choices and operate, maintain and adapt technology.	Renewable energy, Energy efficiency, Energy access	Public	Private and public	Implemented	
All	Mitigation	The Global Carbon Capture and Storage Institute: The Global Carbon Capture and Storage Institute (GCCSI) was established at the initiative of the Australian authorities. The aim of the institute is to contribute to a more rapid international dissemination of CO_2 capture and storage technologies. The Norwegian state enterprise Gassnova is a member of the institute	Energy, Industry	Public and private	Public and private	Implemented	
All	Mitigation	The technology centre for CO_2 capture at Mongstad (TCM) is the world's largest facility for testing and improving CO_2 capture. TCM is an arena for targeted development, testing and qualification of CO_2 capture technologies. International dissemination of the centre's experiences and results is important to reduce the costs and risks associated with large-scale CO_2 capture. Knowledge gained will prepare the ground for CO_2 capture initiatives to combat climate change. TCM is a joint venture between the Norwegian state, Equinor, Shell and Total.	Energy, Industry	Private and Public	Private and public	Implemented	
Non-Annex I	Mitigation	GEEREF is an innovative fund that aims to mobilise private sector finance. By providing new risk-sharing and contributing to co-financing options, GEEREF plays a role in increasing the uptake of renewables and energy efficiency in developing countries. The approach is demand-driven in markets that need more risk capital to evolve. GEEREF's support to regional sub-funds tailored to regional needs and conditions stimulates these markets.	Renewable energy, Energy efficiency	Public	Public	Implemented	Norway participated in the establishment of the Global Energy Efficiency and Renewable Energy Fund (GEEREF) in 2008 together with the European Commission and Germany.

Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
Tanzania, Malawi	Adaptation	Global Framework for Climate Services (GFCS) Adaptation Programme in Africa. Enhanced capacity of National Meteorological and Hydrological Services to provide climate services, and enhanced capacity of the health, agriculture/ food security and DRR sectors to use climate services in decision-making processes.	Agriculture/food security, Health, DRR	Public	Public	Implemented	
Regional Africa	Adaptation	Global Framework for Climate Services (GFCS) – Adaptation and disaster risk reduction in Africa. Building capacity for the prediction of severe weather events in Africa. Support to meteorological services.	Agriculture/food security, Health, DRR, energy, water (GFCS priority sectors)	Public	Public	Implemented	Support through WMO to regional meteorological offices and to the GFCS secretariat in Genève.
Regional Africa	Adaptation	Strengthening the capacity of climate services in Africa through expert deployments	Agriculture/food Security, health, DRR	Public	Public	Implemented	Support through Norwegian Refugee Council, in coordination with GFCS and its partners.
Bangladesh, Myanmar, Vietnam	Adaptation	Meteorological services in Bangladesh, Myanmar and Vietnam 2017- 2019	Agriculture/food Security, fisheries, health, DRR	Public	Public	Implemented	Support from Norwegian NMHS to partner institutions
Malawi, Tanzania	Adaptation	Weather and Climate Services in Tanzania and Malawi as Digital Public Goods	Agriculture/food Security, health, DRR	Public	Public	Delayed due to Covid-19	Pilot project
Non-Annex I	Core support	Agricultural Research through the Consultative Group on International Agricultural Research (CGIAR). The research focusses on reducing poverty, improving food and nutrition security for health and improved natural resource systems and ecosystem services. This includes adaptation to a changing climate. Research in partnership with national and international institutions. National ownership including training, is central.	Agriculture, Fisheries, forestry, Food Security	Public	Public	Implemented	NOK 100 mill contributed in 2018. NOK 130 mill contributed in 2019.
Non-Annex I	Adaptation	Agricultural Research through the Global Crop Diversity Trust on Crop Wild Relatives to collect crop genetic material amongst crop wild relatives which show a specific tolerance to various climate stresses. The collected genetic material is used in pre-breeding programmes to breed the climate stress tolerant genetic traits into the domesticated crops.	Agriculture, Food Security	Public	Public	Implemented	New agreement signed in 2017. NOK 6.7 million in the period 2017–2020.

Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
Non-Annex I	Adaptation	Climate adaptation in agriculture and food production. A number of projects are supported through NGO's, the Rome based UN agencies (FAO, WFP and IFAD) and national/regional institutions with the aim to contribute to climate change adaptation, especially among small scale farmers and fishermen in developing countries.	Agriculture/ fisheries/ food production/ food security	Public	Public	Implemented	

Table A3-25 (CTF table 9). Provision of capacity-building support [a]

Recipient country / region	Targeted area	Programme or project title	Description of programme or project [b,c]
Various REDD+ partner countries	Mitigation	The UN-REDD Programme	The UN-REDD Programme is a collaborative partnership bringing together the expertise of the UN Food and Agricultural Organization (FAO), the UN Development Program (UNDP) and the UN Environment Program (UNEP). The Programme has over 60 partner countries. Through its global activities UN-REDD contributes to the development of methodology and building of capacity within areas such as REDD+ governance, MRV, biodiversity and green economic development.
Various REDD+ partner countries	Mitigation	The Forest Investment Program (FIP)	The Forest Investment Program (FIP) under the CIF provides financing at scale to a limited number of pilot countries to support the implementation of their national REDD+ strategies. Over time, the intention is to help countries access larger and more sustainable results-based REDD+ payments.
Various REDD+ partner countries	Mitigation	Forest Carbon Partnership Facility (FCPF)	The Forest Carbon Partnership Facility is a global partnership of governments, businesses, civil society, and Indigenous Peoples focused on reducing emissions from deforestation and forest degradation. The objective is to pilot a performance-based payment system for REDD+ activities and to test ways to sustain or enhance livelihoods of local communities and to conserve biodiversity.
Various REDD+ partner countries	Mitigation	BioCarbon Fund Initiative for Sustainable Forest Landscapes (BioCF ISFL)	Norway is a contributor to the ISFL, managed by the World Bank. It promotes reducing greenhouse gas emissions from the land sector, from deforestation and forest degradation in developing countries (REDD+), and from sustainable agriculture, as well as smarter land-use planning, policies and practices. ISFL aims to support economic development by protecting forests, restoring degraded lands, enhancing agricultural productivity, and by improving livelihoods and local environments. The fund provides technical assistance that impact multiple sectors of the economy and result-based payments to incentivize and sustain program activities.
Global	Mitigation	NORWEP (Norwegian Energy Partners)	NORWEP is a public-private partnership between three Government Ministries and Norwegian energy companies. The aim is to promote Norwegian energy competence in international markets, which also implies capacity-building in developing countries.
Both Annex-I and non-Annex-I	Mitigation, Adaptation, Technology development and transfer	The International Centre for Hydropower (ICH)	The International Centre for Hydropower (ICH) is based in Norway and has members from the hydropower industry as well as Norwegian public institutions. Its aim is promoting hydropower and power market competence in emerging markets and developing countries. Institutional frameworks and capacity building as well as technological transfer are central in ICH's programmes.
Both Annex-I and non-Annex-I	Mitigation, Technology development and transfer	The Carbon Sequestration Leadership Forum	The Carbon Sequestration Leadership Forum (CSLF) has 26 member states. It is a Ministerial-level international climate change initiative that is focused on the development of improved cost-effective technologies for carbon capture and storage (CCS). It also promotes awareness and champions legal, regulatory, financial, and institutional environments conducive to such technologies.
Both Annex-I and non-Annex-I	Mitigation	Sustainable Energy for All (SE4All)	Norway has supported the SE4All initiative since its launch in Oslo in 2011.

Recipient country / region	Targeted area	Programme or project title	Description of programme or project [b,c]
Coastal developing countries south of Sahara through FAO	Adaptation	EAF Nansen Project	The EAF Nansen Programme and the research vessel Dr. Fridtjof Nansen has since 1975 assisted developing countries in collecting marine research data. The vessel is an integral part of the Nansen programme. The programme is run by the Food and Agriculture Organization (FAO) and funded by Norway. The vessel is operated by Norway's Institute of Marine Research (IMR), who also provide the scientific services. From 2010 to 2015 Norway supported the project "Climate effects on biodiversity, abundance and distribution of marine organisms in the Benguela Current (NansClim)". The objective was to identify and describe possible trends in ocean climate and corresponding changes in marine biodiversity and fisheries in the region, using data collected through the "Nansen Programme" together with relevant available data. Based on the results from NansClim it was decided that in the new phase of the Nansen Programme starting in 2017, climate change issues should be incorporated to a larger degree. A science plan has been developed for the new phase of the Programme, where one of three main categories is "understanding the impacts of climate change on fish stocks and ecosystems, including setting up monitoring systems." This is reflected in the research topics and the title of the new programme: "Supporting the Application of the Ecosystem Approach to Fisheries Management considering Climate and Pollution Impacts". The new state of the art vessel has larger capacity and a laboratory specifically designed for climate studies.
Tanzania	Adaptation	Tanzania Agricultural Partnership (TAP) phase II	The overall Project goal is the establishment of a public-private sector platform that provides commercial and developmental support to sustainable and profitable small-holder agriculture in Tanzania.
Malawi	Adaptation	AIIC – Malawi Agriculture Partnership (MAP) II	The overall Project goal is the establishment of a public-private sector platform that provides commercial and developmental support to sustainable and profitable small-holder agriculture in Malawi.
Zambia	Adaptation, Food Security, Capacity Building	Conservation agriculture programme (CAP) phase II	Support to the CFU Zambia programme to scale up conservation agriculture in Zambia. The programme is implemented in collaboration with the Ministry of Agriculture
Non-Annex I	Adaptation	GCDT – Genetic Resources – Crop Wild Relatives Project	Global Crop Diversity Trust- Crop Wild Relatives – CWR- work with the wild relatives of 29 major food crops. The project collects the wild plants (crop relatives); evaluates them for the useful traits; makes the resulting information widely available; provides them to gene banks for conservation; and prepares them ('pre-breeding') for use in breeding crops for new climates. Pre-bred material is fed into ongoing, active breeding initiatives in developing countries. The project was concluded in 2020.
Global	Adaptation	Climate Change, Fisheries and Aquaculture. Adaptation and mitigation.	The project aims at testing methods for vulnerability analyses related to climate, and adaptation strategies within fisheries and fish farming in various regions.
Global	Mitigation Technology Development and transfer	Energy Sector Management Assistance Programme – ESMAP	ESMAP is a partnership between the World Bank Group and 18 partners to help low and middle-income countries reduce poverty and boost growth, through environmentally sustainable energy solutions. ESMAP's analytical and advisory services are integrated within the WBG's country financing and policy dialogue in the energy sector. Through the WBG, ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG7) to ensure access to affordable, reliable, sustainable and modern energy for all. Norway provides core funding to the ESMAP Multi-Donor Trust Fund hosted in the World Bank.
Global	Mitigation Technology development and transfer	Clean Cooking Alliance	The Clean Cooking Alliance works with a global network of partners to build an inclusive industry that makes clean cooking accessible to the three billion people who live each day without it. Achieving universal access to clean cooking solutions requires scaling up a range of technologies and business models. The Alliance's work is built around three core pillars: Driving consumer demand for cleaner, more modern stoves and fuels by supporting behaviour change and awareness-raising interventions; Mobilizing investment to build a pipeline of scalable businesses capable of delivering affordable, appropriate, high-quality clean cooking products; and fostering an enabling environment for industry growth by advocating for effective and predictable policies, providing trusted, relevant data, and serving as the convener and champion of the clean cooking sector. Norway provides core funding to the Alliance.

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. Norway has implemented a broad range of policies and measures that reduced emissions and enhance removals. Moreover, this BR5 explains how Norway plans to fulfil its commitment for the second commitment period of the Kyoto Protocol (2013–2020). In accordance with the Climate Change Act the Government annually submits to the Parliament updated information on status and progress in achieving the climate targets under the law. This ensures broad political ownership of the target and transparency while progressing towards the achievement of the target.

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. Through the climate agreement with the EU, Norway will take part in EUs climate legislation from 2021 to 2030. This legislation provides legally binding climate targets for Norway (see chapter 4 of NC8). The EFTA Surveillance Authority (ESA) is responsible for monitoring and enforcing compliance. For more information about the Pollution Control Act, the Greenhouse Gas Emissions Trading Act and the Climate Change Act, see chapter 4 of NC8.

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 does not have any other information to report on this matter in this BR5.

Annex IV. List of acronyms

AAU	Assigned Amount Unit
ABA	Arctic Biodiversity Assessment
ADPC	Asian Disaster Preparedness Center
ACTRIS	Aerosols, Clouds, and Trace gases Research Infrastructure Network
AGAGE	Advanced Global Atmospheric Gases ExperimentOS
AMAP	Arctic Monitoring and Assessment Programme
ASAP	Automated Shipboard Aerological Programme
AWG	Ad-hoc Working Group
BAT	Best Available Techniques
BR	Biennial Report
BRA	Available area
CAEP	Civil Aviation Environment Programme
CAFF	Conservation of Arctic Flora and Fauna
CAFI	Central African Forest Initiative
CTCN	Climate Technology Centre and Network
CSEUR	Consolidated System of European Union Registries
CTCN	Climate and Technology Centre and Network
CTF	Common Tabular Format
DDR	Disaster Risk Reduction
DES	Data Exchange Standards
ECA&D	European Climate Assessment and Dataset
ECAC	European Civil Aviation Conference
ECAS	European Commission Authentication Service
ECCSEL	European Carbon Dioxide Capture and Storage Laboratory Infrastructure
ECMWF	European Centre for Medium-Range Weather Forecasts
EEA	European Economic Area
EEH	EPIM Environmental Hub
EFTA	European Free Trade Association
CCAC	Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants
CASTOR	CO_2 from Capture to Storage
CCAP	Center for Clean Air Policy
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CICERO	Centre for International Climate and Environmental Research
CIF	Climate Investment Funds
CLRTAP	Convention on Long-range Transboundary Air Pollution
CMIP6	Coupled Model Intercomparison Project Phase 6
COAT	Arctic Climate-ecological Observatory for Arctic Tundra
CRF	Common Reporting Format
CSLF	Carbon Sequestration Leadership Forum
EMEP	European Monitoring and Evaluation Programme
EnDev	Energising Development
ERA	European Research Area
ERT	Expert Review Team
ERU	Emission Reduction Unit
ESFRI	European Strategy Forum on Research Infrastructures
ESI	Environmental Ship Index
ESMAP	Energy Sector Management Assistance Program
EV	Electric Vehicles
EU ETS	European Union Emission Trading System
EU	European Union
EUMETNET	European Meteorological Services Network
EUR	Euros
FAO	Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility

FEED	Front End Engineering and Design
FFFSR	Friends of Fossil Fuel Subsidy Reform
FIP	Forest Investment Program
GAW	Global Atmosphere Watch of WMO
GCIAR	Consultative Group on International Agricultural Research
GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GCF	Green Climate Fund
GEF	Global Environment Facility
GFCS	Global Framework for Climate Services
GFDRR	Global Facility for Disaster Reduction and Recovery
GGGI	Global Green Growth Institute
GHG	Greenhouse gases
GIS	Gas-insulated switchgear
GNI	Gross National Income
GSI	Global Subsidies Initiative
GTOS	Global Terrestrial Observation System
GWP	Global Warming Potential
HFC	Hydrofluorcarbon
ICAO	International Civil Aviation Organization
ICH	International Centre for Hydropower
ICIMOD	International Centre for Integrated Mountain Development
ICOS	Integrated Carbon Observation System
ICSU	International Council for Science
IEA	International Energy Agency
IEF	Implied Emission Factor
IGBP	International Geosphere-Biosphere Programme
IIASA	International Institute for Applied Systems Analysis
IMO	International Maritime Organisation
IISD	International Institute for Sustainable Development
IMR	The Institute of Marine Research
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPY	International Polar Year
IRENA	International Renewable Energy Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
ITL	International Transaction Log
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology
JI	Joint Implementation
JPI	Joint Programming Initiatives
KP	Kyoto Protocol
LDC	Least Developed Countries
LDCF	Least Developed Country Fund
LPG	Liquefied Petroleum Gas
LULUCF	Land Use and Land Use Change and Forestry
MW	Megawatt
NC	National Communication
NCCS	Norwegian Centre for Climate Services
NE	Not Estimated
NCS	Norwegian Continental Shelf
NEFCO	Nordic Environment Finance Corporation
NFI	National Forest Inventory
NGO	Non-Governmental Organisation
NIBIO	Norwegian Institute of Bioeconomy Research
NICFI	Norway's International Climate and Forest Initiative
NFLI	Norwegian Forest and Landscape Institute
NGL	Natural Gas Liquids
NIBIO	Norwegian Institute of Bioeconomy Research
NIFU	Nordic Institute for Studies in Innovation, Research and Education

NILU	Norwegian Institute for Air Research
NIR	National Inventory Report
NIVA	Norwegian Institute for Water Research
NMVOC	Non-methane Volatile Organic Compound
NOK	Norwegian Kroner
NORAD	Norwegian Agency for Development Cooperation
NorClim	Climate of Norway and the Arctic in the 21st Century
NorESM	Norwegian Earth System Model
NORKLIMA	Climate Change and Impacts in Norway
NOU	Official Norwegian Report
NRPA	National Public Road Administration
NPI	The Norwegian Polar Institute
NVE	Norwegian Water Resources and Energy Directorate
NSDS	National Strategy for Sustainable Development
NTP	National Transport Plan
ODA	Official Development Assistance
OfD	Oil for Development
OECD	Organisation for Economic Cooperation and Development
PAGE	UN Partnership for Action on the Green Economy
PaM	Policies and Measures
PCF	Prototype Carbon Fund
PDO	Plans for Development and Operation
PFAN	Private Finance Advisory Network
PFC	Perfluorcarbon
PIO	Plan for installation and operation of facilities for transport and utilisation of petroleum
PHEV	Plug-in Hybrid Vehicles
PPCR	Pilot Program for Climate Resilience
QA/QC	Quality Assurance/Quality Control
R&D	Research and Development
RCN	Research Council of Norway
REDD+	Reducing emissions from deforestation and forest degradation
RegClim	Regional Climate Development under Global Warming
RMU	Removal Unit
RMU	Removal Unit
SAR	Search and Rescue
SCCF	Special Climate Change Fund
SD	Sustainable Development
SDG	Sustainable Development Goals
SEF	Standard Electronic Format
SET-plan	Strategic Energy Technology Plan
SIOS	Svalbard Integrated Arctic Earth Observing System
SPF	Specific Fan Power
SWDS	Solid Waste Disposal Sites
SWIPA	Snow, Water, Ice and Permafrost in the Arctic
TCM	Technology Centre Mongstad
TEK	Technical building regulation code
TWh	Terawatt hour
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIS	The University Centre in Svalbard
USD	US Dollar
VAT	Value Added Tax
VRU	Vapour Recovery Unit
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WRI	World Resources Institute

Published by:
Norwegian Ministry of Climate and Environment

Additional copies may be ordered from:
Norwegian Government Security and Service Organisation
publikasjoner.dep.no
Telephone: + 47 22 24 00 00
Publications are also available on:
www.government.no
Publication number: T-1582 E

Cover photo: Getty Images/Anastasiia Shavshyna

Print: Norwegian Government Security and Service Organisation 03/2023 – Impression 80

Trykksak
2041 0446