Norway's long-term low-emission strategy for 2050

– An innovative society with attractive towns and communities

***Note**: The strategy was adopted in Norway by the Norwegian Parliament in October 2019. In February, 2020 Norway* updated and enhanced its nationally determined contribution under the Paris Agreement to reduce emissions by.*at least 50 per cent and up towards 55 per cent by 2030, compared to 1990-levels. This is not fully reflected in the translated text.*

***Also note:** The Norway's long-term low-emission strategy for 2050 as presented here has been translated from its original Norwegian language.*

Introduction

Climate change is having impacts in larger and larger parts of the world, and there has been no decline in global greenhouse gas emissions in recent years. At the same time, there are growing losses of biodiversity and ecosystems. These changes in combination are threatening our ability to feed a growing global population. However, significant efforts are being made to change course. The Paris Agreement, the Sustainable Development Goals, technological advances, responsible business conduct and emerging recognition that everyone must take a share of the responsibility – these are all signs that change is possible.

If the world shifts to a pathway that reduces greenhouse gas emissions and strengthens the carbon stock in forests and soils, protects ecosystems on which we all depend, and results in sustainable use of resources, this will alter the entire basis for development of our societies. It will involve a steady reduction of emissions from energy use, the production of goods and services, and the way people live and get around. We will have to develop integrated, sustainable systems for land use and environmental management. And these changes will have to take place while the global population is still growing.

We are already beginning to have an idea of the level of costs we may face if the world does not succeed in achieving climate and environmental targets and the Sustainable Development Goals. We must recognise that we are experiencing a prolonged climate crisis that is a serious threat to both people and the environment. Scientists have confirmed that it is not too late to act, but we have very little time. The global transformation must start now, and every country must play its part.

A global transformation will be a challenging process, but will also offer many opportunities. The benefits of a global low-emission development pathway in line with the Paris Agreement will be far greater than the costs. This has been established in many international studies. In 2006, the Stern Review[1] concluded that the costs of not reducing global emissions would be far higher than the costs of taking action to cut emissions. Since then, the Global Commission on the Economy and Climate has published several studies with similar conclusions. The benefits of a low-emission future will also include towns that are pleasant to live and work in, with cleaner air and less congestion and crowding. New market opportunities will open up, and creativity and innovation will be stimulated. New products and services will create competitive jobs and result in value creation.

However, a low-emission transformation will involve both social and economic costs. There will be changes in many industries, and employees will need adapt their skills and qualifications accordingly. Innovation and technology development, investments in infrastructure and action to facilitate change all involve costs.

Norway's ability to thrive will depend on the choices we and the rest of the world make now and in the time ahead. Decisions made today will determine what energy and transport systems, towns and buildings, forests and countryside are like in 2050. The way other countries develop their energy systems and spatial management systems will have a strong influence on conditions in Norway in 2050. But choices made by the Norwegian Government, the Storting (Norwegian parliament), and by municipalities and counties, the business sector and individuals in Norway – on resource use, spatial management and how and where to build and travel – will have major impacts on the situation in Norway in 2050. Norway's target of becoming a low-emission society must therefore be made an integral part of the basis for decision making from now onwards.

In planning for Norway's transformation to a low-emission society, it will be vital to ensure that everyone is pulling in the same direction and that changes take place quickly enough for Norway to achieve its climate targets. It is a political responsibility to ensure that new opportunities can be used and help to ease the transition. Norway has a small, open economy and is dependent on technology development and markets in the rest of the world. This means that Norway cannot rely on a unilateral approach.

And Norway is not on its own. The Paris Agreement reflects the understanding that global cooperation is essential to achieve the climate targets. All the parties to the agreement have

[1] *The Economics of Climate Change: The Stern Review*, October 2006.

therefore agreed to the global target of holding 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. The Sustainable Development Goals, adopted by the UN in the same year as the Paris Agreement, reflect worldwide recognition that it is not possible to eliminate poverty, hunger and social disparities unless we also take steps to safeguard nature as the basis for our livelihoods and to halt climate change. The Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) have concluded that challenges in both these areas must be resolved to promote welfare improvements and social development for the world population. Global growth must be kept within safe ecological limits in order to maintain the capacity of natural systems to provide the ecosystem services on which we all depend.

Norway will need to make wise choices during its transformation to a low-emission society, so that there is room for a wide variety of solutions within a stable long-term framework. This strategy presents the Government's general priorities and important considerations for the pathway towards a low-emission society in 2050. The Government's intention is to provide a stronger basis for its climate policy and predictable long-term structures that will enable all stakeholders to pull in the right direction.

This strategy is Norway's answer to the call for all countries to develop long-term low-emission strategies, as set out in the Paris Agreement. Such strategies are additional to the emission reduction targets countries communicate in their binding nationally determined contributions (NDCs) under the Paris Agreement. This strategy does not, therefore, entail any new international commitments for Norway, but is based on the targets already set out in the Act relating to Norway's climate targets (Climate Change Act). It is divided into three chapters. Chapter 1 describes the basis for a low-emission society and the global, regional and national starting point for a low-emission development pathway. Chapter 2 gives an account of Norway's climate targets and describes what Norway will be like as a low-emission society in 2050 once these targets have been achieved. Chapter 3 describes the Government's general priorities and important considerations for the pathway towards a low-emission society.

1 The basis for a low-emission society

1.1 The necessary low-emission society

The 2015 Paris Agreement was adopted in recognition of the irreversible loss and damage being caused by climate change and the serious threat it poses to nature and society. Together with growing pressure on natural resources and land, accompanied by the loss of species and

ecosystems and litter and other pollution, climate change is a serious threat to the world's capacity to provide fundamental services such as clean water, sufficient food and safe homes. It is vital for the international community to succeed in curbing global warming.

The Paris Agreement affirms global willingness to achieve a low-emission development pathway. At the Paris summit, the world's countries agreed to the target of holding 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. In order to achieve this long-term temperature target, countries agreed that they would aim to reach global peaking of greenhouse gas emissions as soon as possible, and to undertake rapid reductions after this in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.

All parties to the agreement must contribute to collective progress towards the temperature target. They do this by preparing, communicating and maintaining successive nationally determined contributions (NDCs) setting out the emission targets that they intend to achieve. Each country must carry out domestic mitigation measures with the aim of achieving its NDC. Each new NDC will represent progression beyond that country's current NDC, and reflect the highest possible level of ambition. Thus, the Paris Agreement and its objectives provide a basis for action and an important starting point for climate policy in every country, including Norway.

The NDCs so far communicated under the Paris Agreement are by no means sufficient to achieve the long-term temperature target. The next deadline, when all countries are to communicate new or updated emission commitments, is in 2020.In February 2020, Norway updated and enhanceds its nationally determined contribution under the Paris Agreement to reduce emissions by at least 50 per cent and towards 55 per cent compared to 1990 levels by 2030. .[2]

The Paris Agreement also calls on countries to formulate and communicate long-term low greenhouse gas emission development strategies. A strategy of this kind can be used to establish and communicate an ambitious vision and a long-term horizon for a country's short and medium-term climate targets and policies, including those communicated in their NDCs. It can also provide a more predictable political framework for a low-emission development pathway. Long-term low-emission strategies do not entail new targets or commitments under the Paris Agreement, and countries have not been asked to report on them. The provisions of the Paris Agreement on mitigation are being implemented in a changing world. In the period

[2] Norway submitted its enhanced NDC on 7th February 2020, strengthening its target from a 40 % reduction to a reduction of 50 % and up to 55 % by 2030 compared to the 1990 level.

up to 2050, circumstances outside international and domestic climate policy will also strongly influence low-emission development pathways. Predicting future developments always involves uncertainty, but it is nevertheless possible to outline some global trends up to 2050.

The UN estimates that the world population will increase to nearly 10 billion by 2050. Most of the growth will be in what are now developing and middle-income countries. In Europe and North America, the proportion of older people will be higher than today. Economic growth will lift more people into a global middle class. A rising global population and economic growth suggest there will also be rising energy demand, more pressure on land for various purposes such as housing, infrastructure and food production, and higher consumption.

Most of the growing global population will be urban dwellers. The number of people living in urban areas has risen from about 750 million in 1950 to about 4.2 billion today. According to the UN, urbanisation will continue. It is estimated that another 2.5 billion people could be urban dwellers by 2050. This would be the equivalent of building a new town of 1.6 million people every week from 2020 onwards.

According to the UN Environment Programme (UNEP), the world is currently using 1.6 planets' worth of resources every year. This high level of consumption will result in resource scarcity in many important sectors and areas by 2050. Establishing a circular economy, in which resources are not wasted and the value of products and materials is maintained for as long as possible, is a way of counteracting resource scarcity.

Both resource scarcity and climate change impacts will alter conditions for urban development up to 2050 in many parts of the world. In some regions, water will be in short supply. Many of the world's largest cities are low lying and at risk from sea level rise, and will be affected by changing rainfall patterns and heatwaves. Many countries are therefore linking and integrating climate change mitigation and adaptation with sustainable development when developing their long-term low-emission strategies.

In addition to a rapidly rising population and increasing pressure on resources and land, we are experiencing rapid technological development. Automation, robotisation and digitalisation are some of the technology trends that are likely to influence development pathways, working life and the ways people interact in the years ahead. Although the development of new technologies and business models may be driven by considerations other than climate change, these developments may also lead to reduced emissions and reduced and more efficient resource use.

1.1.1 A global low-emission development pathway

The world population has risen from 1 billion to more than 7 billion in the past 200 years. During the same time frame, people have been altering and putting pressure on many areas

and ecosystems across the world. We have used large quantities of coal, oil and natural gas and extracted considerable volumes of metals and minerals. More than 70% of land areas that are not ice-covered are now directly influenced by human activities. The overall results include a substantial rise in the atmospheric concentration of CO_2 since pre-industrial times.[3]

Greenhouse gas emissions have already altered the Earth's climate. The world is warmer; global mean temperature has risen by about 1 ºC relative to pre-industrial levels. Global sea levels have risen as snow and ice have melted. The oceans have become more acidic. The rise in global mean temperature has resulted in more frequent and more intense extreme weather events.

In 2018, the Intergovernmental Panel on Climate Change (IPCC) presented a report which concluded that limiting the rise in temperature to 1.5 ºC would avoid the most serious impacts of global warming. Many of the risks to nature and society were found to be considerably lower for a temperature rise of 1.5 ºC than for a rise of 2 ºC.

The aggregated NDCs so far communicated under the Paris Agreement are expected to result in global warming of about 3.2 ºC relative to pre-industrial levels by the end of this century. This is nowhere near what is needed to achieve the Paris Agreement temperature target of holding global warming to well below 2°C below pre-industrial levels and pursuing efforts to limit the temperature rise to 1.5°C.

According to the IPCC, the global warming trend and its impacts are not uniform throughout the world. Some areas are warming more than others, and the impacts will vary depending on geographical, topographical and other factors.

The global rise in temperature could potentially have serious impacts on nature and society in all countries, although it is the poorest and most vulnerable countries that are most at risk. Conditions for agricultural, forestry, fisheries and aquaculture operations will alter as the climate changes. Rising sea levels, higher precipitation and more flooding may cause serious damage to infrastructure and property. Norway's government-appointed Climate Risk Commission pointed out in its report[4] that climate change is expected to curb worldwide economic growth and may increase the risk of political instability, humanitarian disasters and violent conflicts. Increased migration flows, unstable food prices, interruption/disruption of supplies and altered production and trade patterns may become important risk factors for the

[3] Defined here as before 1850, in line with the IPCC Fifth Assessment Report.

[4] NOU 2018: 17 Summary *Climate risk and the Norwegian economy*

international economy. For example, food and other goods produced in high-risk countries may become more expensive.

The IPCC report *Global Warming of 1.5°C* concludes that it would be possible but challenging to limit global warming to 1.5°C. Achieving this would require rapid, deep cuts in emissions, and ambitious steps to enhance carbon dioxide removals by uptake in ecosystems. In emission trajectories where there is no or little overshoot of 1.5 ºC warming, global greenhouse gas emissions are typically reduced by 40–50 % by 2030 compared with 2010. Emissions of CO_2 must be reduced to net zero by mid-century.[5] Emissions of other greenhouse gases must also be reduced.

Emissions from all major sectors, including energy, industry, transport, buildings and agriculture, forestry and other land use (AFOLU), will have to be reduced. AFOLU sectors will also have to play a part in enhancing removals of greenhouse gases. In relevant sectors, removals of CO_2 from the atmosphere can be used to compensate for residual emissions that are impossible to eliminate. This can for example be done using combustion of biomass in power plants combined with carbon capture and storage (bioenergy with CCS, or BECCS),[6] or steps can be taken to enhance removals in forest and other land categories. There are uncertainties relating to how emission reductions and increases in removals will be split between sectors, countries and regions, and what contributions can be expected from different technologies, solutions and methods. Nevertheless, some of the main features of a global low-emission development pathway are clear, and are described in the IPCC's assessment reports and special reports.[7]

Fossil energy use accounts for the largest share of global greenhouse gas emissions. To achieve a development pathway in line with the Paris Agreement, it will therefore be necessary to make deep cuts in greenhouse gas emissions from fossil energy use. One feature of scenarios that give emission trajectories consistent with limiting global warming to both 2 ºC and 1.5 ºC is that electricity production is practically emission-free by around mid-century. This means that it will be particularly important to make deep cuts in emissions from electricity production in the coming decades, both because this is currently a major emission source and because emission-free electricity will be needed to achieve cuts in other sectors. The IPCC states that further emission reductions that will needed to pursuing efforts to limit

[5]The term net zero is used to describe a situation where anthropogenic emissions are balanced by anthropogenic removals (for example by forest).

[6]Carbon capture and storage is a process in which carbon dioxide (CO_2) from sources such as power plants or industry is separated (captured) and transported to a location for long-term storage (for example underground geological formations) instead of being released to the atmosphere.

[7]IPCC 2014: *IPCC Fifth Assessment Report (AR5)*; 2018: *Global Warming of 1.5 ºC*; and 2019: *Climate Change and Land*

the temperature increase to 1.5°C will have to be made mainly in the industry and transport sectors.

Deforestation and forest degradation and agriculture and other land use are both major sources of greenhouse gas emissions, together accounting for about one fourth of global anthropogenic emissions. Enhancing CO_2 removals in forest, reducing deforestation and forest degradation, and using biomass sustainably to replace fossil energy and products are all part of the solution. However, the IPCC emphasises in its report that land is a very limited resource. Mitigation measures that require large areas of land may result in conflicts between different policy objectives and require trade-offs between climate policy and other interests.

Emissions from transport and industry will have to be substantially reduced. Industrial sectors will need to develop and deploy low-emission technologies and renewable raw materials and become more effective. Carbon capture and storage (CCS) will be a necessary option for residual emissions that cannot be eliminated by using emission-free alternatives or technological advances. A low-emission pathway in the transport sector will require greater use of zero-emission solutions such as biogas, hydrogen and electrification. The transition can be helped by reducing transport needs and improving efficiency. Sound land-use planning, more effective goods transport, greater use of public transport, cycling and walking and new innovative mobility solutions will all be needed as part of the approach.

It is also essential to put in place the enabling conditions for a low-emission development pathway. There must be a shift towards sustainable solutions for investment, technology, material and energy use and consumption. This will require sound planning and policy instruments to ensure that long-term investment decisions taken in the near future do not lock in high emissions, making it more difficult to achieve a low-emission pathway. At the same time, it is important that this approach has broad public support.

There is general agreement that pricing greenhouse gas emissions is vital if we are to achieve a cost-effective low-emission development pathway. Global consensus had been reached on this as long ago as 1992, when the Climate Change Convention was adopted. The polluter-pays-principle was therefore incorporated into the Convention. Putting a price on emissions gives incentives to reduce emissions, improve efficiency and develop and deploy low-emission technologies.

Innovation and technology development will also be essential. The prospects of achieving climate policy targets and the costs of doing so will depend on the availability of environmental technology and the mitigation effects it provides. It will be necessary to deploy

technologies that are already available at scale, continue to develop and implement others that are not yet commercially available, and develop completely new technologies.

Most of the pathways[8] that describe emission trajectories consistent with limiting global warming to 1.5 degrees include CCS to reduce emissions from industry and power generation that are difficult to deal with in any other way. Many pathways also include carbon dioxide removal (CDR), i.e. removal of CO_2 from the atmosphere through afforestation and bioenergy with carbon capture and storage (BECCS). This will require considerable areas of land and may have serious adverse impacts on the environment. It is therefore uncertain to what extent it will be practicable or environmentally sound to make large-scale use of CDR. However, this approach may be a necessary part of the solution if cuts in greenhouse gas emissions are not rapid enough. The more quickly the world reduces emissions, the less need there will be for CDR.

Behaviour patterns and lifestyle choices are important drivers of emissions globally. A sustainable lifestyle and behavioural patterns, including lower material consumption, a healthy diet and lower demand for transport, will reduce emissions and ease the transition to a low-emission pathway. This is true of the parts of the world and population segments that are not poor. The IPCC report *Climate Change and Land* points out that the global food system accounts for 21–37 % of total net anthropogenic greenhouse gas emissions. It will be possible to achieve vital sustainable development goals and at the same time reduce emissions, not only by changing the way the agricultural sector operates but also by changing the way we store food and through dietary choices and steps to reduce food waste.[9]

The success of a transition to a low-emission pathway will both influence and be influenced by the extent to which the world achieves other global objectives such as the UN Sustainable Development Goals (SDGs). According to the IPCC report *Global Warming of 1.5°C*, a global emission trajectory consistent with warming of 1.5 °C will have positive effects on progress towards other SDGs, especially those on good health, clean energy for all, sustainable cities and communities, responsible consumption and production and life below water. The report also identifies potential conflicts between policy objectives and trade-offs that may be necessary, for example between mitigation options and efforts to eradicate hunger and poverty and provide clean water and access to energy. Fewest trade-offs will be needed in a low-emission pathway where energy needs and consumption are low and the emission intensity of the food system is also low.[10]

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[8] IPCC, 2018: *Global Warming of 1.5 °C*. Summary for Policymakers, Figure SPM.3b.

[9] IPCC 2019: *Climate Change and Land*, Summary for Policymakers, B.2.3.

[10] IPCC 2019: *Climate Change and Land*, Summary for Policymakers, B.2.1, B.2.3.

Knowledge base
The IPCC's reports are considered to provide the best available knowledge base for developing climate policy. The IPCC assesses and reviews relevant scientific papers on climate change, its impacts and possible climate change adaptation and mitigation measures. The panel evaluates published scientific literature, but does not conduct its own research.

The special reports *Climate Change and Land* and *Global Warming of 1.5°C* are the IPCC's most recent and up-to-date reports. The IPCC will continue to publish assessments in the years ahead, starting with another special report on the ocean and cryosphere in autumn 2019.

It is vital that Norway's climate policy is based on the best available scientific knowledge on climate change and emissions globally, and especially on the work of the IPCC, which is the foundation for global climate cooperation under the Climate Change Convention.

1.1.2 Circumstances, opportunities and challenges for Norway

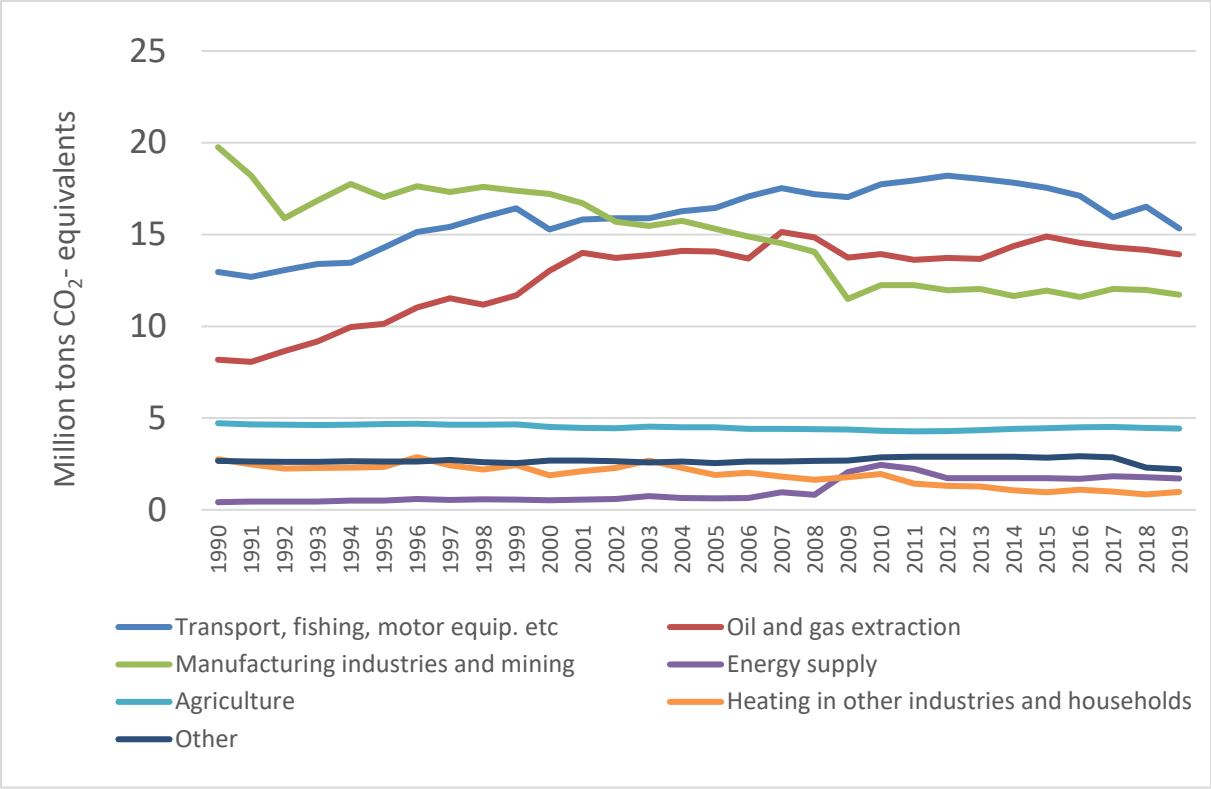
A low-emission development pathway in line with the Paris Agreement will entail both opportunities and challenges for all countries, including Norway. Global trends have a major impact on developments in a small open economy like Norway's. Ensuring full, effective use of labour and other resources will be vital in Norway's transition to a low-emission society.

The transition to a low-emission society has to take the current level of emissions as its point of departure. As in other OECD countries, the level of emissions is high in Norway today. In 2018, per capita emissions in Norway were about 10 tonnes CO_2-eq. By way of comparison, the average levels in 2017 were 11.9 and 8.8 tonnes CO_2-eq respectively for the OECD countries and the EU,[11] while the world average was about 6.5 tonnes CO_2-eq.[12] Emissions in different sectors are an important starting point for the path towards a low-emission society.

Figur 1.1 GHG Emissions by sector, 1990-2019

[11] Eurostat, 2017, Greenhouse gas emissions per capita, European Environment Agency.

[12] The global estimate is based on 1) emission figures for 2017 from UNEP (2018) *Emissions Gap Report 2018* and 2) population figures from the UN Department of Economic and Social Affairs (2017): *World Population Prospects: The 2017 Revision*



Source: Norwegian Environmental Agency

Norway is in a strong position for the transition to a low-emission pathway. Participation in the labour market is high, and there are abundant natural resources, a skilled workforce and sound state revenues. People in the Norwegian workforce are generally well-qualified and productive. This is a good starting point for making use of new knowledge and new technology.

Wealth is more equally distributed in Norway than in most other countries. Most people have the resources and freedom to plan their lives according to their own views and wishes. The low level of inequality means that people generally trust each other and the public authorities. This makes cooperation easier, whether in the business sector, in working life or in the public sector. It also gives individual people a feeling of security and a sense of belonging, and results in social and political stability. Welfare schemes provide a safety net that reduces risks for the individual, and can make people more willing to be creative and innovative. This situation is positive both for general social development and the Norwegian economy, and is a good starting point for the transition to a low-emission society.

However, Norway will have to deal with a number of challenges in the years ahead. As in the rest of northern Europe, there will be an ageing population in the period up to 2050. This may influence on Norway's prospects of achieving a low-emission transition involving rapid

technological change, and will mean that a lower proportion of the population is in employment.

One of the main challenges for Norway in the time ahead will be to adjust to a new situation where it is more similar to Western economies that do not have oil and gas resources. Growth will have to take place in sectors where there is no economic resource rent. This means that tax revenues will be lower and companies cannot expect as high a return on their capital as in the petroleum sector. Fullfilment of the Paris Agreement , may result in lower demand for energy based on fossil sources and may thus reduce the value of the remaining oil and gas on the Norwegian continental shelf. The value of Norway's oil and gas is also affected by many other factors, including energy demand and the relative costs of developing new energy resources.

The transition to a low-emission society will alter the conditions for business and industry and will require changes in every country, including Norway. The Norwegian economy and business sector have been through major restructuring processes before. The industrial structure has changed radically in the past 40–50 years. Changing economic conditions, including the development of new technology and alterations in demand and competitive conditions, mean that some companies and industries will grow while others become less important. Even though many people will continue in their current line of work, some industries and workplaces will be vulnerable in a global low-emission future. Adaptability will be essential, and people and groups in some areas of the economy are likely to find that they need different qualifications or that there are fewer opportunities for employment.

Norway is pursuing an ambitious climate policy together with the European Union. Norway has undertaken to reduce its greenhouse gas emissions by at least 40% by 2030 compared with the reference year 1990 in cooperation with Iceland and European Union[13]. This is Norway's first contribution to implementation of the Paris Agreement for the period 2021–2030, and the emission reduction target was made legally binding in the Climate Change Act. In October 2019, the European Union, Iceland and Norway formally agreed to cooperate on reducing greenhouse gas emissions by at least 40% by 2030.

On 7 February 2020, Norway updated and enhanced its nationally determined contribution (NDC) under the Paris Agreement, committing to emission reductions of at least 50% and up to 55% by 2030 compared to the 1990 level. Norway is seeking to fulfil its enhanced ambition through its cooperation on climate action with the EU. In the event that Norway's enhanced nationally determined contribution goes beyond the target set in the EU's next NDC, Norway

[13] Norway submitted its enhanced NDC on 7th February 2020, strengthening its target from a 40% reduction to a reduction of 50 % and up to 55 % by 2030 compared to the 1990 level.

intends to use voluntary cooperation under Article 6 of the Paris Agreement to fulfil the part that goes beyond what is fulfilled through the climate cooperation with the European Union.

Through the cooperation with the EU and Iceland, Norway will also take part in EU climate legislation in the period 2012–2030. This will be an important part of the framework for Norway's climate policy and ensure a shift to a low-emission pathway in line with neighbouring countries. Norway has generally close links with the EU, which is our most important trade partner. For example, the Nordic and European power markets are becoming more and more closely integrated, both in regulatory terms through the EEA Agreement and physically as new interconnectors are built to increase transmission capacity between countries. Closer integration between the Norwegian and European power supply systems will increase the value of Norway's flexible hydropower, and make it easier to import electricity in dry years and periods when Norway has an electricity deficit. Power trade and exchange provides flexibility that will be an advantage as the power system is developed further. Cooperation in this field therefore benefits all parties and supports the shift to a low-emission development pathway.

As the world makes progress towards the long-term goal of the Paris Agreement, it will be important to shift production to goods and services that are competitive as the price of emissions rises, stricter regulation of emissions is introduced and consumer preferences change. Companies that are able to produce goods or services with low or zero emissions of greenhouse gases will be the winners in this situation. Technology development, resource efficiency, better use of energy, more use of renewable raw materials and input factors, and circular solutions and waste management will all be important elements in this green transformation. In many industries, a long-term focus on technology development and dissemination will be needed.

Climate change will have impacts in Norway. According to the report *Climate in Norway 2100*,[14] the annual temperature in Norway is expected to rise by 3.3–6.4 ºC, which is more than the expected rise in global mean annual temperature. Other expected changes include higher precipitation, more frequent and more intense extreme rainfall, more frequent rain-induced flooding and more frequent landslides and avalanches. In Svalbard, the mean temperature may rise from minus 8–9 ºC to plus 1–2 ºC by the end of the century if emissions continue to rise at the present rate.[15]

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[14] Norwegian Climate Service Centre (2015): *Climate in Norway 2100* (condensed version of the Norwegian report *Klima i Norge 2100*).

[15] Norwegian Climate Service Centre (2019): *Climate in Svalbard 2100*. This rise is estimated under the RCP8.5 scenario used in the IPCC's Fifth Assessment Report. This is a scenario in which the world as a whole fails to curb growth and reduce greenhouse gas emissions.

In its 2018 report, the Climate Risk Commission assessed both the transition risk for Norway, in other words the risks associated with implementing global climate policy, and physical risks, or the risks associated with a changing climate. The Commission emphasised that global factors are important to a small country like Norway. In its assessment of physical risk, the Commission highlighted the fact that climate change impacts in other countries can pose a risk to the Norwegian economy. As regards transition risk, the Commission pointed out that successful implementation of global climate policy or major technological advances may reduce the value of Norway's remaining petroleum reserves.

However, the Commission concluded that Norway is less vulnerable to climate change than most other countries, and one of the countries with greatest adaptive capacity. Exposure to direct adverse impacts of climate change is generally lower in developed countries than in poor developing countries. In addition, countries like Norway generally have better-functioning institutions, a higher level of education and a more diversified business sector. Higher income levels and flexible labour markets also give greater capacity to absorb the costs of a transition to a low-emission society.

2 A low-emission future

2.1 Norway's climate targets

Clear, ambitious climate targets provide a predictable basis for a low-emission development pathway for the authorities, municipalities, the business sector and individual people. Norway's climate targets for 2030 and 2050 are set out in the Act relating to Norway's climate targets (Climate Change Act). The purpose of the Act is to promote the implementation of Norway's climate targets as part of its process of transformation into a low-emission society by 2050.

Norway has undertaken to reduce its greenhouse gas emissions by at least 40% by 2030 compared with the reference year 1990. This is Norway's first contribution to implementation of the Paris Agreement for the period 2021–2030, and the target was established by law in the Climate Change Act . In October 2019, the European Union, Iceland and Norway formally agreed to cooperate on fulfilling their respective greenhouse gas emission reduction targets by 2030[16]. Cooperating with the EU on climate policy can help to ensure a cost-effective transformation process and equal conditions of competition for businesses in Norway and the EU. The agreement between Norway, Iceland and the EU on cooperation to fulfil the 2030 climate targets means that Norway will not only take part in the Emissions Trading System (EU ETS) but also in action under the Effort Sharing Regulation (for non-ETS emissions)[17] and under the Regulation on land use, land use change and forestry (LULUCF).

In its political platform, the current Government announced that it would draw up a plan for achieving Norway's climate commitments, including action to cut non-ETS emissions within Norway by 45%, once an agreement with the EU on joint fulfilment of climate targets was in place. This target was to be for 2030 and relative to 2005. The Government's aim was to achieve this reduction through domestic measures, and it was making plans to this end. If strictly necessary, Norway could make use of the EU flexibility mechanisms.

The Government's political platform also states that ambitions for cutting non-ETS emissions will be specified by sector, and will include halving emissions from the transport sector by 2030 compared with the 2005 level. This target is based on the assumption that technological advances will be made in various segments of the transport sector. The Government has also

16 The Agreement between the EU, Iceland and Norway relates to the emission reduction target of at least 40 % reduction by 2030. Norway also seeks to fulfil the enhanced target through climate cooperation with the EU.

17 Emissions covered by the Effort Sharing Regulation are largely from transport, agriculture, waste and heating buildings, and also include some emissions from industry and the oil and gas sector.

adopted an action plan for green shipping in which it announced the ambition of reducing emissions from domestic shipping and fishing vessels by half by 2030. In addition, the Government and the agricultural organisations have signed a letter of intent agreeing to work to reduce greenhouse gas emissions and enhance carbon uptake. A target of reducing emissions by 5 million tonnes CO_2-eq has been set for the period 2021–2030.

Norway's target of being a low-emission society by 2050 has been made legally binding in the Climate Change Act. 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 emission reductions of the order of 80–95% from the level in the reference year 1990. In its political platform, the Government has agreed to strengthen the target to emission reductions of the order of 90–95% and to propose that the Parliament amends the Climate Change Act accordingly to reflect this. The effect of Norway's participation in the EU ETS is to be taken into account in assessing progress towards this target. This means that the contribution made by the ETS sector in Norway to emission reductions in Europe through its participation in the EU ETS is to be included when assessing progress towards the 2050 target. The Climate Change Act does not preclude joint fulfilment with the EU of the target of Norway becoming a low-emission society by 2050.

The costs Norway incurs in achieving a particular climate target will depend on technological developments globally. These are uncertain and will depend partly on the extent to which the rest of the world pursues an ambitious climate policy. If most larger countries gradually introduce ambitious climate policies, effective, low-cost technologies to replace energy based on fossil fuels with renewable energy will be developed much more rapidly.

2.2 Everyone is working towards the climate targets

The whole of society must be involved if we are to succeed in the low-emission transformation. Central government, counties and municipalities, the business sector, research institutes, voluntary organisations and individuals all have important roles to play in developing a low-emission society. Although each of us will have to plan our own activities so that they are compatible with a low-emission pathway, cooperation and coordination will be essential to ensure that everyone is pulling in the same direction.

In their policy development, the authorities must use instruments and tools that give incentives consistent with the target of achieving a low-emission society by 2050. In Chapter 1.3 of this strategy, the Government sets out general priorities and important considerations

for developing a policy and policy instruments to promote the transformation to a low-emission society by 2050.

The businesses and industries will play an important part in developing and deploying low-emission technologies and solutions. Business and industry must help to bring about cuts in Norway's greenhouse gas emissions while maintaining high value creation and employment levels. The transformation process will require the business sector to adjust to competing in a low-emission future. Businesses included in the EU ETS will, like businesses in the EU, have to change within a system where very few emission allowances will be issued by 2050 and new allowances will cease to be issued soon after 2050, assuming that the EU continues to maintain the rules for linear reduction of the emission cap. It will therefore be essential to urgently initiate technology development in areas with long timelines for technological change.

Reporting on climate risk can raise companies' awareness of the types of climate-related risks and opportunities they may face. In its 2018 report, the Climate Risk Commission pointed out that it is important for businesses to improve their understanding of climate risk so that they have a stronger basis for decision making and can ensure that investment decisions are more robust in the face of greater uncertainty. The Commission also highlighted how important it is for financial market participants to have a sound understanding of climate risk in different sectors and economic activities.

Business and industry have already begun the process of transformation. Since 2016, 16 sectors have drawn up roadmaps for green competitiveness. These describe each sector's goals, visions and plans for reducing or eliminating greenhouse gas emissions by 2050 while at the same time increasing value creation and assuring employment.

Box 2.1 The Norwegian Process Industries' Roadmap – combining growth and zero emissions by 2050

In 2016, the Norwegian process industries drew up a roadmap describing their vision for developing a competitive sector combined with zero emissions in 2050. The roadmap identifies technologies the sector believes it will be possible to implement by 2050, provided that the sector is operating within a stable long-term and globally competitive policy framework.

These include:

- carbon capture and utilisation (CCU);
- greater use of biomass in processes and products;
- greater use of hydrogen as a reducing agent and energy carrier;
- technological breakthroughs in zero-carbon process technologies such as inert anodes;

- new production methods that use less energy and generate lower emissions;
- utilising by-product streams for new products;
- developing inputs and products that have a low carbon footprint during both production and use.

Source: Federation of Norwegian Industries (2016): *The Norwegian Process Industries' Roadmap – combining growth and zero emissions by 2050* (Summary in English)

The municipalities and counties have wide responsibilities – they provide services, exercise authority and purchase large quantities of goods and services. They also have a substantial property portfolio. Municipal and county authorities are responsible for spatial planning to provide areas that are attractive both to live in and for business development. This means that the municipalities and counties are at the heart of the low-emission transformation process. Their role as planners is particularly important. Almost all decisions municipalities make on the siting and design of commercial activities, homes, infrastructure and services have long-lasting effects on energy use and emissions.

Land-use management by the municipalities influences the capacity of land to absorb and store carbon. Some land-use change, for example deforestation and development of peatlands, will increase emissions from these areas. Unless municipalities ensure that planning for a low-emission development pathway is an integral part of their activities, there is a risk of locking in a high level of emissions for many years, making it difficult and unnecessarily costly to achieve climate targets. It is therefore essential to use a long-term approach in both spatial and general planning processes, take climate change into account, and facilitate a low-emission pathway.

The municipalities and counties are major purchasers of goods and services. They can include requirements relating to the climate and environmental footprint in procurement processes, thus reducing their own emissions and also encouraging the development of zero- and low-emission solutions. For example, since 2017 the City of Oslo has required its own construction sites to be fossil-free, and is now testing whether it can also require them to be emission-free.[18] A number of municipalities have invested in zero-emission vehicles and abatement technology at waste management sites. The counties are partly responsible for public transport services, and have been using requirements in procurement processes to promote the development and use of zero-emission solutions in this field. The Norwegian Public Roads Administration has also been playing a leading role, for example by pioneering the development and testing of new low-emission technologies for ferries.

[18] An emission-free construction site uses energy sources that do not result in emissions of CO_2-eq or NO_x at the site. (From DNV GL (2018): *Guide to arranging fossil- and emission-free solutions on building sites*).

Everyone living in Norway also has a part to play in shaping a low-emission society through their daily choices and activities. The way we get around, the way we live, and the goods and services we buy influence Norway's emissions, and also emissions outside the country's borders. Consumers can promote low-emission solutions by creating a demand for low-emission goods and services. Employees can use their skills in creating a green, competitive labour market. Children and young people who have not yet entered the workforce can use educational and vocational choices to shape their own opportunities. People who are already in the labour force will need to use and expand their skills through new tasks, new jobs or new qualifications.

Voluntary work plays a significant role in Norway. It is an important basis for an inclusive society that maintains the local environment and provides a good quality of life for everyone. The voluntary sector can also play an important part in achieving a low-emission development pathway. Many of the larger organisers of sports and cultural events are leading the way in seeking to make their events as green and sustainable as possible. Sports, neighbourhood and cultural associations and societies often organise systems for lending, swapping and buying second-hand equipment. Voluntary workers are also a vital part of Norway's emergency response. This will become even more important because climate change may increase the risks associated with certain outdoor activities. In addition, the environmental organisations are largely voluntary, and are one of the most important drivers of a low-emission development pathway in Norway. They bring together many voices for climate and the environment, and are able to generate enthusiasm, highlight what is needed and demonstrate solutions.

Box 2.2 Children and young people today – adults in 2050

The Ministry of Climate and Environment invited representatives of children's and youth organisations to a meeting on 11 June 2019 to provide input on what a low-emission society should be like and how to achieve this. They described a low-emission society in 2050 as emission-free, safe and resilient, with innovative local communities and towns. These were the main points:

- *Resources are valuable assets:* we repair things, and share and recycle them.
- *The right choices are easy to make:* there are systems and labelling schemes that encourage and support green behaviour and help us all to make sustainable choices. The municipalities provide systems for recycling, waste separation at source, managing plastic waste, etc.
- *Quality is more important than quantity:* products are manufactured sustainably, quality is high and they are durable.
- *We value nature highly:* we spend more time together in the outdoors. Our local forest and countryside is accessible to everyone, with marked paths.
- *We make green travel choices:* we generally spend our holidays locally, but when we do travel, green modes of travel are easy, attractive and inexpensive to use. There

is infrastructure for cycling, walking and public transport both in and outside towns. All cars are zero-emission, and we use high-speed trains more often than planes. We still travel abroad, but more of our travel and holiday trips are in Norway.

- *We have green jobs:* jobs in the oil and gas sector have not been replaced by jobs in one specific sector – many sectors are involved. We have used Norway's advanced skills and knowledge from the petroleum sector to develop green industries and workplaces, for example in fisheries, shipping and offshore wind.
- *We are generous and show solidarity:* Norway shares its wealth with parts of the world that are exposed and vulnerable to climate change.
- *Our diet is healthy and climate-friendly, and we eat food that is sustainably and locally produced.*

2.3 Norway – a low-emission society in 2050

Norway's transition to a low-emission society will be dependent on a similar shift globally 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. If global emissions in the years ahead do not approach a pathway consistent with achieving the long-term temperature target of the Paris Agreement, the development of low-emission technologies could be slow. This would result in high costs for reducing emissions in Norway, and make it more difficult to achieve Norway's climate targets. At the same time, it would become more urgent to adapt to the effects of a changing climate, such as extreme weather events and flooding, and the costs of doing so will rise. However, if global emissions are in line with the long-term temperature target of the Paris Agreement, emissions in Norway will also be low in all sectors. Considering the uncertainties ahead, the Climate Change 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. The effect of Norway's participation in the EU ETS is to be taken into account in assessing progress towards this target.

Describing the future is always an exercise in uncertainty, regardless of whether we are looking five, ten or fifty years ahead. Descriptions of the future are always based on circumstances at the time when they are made. It is now 30 years till we reach 2050. With such a long time horizon, it is not possible to give a correct or complete picture of what Norwegian society will be like. Even assuming that the world as a whole and Norway have achieved their climate targets by 2050, and that Norway has become a low-emission society, it is uncertain how the remaining emissions will be split between sectors and which technologies will have been successful. There are many other factors not related to the climate policy framework that will also play a part in determining what a low-emission society is like in 2050. These add to the level of uncertainty of descriptions of a low-emission future for the world as a whole and for Norway.

Assuming that by 2050, the global emission pathway is in line with the long-term temperature target of the Paris agreement and that Norway has achieved its climate targets, Norway will be a low-emission society with the following general characteristics:

- Emissions are low in all sectors.
- Forest and other land categories and natural resources are managed sustainably and in a way that promotes removals and minimises emissions of greenhouse gases. Norway's land and water act as carbon sinks and supply the population with materials, food and energy.
- The business sector is green, with low greenhouse gas emissions.
- Cities and communities are designed to minimise greenhouse gas emissions and provide good living conditions for their inhabitants.

Low emissions in all sectors

By 2050, Norway and other countries have achieved low emissions in all sectors. This means that energy and resource efficiency are high and a circular economy underpins low-emission, sustainable production and consumption.

As a result of technological advances, the transport sector is using zero- and low-emission solutions for passenger cars, public transport and heavy goods vehicles. Transport needs have been reduced by developing more compact cities and communities and new digital communication solutions. Passenger and freight transport has been made more effective. Sound land-use planning, greater use of public transport, cycling and walking and new, innovative transport solutions have all played a part in this. There have been similar developments in the shipping and maritime transport sector.

Emissions from goods and products supplied by Norwegian industry are low. This has been achieved by electrification, switching from fossil to renewable raw materials, introducing low- and zero-emission technology and using carbon capture and storage (CCS). Circular value chains are the norm.

The agricultural sector is supplying safe, healthy food, and agricultural resources are being used wisely. Greenhouse gas emissions from agriculture have been reduced and carbon fixation has been enhanced. New technology makes optimal application of fertiliser possible, thus reducing emissions. More widespread use of zero-emission vehicles has reduced the need for based on renewable energy sources, and autonomous vehicles are in use, making farming operations more effective. Manure is used to produce biogas, replacing energy based on fossil fuels in both agriculture and other sectors, and at the same time cutting emissions from livestock. Improvements in breeding programmes and feeding are also reducing emissions

from livestock. These improvements are being enhanced by more sustainable land use, cuts in food waste, new technology and a trend towards a healthier diet with a higher proportion of plant-based foods, all of which reduce greenhouse gas emissions further.

Forests are used sustainably in 2050, increasing CO_2 uptake and storage, and also supply renewable raw materials to replace energy based on fossil fuels and materials. Forest management has been improved to enhance CO_2 removals and to ensure that forests are better adapted to climate change. Use of forest resources is being combined with protection and conservation measures to ensure that forestry is sustainable and that biodiversity and ecosystem services are maintained. A large proportion of felled timber is used for durable products such as building materials, and residues and by-products are valued and used to a much larger extent than today. New technology and business models make it possible to use forest biomass for a variety of purposes, for example to replace soybeans in animal fodder, fish feed, bioplastics and clothes and other textiles. Forests are also an important source of bioenergy, which is replacing energy based on fossil fuels. Effective, sustainable land use and densification of built-up areas has reduced emissions from deforestation, peatland development and other types of land-use change to low levels. Forests are being managed is in a way that gives long-term high levels of carbon removals, strengthens the carbon stock and maintains forests as a source of climate and environmentally friendly energy and raw materials.

A diversified economy and green competitiveness

By 2050, Norway has developed a green business sector by making use of the opportunities offered by a global transition to a low-emission development pathway. High demand for low- and zero-emission technology and low-emission products provides a basis for greening of business and industry. Norway has a diversified economy and a rich natural resource base. Participation in working life is high and the workforce is skilled.

There are many similarities between companies that are succeeding in 2050 and those that were successful before the low-emission transition. They supply products and services that are in demand at competitive prices. And they are able to compete under conditions that favour low-emission solutions, both in Norway and elsewhere.

Business and industry makes widespread use of smart, innovative, green and competitive solutions. Norway's resource base is an important driver of industrial development. Its forests, renewable energy sources and mineral resources provide important inputs for a global low-emission economy. Norway is still one of the world's leading energy nations. Ocean resources play a key role, and the oceans produce food for a growing global population. Norway is also still an important maritime nation, and has industries that supply high-tech low- or zero-emission maritime transport solutions. Nevertheless, the country's most important asset is its highly qualified and skilled workforce.

Climate-smart cities and communities and a high quality of life

Cities and communities are attractive and climate-friendly, provide good, safe living conditions and workplaces and encourage an active, healthy lifestyle. The air is cleaner, and more public transport is available both within and outside towns. In addition, there is good walking and cycling infrastructure.

Norway's cities and communities have been made more attractive by upgrading meeting places and public spaces. Existing public spaces and buildings have been given new life through innovative use. Outside the larger towns, communities have dynamic centres with a good balance between residential areas, commercial activities and workplaces. Footpaths and cycle paths, green spaces and outdoor recreation areas have been combined with easy access to cultural activities, workplaces, school and other activities. Even though it is not possible for everyone to walk or cycle to work and school, zero-emission vehicles and better public transport have more or less eliminated emissions from passenger transport.

Densification of urban areas reduces the need for building on undeveloped land that can instead serve as carbon sinks. This is being done in a way that takes into account the need for green spaces, promotes people's well-being and results in dynamic cities and communities. There has been a focus on energy efficiency in both new and existing buildings, and resources and energy are now being used more efficiently than before.

New technologies and climate-smart solutions are an integral part of everyone's lives, whether they live in the cities or in rural areas. The sharing economy and new business models have made it more normal to lease or rent – for example, people tend to share products and services that are not used all the time, such as cars, holiday cabins, boats and some tools. Products are increasingly designed for durability and to be possible to recycle. They are also designed so that they can be repaired, and manufacturers' business models put more emphasis on repair and recycling. More widespread use of digital communication allows more flexibility in where people work from, reduces the need for transport and gives people more free time.

3 The pathway to a low-emission society

3.1 Strategic priorities for the pathway to a low-emission society

Norway is pursuing an ambitious climate policy, and will continue to do so. The Government's long-term target is for Norway to be a low-emission society by 2050 where resource use is efficient and the business and industry is competitive.

In its political platform, the Government announced its intention of restructuring the Norwegian economy and contributing to Norway's transformation into a low-emission society by mid-century. This process must also result in a development pathway that safeguards biodiversity and builds a sustainable welfare-based society.

To promote the transformation of Norway into a low-emission society, the Government is required to submit updated climate targets to the Storting (Norwegian parliament) in 2020 and every five years after that. These will be based on the best available science and, as far as possible, will be quantitative and measurable. The climate targets are to represent a progression from the preceding targets and promote a gradual transformation in the period up to 2050.

Norway's climate and environmental policy must be designed to ensure that the country achieves its climate and environmental targets. To minimise conflict between climate targets and goals in other policy areas, the use of policy instruments needs to be closely coordinated. The Norwegian Government's climate policy is therefore based on the following:

- *The polluter-pays principle.* Policy instruments should be chosen on the principle that anyone who causes pollution or environmental damage must pay for the damage they cause.
- *Policy instruments must be effective.* Environmental taxes, emissions trading, direct regulation, agreements, information and subsidies must be combined as effectively as possible.
- *Support for technology development.* The development and deployment of environmental technology and climate and environmentally friendly energy technology is important in addressing climate and environmental problems, and can also open up new market opportunities for Norwegian business and industry.
- *Global effects are of crucial importance.* Norway's climate policy instruments must play a part in reducing global emissions.
- *A low-emission society, not a low-income society.* Policy instruments should be designed to achieve environmental targets as reliably as possible and at the lowest possible cost to society. We must make full use of the opportunities offered by a green shift in the economy.

In addition, the target of Norway becoming a low-emission society by 2050 must be taken into account in land-use planning, infrastructure development and public investment.

Using its climate policy principles and its intention of making climate policy progressively stricter as a starting point, the Government will provide a suitable framework for Norway to become a low-emission society by 2050. It will use a variety of tools including monitoring progress towards targets and pricing emissions to promote a low-emission development pathway for business and industry, local government and individuals. Steps to strengthen and adjust climate policy in the years up to 2050 will be in line with the Climate Change Act and in accordance with the Paris Agreement communicate a nationally determined contribution every five years, representing progression beyond its current goals and reflecting the highest possible level of ambition.

Box 3.1 2030 – an important milestone on the path towards a low-emission society

Under the Paris Agreement, Norway has updated and enhanced its nationally determined contribution under the Paris Agreement.to reduce its emissions by at least 50 % and up to 55 % by 2030 compared to 1990 levels.

Norway's first NDC under the Paris Agreement was to reduce its greenhouse gas emissions by at least 40 % by 2030 compared with the reference year 1990. In October 2019, the European Union, Iceland and Norway formally agreed to cooperate on reducing greenhouse gas emissions by at least 40 % by 2030.

Norway is also seeking to fulfil its enhanced ambition through its cooperation on climate action with the EU. In the event that Norway's enhanced nationally determined contribution goes beyond the target set in the EU's next NDC, Norway intends to use voluntary cooperation under Article 6 of the Paris Agreement to fulfil the part that goes beyond what is fulfilled through the climate cooperation with the European Union.

The policy Norway pursues and the choices it makes in the period up to 2030 will be of crucial importance in laying the basis for the transition to a low-emission society by 2050.

Through the climate cooperation with the EU and Iceland, Norway will also take part in EU climate legislation in the period 2021–2030. The EU's climate policy is based on three pieces of legislation: the Emissions Trading System (EU ETS), the Effort Sharing Regulation for emissions that fall outside the EU ETS, and the Land Use, Land-Use Change and Forestry (LULUCF) Regulation.

The EU ETS applies to emissions from installations in industry and the energy supply sector, and to aviation within the European Economic Area (EEA). About half of Norway's total emissions are covered by the system. The ETS sets a joint European cap on emissions, which must not exceed the total number of allowances available. A key mechanism of the ETS is the

annual tightening of the cap. As a result of this annual reduction in the number of emission allowances, the allowances issued in 2030 will correspond to a cut of 43 % in emissions from all the installations included in the system from 2005. If the linear reduction rate for allowances is maintained unchanged after 2030, the number of allowances available for the installations in the system will be reduced to 365 million by 2050. This is about 84 % lower than the volume of emissions in 2005.

The Effort Sharing Regulation applies mainly to emissions from transport, agriculture, buildings and waste, but also to emissions from the oil and gas industry and manufacturing that fall outside the EU ETS. The Regulation is designed to ensure that the non-ETS emissions in the EU as a whole are reduced by 30 % from 2005 to 2030. Each country is assigned a binding national target to reduce its emissions by between 0 and 40 % between 2005 and 2030, depending on its GDP and taking cost effectiveness into account. The Regulation translates this commitment into binding annual greenhouse gas emission targets for each country for each year in the period 2021–2030. Countries may choose to achieve their targets by reducing their own emissions or through cooperation with other European countries.

The LULUCF) Regulation applies to the following land accounting categories: managed forest land, afforested land, deforested land, managed grassland, managed cropland and managed wetland. If emissions are higher than removals nationally, the accounted net emissions must be offset in one of three ways (the 'no-debit' rule): 1) by purchasing LULUCF credits from other EU/EEA countries; 2) by a corresponding extra reduction in emissions under the Effort Sharing Regulations, either nationally or 3) by purchasing emission allowances from another country's annual emission allocation under the Effort Sharing Regulation. If removals exceed emissions in a country, a small share of the net removals can be used to meet the country's commitment under the Effort Sharing Regulation. Each country must also calculate a reference level for managed forest, in practice the level of harvesting in the period 2021–2030. If the actual quantity harvested is higher than the reference level, this is accounted for as emissions. A lower level of harvesting is accounted for as removals. A compensation mechanism that can be used under certain conditions has been established for countries where emissions from managed forest land exceed removals. This allows countries to increase the level of harvesting above the reference level having to account for the difference as emissions.

Norwegian participation in the EU ETS has been part of the EEA Agreement since 2008. Once an agreement on joint fulfilment is concluded with the EU, Norway will also take part in efforts to reduce emissions under the two regulations on non-ETS emissions. This means that Norway will participate in EU efforts to cut emissions on the same lines as the EU member states. Under the Effort Sharing Regulation, Norway will be allocated a target of reducing non-ETS emissions by 40 %. Like the EU member states, Norway will have an obligation to comply with the no-debit rule for the LULUCF sector. This agreement will be included in

Protocol 31 of the EEA Agreement, and Norway will only be bound by the two regulations for the period 2012–2030.

The agreement with the EU sets out the scope of Norway's 2030 target of reducing emissions by 40 % compared to 1990 levels, but it is up to the Storting and Government to determine how they are to be achieved. The agreement does not preclude emission cuts exceeding those Norway undertakes through its participation in the EU climate legislation. For example, the Government's political platform sets out the ambition of reducing Norway's non-ETS emissions by 45 % by 2030 relative to 2005. The Government intends to achieve this through domestic emission reductions, and it is making plans to this end. If strictly necessary, Norway can make use of the EU flexibility mechanisms. This ambition will entail voluntary strengthening of Norway's commitments for non-ETS emission reductions beyond those in the agreement with the EU on joint fulfilment. will draw up a plan for achieving Norway's climate commitments once an agreement with the EU on joint fulfilment is in place In this connection, the Government has commissioned a review by several government agencies of mitigation measures that can bring about reductions of at least 50 % in non-ETS emissions by 2030.

3.2 A climate policy that results in a low level of emissions in all sectors

3.2.1 It must pay off to cut greenhouse gas emissions

Putting a price on emissions is consistent with the polluter-pays-principle. This approach encourages a shift to more climate-friendly production and consumption. The main instruments of Norwegian climate policy are therefore taxes and emissions trading, which are cross-sectoral economic instruments. More than 80 % of Norwegian greenhouse gas emissions are currently subject to the CO_2 tax, included in the EU ETS, or both. Cross-sectoral economic instruments affect all stakeholders, and give incentives to develop and deploy new technologies. Both current and anticipated prices of emissions will influence how individuals and companies adapt and the decisions they make.

Policy instruments used in addition to taxation and emissions trading are direct regulation, standards, agreements and grants for emission reduction measures. These instruments also provide incentives for research and development of low-emission technology. Direct support for technology development is also provided.

Putting a price on emissions – the Emissions Trading System

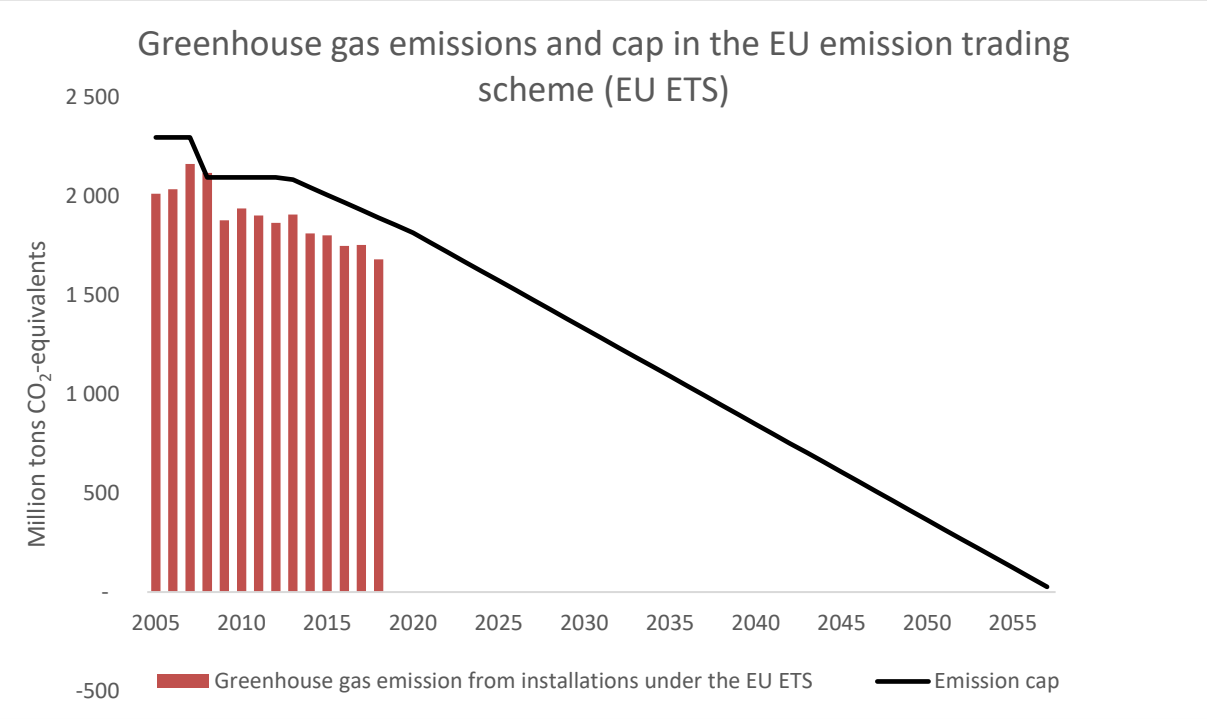
The manufacturing and petroleum sectors in Norway will continue to develop within the framework of the EU Emissions Trading System (EU ETS). Norway has been part of the EU

ETS through the EEA Agreement since 2008, and this is crucially important for achieving the country's climate targets. According to the Climate Change Act, the effect of Norway's participation in the EU ETS is to be taken into account in assessing progress towards its 2050 target. This means that the contribution made by Norwegian companies to emission reductions in Europe through their participation in the EU ETS will be included in assessments of progress towards the target.

Through the annual reductions in the number of allowances issued, the EU ETS will ensure substantial cuts in emissions. After 2020, the annual reduction in the number of allowances will correspond to almost 50 million tonnes CO_2-eq. If the linear reduction rate is maintained after 2030, the number of allowances available will drop from 2 billion in 2013 to 365 million in 2050. This is a reduction of about 86 % from 1990. The steady reduction in the number of allowances available will drive emission reductions in sectors covered by the EU ETS, both in the EU and in Norway.

The dwindling number of allowances available will mean that installations in the ETS sector have to make deep cuts in their emissions by 2050. Even if the European power supply system is entirely decarbonised, other ETS sectors will also have to reduce their emissions. If the EU ETS continues after 2050 with the same linear reduction rate for the cap, the number of emission allowances issued for manufacturing, the petroleum sector and electricity production will be reduced to zero soon after 2050.

Figur 3.1 Emissions and emissions cap in the EU ETS



The figure shows actual greenhouse gas emissions from installations in the EU ETS from 2005 to 2018 (bars). The green line shows the number of emission allowances available from 2005 onwards (the cap), assuming that the linear reduction rate remains unchanged after 2030.

Source: Ministry of Climate and Environment

Putting a price on emissions – taxation

Norway introduced a CO_2 tax in 1991, and was one of the first countries in the world to do so. Since then, taxation of greenhouse gas emissions has been one of the main instruments of Norwegian climate policy. About 66 % of Norway's total greenhouse gas emissions and 67 % of its non-ETS emissions are now taxed. The tax applies to almost all use of fossil fuels that is not covered by the EU ETS.

If the tax is set to give the same carbon price for all emissions, the incentive to reduce emissions is the same across the board. This makes it easier to achieve specific targets at the lowest possible cost to society. In some cases, Norway has applied reduced tax rates and exemptions from the carbon tax. However, n the last few years, a number of the reduced tax rates and exemptions have been removed. The standard carbon tax rate has been raised gradually, and was NOK 508 per tonne CO_2-eq in 2019.

Raising taxes gradually over time provides a stable and predictable economic framework, and promotes the development of markets for new low- and zero-emission technologies. The design of instruments for pricing emissions will be developed further over time.

Regulatory measures

A number of general and sector-specific acts, which vary in purpose, are used to regulate greenhouse gas emissions in Norway today. The most important of them are the Pollution Control Act and the Planning and Building Act.

Regulation can ease the transition to a low-emission society provided that regulatory measures are designed to avoid unsound investments and lock-in of solutions that result in high emissions.. Examples of direct regulation include technical requirements for buildings, biofuel quota obligations for road traffic, regulation of methane emissions from waste treatment and the prohibition of new cultivation in peatland areas.

Direct regulatory measures for greenhouse gas emissions are often used in combination with and to supplement other instruments. A recent example is a prohibition on using mineral oil to heat buildings from 2020, which is being supplemented with grants for the switch to renewable forms of heating and the removal of oil tanks.

Application of the Pollution Control Act can be adapted to different industries, and in combination with funding instruments for the research and innovation sector and any other general policy instruments, this can encourage technology development and cuts in emissions. For example, emissions of nitrous oxide from fertiliser production and diffuse emissions from the petroleum industry have been regulated under the Pollution Control Act. The Act supplements the general economic instruments such as emissions trading and taxes.

3.2.2 A low-emission development pathway must be just and equitable

Most people's lives will improve in a low-emission society. However, this does not mean that the transition will be without consequences. Through the Paris Agreement, Norway has recognised the importance of ensuring that climate policy supports a low-emission development pathway that is just and equitable for all. Norway has also endorsed the Guidelines for a Just Transition adopted by the International Labour Organization (ILO).[19]

These guidelines outline key elements of a just transition, including:

- Social protection for people who are adversely affected by the green transition and support for a green transition in the business sector.
- Skills development for everyone.
- A green transition based on social dialogue.

A major part of the labour force in Norway is employed in public or private entities that will only to a limited extent be directly affected by the transition to a low-emission society. The qualifications they need may change, but people who are employed for example in the health and care sector will mainly be affected by other processes of change in the years up to 2050. However, some sectors will be more directly affected by a low-emission pathway and will face a higher transition risk. Restructuring will be more challenging for these sectors.

Norway has a number of mechanisms that provide good support for restructuring of the labour market. The tripartite cooperation between employers, trade unions and government is of fundamental importance for dealing with various types of challenges. An important element of this cooperation is to ensure that employees in sectors that are going through restructuring have a safety net and that people have opportunities to develop new skills and acquire new qualifications. It is also important that the education system and continuing training programmes put people in a position where they can find jobs in the labour market in a future low-emission society. In its policy platform, the Government stated that it will pursue a skills policy that helps people to develop the knowledge and skills they need to stay in work as new restructuring needs arise and to obtain new jobs in a changing labour market. This will also provide a good basis for a just and equitable transition to a low-emission society.

[19] International Labour Organization (2015): *Guidelines for a just transition towards environmentally sustainable economies and societies for all*

Knowledge is the key to continuing the development of new, green, competitive jobs and a better, more effective public sector. Research and higher education is therefore a crucial area in the development of a sustainable society. The Government presented its long-term plan for research and higher education for the period 2019–2028 in a white paper in October 2018 (Meld. St. 4 (2018–2019)). This constitutes part of the Government's efforts to facilitate growth in overall value creation, create new profitable jobs, restructure the Norwegian economy and implement the transition towards a greener society. The long-term plan includes expansion of targeted research and education initiatives and greater research efforts for the transition to a low-emission society. As part of this process, the Government will give priority to developing technology and solutions for the transition to a greener society, strengthen research and higher education that can increase understanding of climate change and lay a foundation for successful climate change adaptation, and strengthen research and higher education to further develop an integrated, knowledge-based public administration that safeguards considerations relating to climate and the environment.

A just and equitable transition to a low-emission society is an inclusive process involving all parts of society. Everyone must be included, from individuals to civil society organisations. One of Norway's overall political goals is to increase participation in civil society organisations and voluntary work. Because of its importance in Norwegian society, the Government will encourage even more involvement in climate and environmental issues across all types of voluntary organisations and societies.

Today's children and adolescents will be adults in the low-emission society of 2050. Their mobilisation across the country in the spring of 2019 demonstrated a strong engagement and sense of responsibility for their own future. Children's and young people's organisations are already included in public consultations so that their views can be reflected in policy development. The Norwegian Children and Youth Council has been represented in the Norwegian delegation to the international climate negotiations under the Climate Change Convention for several years already. It will be important to maintain this practice as the Paris Agreement is implemented, since the climate negotiations will be the most important arena for ensuring that countries are delivering the contributions they have submitted.

Access to information is an essential basis for participation in decision making. Norway's website miljøstatus.no provides quality-assured information on the state of the environment and environmental trends in Norway, and includes information on climate change for individuals, schools and other groups (some of the information is available in English, see environment.no). A number of government agencies cooperate in providing the information: the Norwegian Radiation and Nuclear Safety Authority, the Directorate of Fisheries, the Institute of Marine Research, the Norwegian Coastal Administration, the Norwegian Food Safety Authority, the Norwegian Polar Institute and the Directorate for Cultural Heritage. The

municipalities also have an important role to play in ensuring that people have access to local information on climate change and the low-emission transition.

3.2.3 Enhancing the knowledge base for Norway's long-term climate policy

Climate policy must be based on the best available science. A sound knowledge base is important not only as a basis for implementing policy as effectively as possible, but also because it helps to reduce uncertainty and puts people in a better position to deal with climate risk. The Climate Risk Commission also highlighted this in its report to the Government.[20]

Climate policy instruments must be developed on the basis of up-to-date knowledge on what is needed to achieve agreed targets. What appears to be a sensible and effective policy in the short term is not always the option that will result in a low-emission development pathway in the long term. Moreover, decisions made now may lock in persistently high emissions and thus prevent Norway from achieving its 2050 target. Analyses of how policy, instruments and measures should be designed to promote a low-emission pathway up to 2050 are therefore extremely important.

One of the next steps will therefore be to initiate a 2050 assessment that analyses measures and instruments for achieving Norway's climate target for 2050. The main purpose will be to develop a sound scientific basis for a framework for a long-term low-emission development pathway in relevant sectors in Norway, in line with its 2050 target.

The analysis will outline pathways towards a low-emission society and choices that can be made to promote a low-emission pathway up to 2050. It is important to develop a sound scientific basis that evaluates restructuring needs and possible solutions, and assesses barriers and costs. Climate risk will be considered where relevant. The Government is promoting the development of zero- and low-emission technology. Some of this work will take place outside Norway. The availability of zero- and low-emission technologies and the costs of their deployment will be important considerations. The analysis will therefore include an overview of technology trends, costs and opportunities internationally.

The analysis must also identify cross-sectoral issues. This applies particularly in areas such as sustainable, integrated land-use management, energy, and a just and equitable transition involving various sectors. It will also be crucially important to analyse the roles of different stakeholders in the transition to a low-emission society. These include central government, counties and municipalities, the business sector including the financial industry, and civil

[20] NOU 2018: 17 Summary *Climate risk and the Norwegian economy*

society. The importance of Norway's relationship with the EU in the period up to 2030 must also be considered.

The transition to a low-emission society in 2050 will affect every part of society. The preparation of the analysis will be an inclusive process, and broad-based public debate will be encouraged. Business and industry will be involved in various ways, including follow-up of the roadmaps various sectors have drawn up for a low-emission transition. These roadmaps describe how different industries can achieve zero emissions by 2050 while at the same time maintaining growth and jobs in Norway.

3.3 Climate-smart towns and communities, and spatial management in line with a low-emission development pathway

Sound social planning and spatial management is important for social development generally and for the development of a low-emission society in particular. Decisions about siting, construction methods and design for buildings, infrastructure and services can influence emissions and energy use for many years into the future. It is therefore vital to start taking the target of transforming Norway into a low-emission society by 2050 into account from now onwards. This will be relevant when making decisions that directly affect land use, such as the construction of roads and cabins, urban development, and the conversion of agricultural land for other purposes. However, it is important to remember that many different interests must be taken into account in spatial planning, including the development of urban areas.

The Planning and Building Act is intended to promote sustainable development in the best interests of individuals, society as a whole and future generations. Within this framework, it allows for climate change to be taken into account in planning a transition to a low-emission society. The Act allows for high priority to be given to local solutions in planning processes. Planning under the Act requires a balance to be found between a number of different, important interests. One factor that will determine how strongly planning processes promote the transition to a low-emission society will be the weight given to considerations of climate change. If plans under the Act are in conflict with national or significant regional interests, the relevant authorities may raise objections to them. This system is designed to ensure that national and significant regional interests are taken into account in local planning. Sound, clear guidance is vital to ensure that municipalities integrate climate considerations into their planning. The Government has therefore adopted central government planning guidelines for municipalities and counties. Two of these documents are particularly important for sustainable land use and climate-smart towns and communities:

- *Central Government Planning Guidelines for coordinated housing, land-use and transport planning*, which highlight the importance of coordinating development

patterns and transport systems. They encourage the development of compact towns and urban areas and steps to promote green forms of transport. They also include guidance for finding a balance between different interests when designing towns and urban communities. In addition, they are intended to play a part in reducing transport needs and the conversion of cultivated and environmentally valuable areas for other purposes.

- *Central Government Planning Guidelines on climate and energy planning and climate change adaptation*, which are intended to facilitate action by municipalities, counties and central government agencies to reduce greenhouse gas emissions and promote a green energy transition through planning processes and otherwise when exercising authority. The guidelines also set out requirements for active climate and energy planning at local level that promotes and plays a part in reducing greenhouse gas emissions and in the green energy transition.

Climate and energy planning is now part of planning processes in the vast majority of municipalities, but there are wide variations in how it is organised and how actively the municipalities use their plans. Some municipalities have a separate climate and energy plan, while others have chosen to integrate climate and energy planning into overall planning processes. A few municipalities, including Hamar and the cities of Bergen and Oslo, have in addition established local carbon budgets, and municipal bodies report on progress towards targets. The Norwegian Environment Agency provides guidance, draws up greenhouse gas emission statistics for municipalities and counties, and has developed a tool for calculating the effects of different mitigation measures on emissions.

The transport sector will be important in Norway's transformation to a low-emission society. The white paper *Norwegian National Transport Plan 2018–2029* (Meld. St. 33 (2016–2017)) sets out the financial framework for central government investments in the transport sector. It is intended to bring about reductions in greenhouse gas emissions from the transport sector that are consistent with Norway's transformation to a low-emission society, and to reduce other adverse environmental impacts. Other important elements of the plan include phasing in new technology, the development of infrastructure for zero-emission vehicles, and tax policy. The Government's initiatives for freight transport; for public transport, walking and cycling; and for green shipping should also reduce emissions from the sector. Norway's electric vehicle policy has already reduced average greenhouse gas emissions from passenger cars. About 8 % of passenger cars in Norway were electric by the first quarter of 2019. The Ministry of Climate and Environment tasked Enova with establishing a zero-emission fund, which was launched in summer 2019. This is a funding instrument including several types of grants to reduce emissions from commercial transport through effective deployment of zero-emission solutions.

Integrated urban land-use and transport agreements involving central government, county and municipal bodies are being negotiated for Norway's largest urban areas. So far, only the agreement for Trondheim and its surroundings has been concluded. These agreements are intended to play a part in achieving the target of zero growth in passenger car traffic for the largest urban areas, and to ensure coordination of land-use planning and the development of public transport and pedestrian and cycle paths.

Box 3.2 The '*Klimasats*' grant scheme

The *Klimasats* grant scheme was established in 2016 and provides support for municipal and county projects. Funding is used to bring about cuts in emissions, increase awareness of possible mitigation measures and increase demand for climate-friendly goods and services.

Grants are available in the following five areas under the *Klimasats* scheme:

- climate-friendly land-use and transport planning;
- investments in climate-friendly transport measurers;
- mitigation measures in other sectors;
- conceptual studies of mitigation measures – help to move from words to action;
- networking to build expertise and share experiences.

Source: Norwegian Environment Agency

1.1.1 Sustainable, integrated spatial management in line with a low-emission development pathway

Patterns of land use develop largely as a result of small-scale decisions, each of which on its own would not have major consequences, but that in combination may result in negative impacts on climate and environment. In making decisions on land use, it is necessary to find a balance between different interests such as food production, infrastructure, climate change, biodiversity and ecosystem services. It is important to avoid decisions that will shift problems elsewhere; for example, measures to reduce deforestation in one area should not result in the development of other carbon-rich areas or areas that are valuable for food production or biodiversity.

Box 3.3 Government expectations for regional and municipal planning 2019–2023

Every four years, the Government publishes its expectations for regional and municipal planning as a means of promoting sustainable development throughout the country. The counties and municipalities must use them as a basis for work on regional and municipal planning strategies and plans, and they also apply to central government participation in these planning processes.

In the latest document, the Government has chosen to focus on four major challenges:

- creating a sustainable welfare society;

- creating an ecologically sustainable society through an active climate policy and responsible resource management;
- creating a socially sustainable society;
- creating a safe society for everyone.

Regional and local authorities have key responsibilities in addressing these challenges. This applies to all counties and municipalities, regardless of their size and expertise. Planning is one of their most important tools in this work.

Source: *National expectations regarding regional and municipal planning 2019–2023*

In order to reduce development of new areas and land conversion, it should be a priority to use areas that have already been developed efficiently and sustainably. It is therefore important to ensure that different land categories are kept in good condition so that their value is maintained or enhanced and they are of benefit to society.

A clearer national approach to land use policy will make it easier to develop an integrated, effective policy based on coordinated evaluation of all land use and to find a balance between different interests and factors that local decision-makers have to take into account. It is important to make an assessment of how a sustainable, integrated spatial management policy can be designed to promote a low-emission development pathway in line with the Paris Agreement and Norway's climate target for 2050.

The agreement between Norway, Iceland and the EU to cooperate on fulfilment of the 2030 climate targets entails an obligation for Norway to ensure that emissions from the LULUCF sector do not exceed removals in 2030. The assessment of land use policy mentioned above could therefore include consideration of how a climate and land use target for 2050 can support a sustainiable and holistic land use management.

3.4 A diversified economy and green competitiveness

3.4.1 Innovation and technology development to find low-emission solutions

Developing a green, competitive low-emission society that creates value and provides workplaces in Norway will require business and industry to focus on low-emission solutions and a robust research and innovation system that can support initiatives all the way from basic research to the market. Knowledge, skills, research and innovation are an essential basis for maintaining an innovative, competitive business sector in Norway. Research and technology development to promote the shift to a greener society is a very high priority and an important element of the Government's long-term plan for research and higher education 2015–2024 (Meld. St. 4 (2018–2019)).

Box 3.4 The Government's action plan for green shipping

Norway is a world leader in the green transition for all shipping segments, but the pace of change must be increased substantially to achieve its ambitions. Norway is already in a leading position globally as regards the deployment of zero- and low-emission technology in the maritime sector. By 2022, more than one third of the country's car ferries will use electric propulsion systems. The *Yara Birkeland* is due to be launched in 2020, and will be the world's first autonomous fully electric container vessel. The grocery wholesaler ASKO is planning to use autonomous vessels for emission-free transport of goods across the Oslofjord. The first hydrogen-powered car ferry will be put into operation in Norway in 2021, and this may prepare the way for longer range emission-free shipping.

- The Government's ambitions are to reduce emissions from domestic shipping and fishing vessels by half by 2030 and to promote the development of zero- and low-emission solutions for all vessel categories.
- The Government will take steps to encourage the emergence of Norwegian winners during the green transition in the shipping sector, and will play a part in developing a sustainable shipping sector for the 21st century.
- The Government will provide a framework that enables the Norwegian maritime industry to acquire experience and expertise that will put it in a good position to be an important supplier for the forthcoming restructuring of the domestic and global shipping sector.

Source: *The Government's action plan for green shipping*, 2019

One of the world's most promising technology markets at present comprises climate, environment and energy technologies. Norway is in a good position to succeed in several areas of these markets. Norway has a well-developed business sector, strong knowledge clusters and good educational and training opportunities in areas such as energy and materials technology, carbon capture and storage (CCS), forestry and agriculture, green shipping technology, waste management and recyling, environmental monitoring and green buildings. In addition, Norway has for many years had strict environmental legislation and has applied effective policy instruments to control greenhouse gas emissions. This situation promotes improvement, development and a restructuring.

In many areas, low-emission solutions are gaining market shares and resulting in wealth creation and jobs. Global climate policy is expected to be made steadily stricter, and this is having a positive effect on willingness to invest in low-emission solutions in various business sectors. Investment in research, development and commercialisation of low-emission solutions is vital, and needs the support of society as a whole. Over time, the Government has scaled up and enhanced research efforts for Norway's transformation to a low-emission society, and it will give priority to technology and solutions for the shift to a greener economy. However, Norway on its own will not be able to develop all the low-emission

solutions that it needs. A small country like Norway also needs to make use of and adapt to technological developments that are taking place internationally.

The Government presented its strategy for green competitiveness in 2017. Its aim is to support a green transition that increases value creation in Norway. One of the main priorities in efforts to strengthen Norway's green competitiveness is to develop targeted initiatives for and focus special attention on climate and environment in publicly-funded research, innovation and technology development, wherever relevant.

Box 3.5 Principles of green competitiveness

The Government set out certain principles of green competitiveness in its strategy:

- the authorities must provide a predictable framework and act as a driving force in Norway's transition to a low-emission society;
- the polluter must pay as part of an integrated policy to promote green competitiveness;
- Norway's target of being a low-emission society by 2050 must be taken into account in planning and investment processes;
- there must be targeted initiatives for and a special focus on climate and environment in publicly-funded research, innovation and technology development wherever relevant;
- the public sector as a customer must support the adoption and development of new environmentally friendly technologies, products and solutions;
- the necessary information must be available to enable consumers, the business sector and investors to choose green solutions and products;
- green competitiveness must be based on well-functioning markets.

Source: *Better growth, lower emissions – the Norwegian Government's strategy for green competitiveness*, 2017

Norway has a broad set funding agencies that promote the development of climate and environmental technology and green competitiveness. The most important of these are Enova, Innovation Norway, the Research Council of Norway and the SkatteFUNN tax incentive scheme.

Enova supports technology and market development that can play a part in the transition to a low-emission society. It runs various programmes that provide investment support and risk reduction for businesses that are developing and testing new solutions or that wish to make use of new technology. The aim is to promote permanent change in the market for new energy-efficient and climate-friendly solutions that will have a place in a low-emission society. Enova's goals are to promote:

- reductions in greenhouse gas emissions that will contribute towards Norway's emission reduction commitment for 2030;
- greater innovation in energy and climate technology that is adapted to the transition to a low-emission society;
- improved security of supply through flexible and efficient use of energy and peak load capacity.

Some of the changes that will be needed depend on technology and solutions that may take years to develop. Companies therefore need considerable willingness to invest and take risks. Funding from Enova reduces the risk for businesses and makes it more likely that new solutions will be developed and deployed. Enova provides support both to help technology initiatives to make the transition from the pilot phase to market introduction, and to promote permanent market change.

Box 3.6 Gassnova

Gassnova is a state-owned enterprise working in the field of carbon capture and storage. Its main task is to promote the development of technology and expertise for cost-effective, innovative CCS solutions. Gassnova is playing a key role in maturing the full-scale CCS project in Norway.

Innovation Norway's main task is to promote business development that is profitable in both business and socio-economic terms, and to unlock the potential for business development in different regions of the country. Innovation Norway administers the environmental technology scheme, which promotes the development of green solutions. The scheme encourages sustainable business and industry in Norway by providing grants for pilot and demonstration projects based on environmental technology.

The Research Council of Norway is charged with generating value added in the research system through the achievement of research that could not otherwise be realised by the various stakeholders on their own. Its mission is to promote an integrated research and development system that supplies high-quality research, develops knowledge that can be used to address major social and industrial challenges, encourages dynamic national and international collaboration, and creates a framework for learning, application and innovation.

The Resarch Council channels funding through research programmes, which issue calls for proposals at regular intervals. Most of its current research activity related to low-emission technologies is in the energy field, primarily renewable energy, energy efficiency and CCS.

The Research Council also administers the SKATTEfunn tax incentive scheme, a rights-based scheme that provides tax deductions for all businesses engaged in R&D.

To promote green competitiveness through research, innovation and technology development, it is important to ensure good coordination between public agencies in the research and innovation system. A good example of this is the PILOT-E scheme, which involves collaboration between Innovation Norway, the Research Council and Enova. The objective of the scheme is to speed up the development and deployment of novel products and services in the field of environment-friendly energy technology as a way of promoting the low-emission transition both in Norway and internationally.

Box 3.7 "Nysnø" Climate Investments

Nysnø was established in December 2017 and began operating in autumn 2018. Its purpose is to make profitable investments in new, climate-friendly technology that directly or indirectly helps to reduce greenhouse gas emissions. Its investments largely target new technology at the transition stage from development to commercialisation. It focuses mainly on companies in early phases of development, but can also make follow-up investments in later phases. Nysnø invests in companies that are not listed on the stock market and/or funds that target such companies, and that operate in or from Norway.

3.4.2 Investment for a low-emission development pathway and assessment of climate risk

To achieve the world's climate targets, it will be necessary to make both public and private investments more sustainable, especially investments in infrastructure and other long-term investments. This is recognised in the Paris Agreement, where one of the aims is to make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. In its 2017 report *Investing in Climate, Investing in Growth*, the OECD pointed out that investments in emission-intensive solutions today can make the transition to a low-emission future both costlier and more difficult. The world cannot rely on finding new finance flows to fund a low-emission future. Already existing finance flows must therefore be used for investments that will promote a low-emission pathway, not prevent it.

Box 3.8 Roadmap for the financial sector

In June 2018, Finance Norway published its *Roadmap for Green Competitiveness in the Financial Sector*. This is intended to point the way towards a profitable and sustainable financial sector in 2030. It includes a number of general and industry-specific recommendations for the financial industry and for the authorities. The roadmap demonstrates that the industry is aware of its role in the transition to a low-emission economy. One of its key recommendations is that the financial industry should contribute to innovation and change in other sectors. Finance Norway points out that as a lender, insurer and investor, the financial

sector can be a good partner and driver of change in other industries, through both pricing and cooperation. The roadmap therefore recommends that the financial sector should work more closely with other industries such as construction, the process industries and the oil and gas industry to identify potential improvements and financing needs. It also recommends intensifying work on active ownership, both individually and collectively, for example through dialogue with companies' boards and management, voting at general meetings, and cooperating with asset managers. Finance Norway points to the need to increase expertise and understanding of climate risk in the industry, and states that this change can be made more quickly and effectively if directors and management have the necessary knowledge. In a survey of Norway's major financial institutions, the Norwegian Climate Foundation found that climate risk is on the agenda of the management and board of most institutions, and that most of them are taking steps to build up their employees' expertise in this field.

Source: Finance Norway, 2018. *Roadmap for Green Competitiveness in the Financial Sector*

The global perspective of the report is also relevant to Norway, both for private and public investments within the country and for private investments outside Norway. Hydropower and water supply infrastructure, roads and buildings are infrastructure types that have a long lifetime in Norway. Decisions on these kinds of investments are made every day at various levels and by a variety of stakeholders. It is therefore vital to ensure proper assessment of how a low-emission development pathway will affect the viability of and risks associated with long-term investments in both the private and the public sector, and to find suitable responses. Assessments of this kind reduce the risk of making unsound investments.

In its 2018 report[21], the Climate Risk Commission identified some general principles that can improve the way society manages climate risk. They include ensuring that there is a sound framework for assessments and decisions and that analytical processes are broad-based and integrated. On the basis of these principles, the Commission drew up recommendations for both the private and the public sector.

The Norwegian Government considers sound information and analyses, good decision-making processes and the right incentives as an important basis for sound management of climate risk in both the private and the public sector. Obtaining more information and knowlege on climate risk can be useful for both sectors.

The Government plans to provide an overview of efforts to identify and reduce climate-related risks in the next white paper on long-term perspectives on the Norwegian economy. The annual budget documents will include an update on the status of this work. The

[21] NOU 2018: 17 Summary *Climate risk and the Norwegian economy*

Government intends to follow up the recommendation by the Climate Risk Commission to stress test Norway's public finances and national wealth. In this connection, scenarios for oil, gas and carbon prices will be established, including a scenario reflecting the objectives of the Paris Agreement.

The Climate Risk Commission recommended the preparation of central government guidelines on climate risk to improve the decision-making system for the public sector. The Government agrees that as climate-related risks become apparent, they must be taken into account in assessments of public policies and measures and must be considered in conjuunction with other forms of risk and the framework used for risk management generally. The Government will review existing guidance on economic analysis for the most relevant sectors and consider whether climate risk is adequately taken into account, given the Commission's recommendation.

One important recommendation by the Commission is that Norwegian companies should use the TCFD framework for climate-related financial disclosures. The Government agrees with the Commision that the TCFD's recommendations provide a useful framework for reporting on climate-related risk. Large Norwegian companies should report in line with the TCFD framework. The Government will consider the Commission's recommendation that a suitable framework should be established for disclosure of climate-related risks in the public sector and at national level. This could be a way of making assessments of climate risk as comparable as possible across sectors. At the same time, stricter requirements for reporting must be weighed up against the increase in costs this will involve.

Many tools for assessing climate risk are available to the municipalities. The Government will evaluate whether the municipalities are take sufficient account of climate-related risks in their spatial planning processes.

3.4.3 Public procurement

The Norwegian public sector procures goods and services worth more than NOK 500 billion every year. This includes everything from major investments such as ferry services and buildings to purchases of office supplies. The organisation of public procurement is intended to ensure effective use of resources in the public sector. Public procurement is also a tool for achieving climate and environmental targets and has implications for the development of a low-emission society. The public sector can in some connections promote innovation and development in the supplier market by creating a demand for new solutions.

New climate- and environment-friendly goods and services are being developed rapidly, and the Government wishes public procurement to be used as a driver of innovation and transformation in the Norwegian economy.

National, county and municipal authorities and bodies governed by public law are required to organise their procurement activities in such a way that they reduce harmful environmental impacts and promote climate-friendly solutions where relevant. They can do this by including environmental criteria and conditions at various stages of a procurement process. If purchasers choose to include an environment-related award criterion, it should as a general rule be given a weighting of at least 30 %. This gives suppliers a clear signal that environmental considerations are an important element of the procurement process.

Although there are legal requirements for public bodies to reduce the environmental impacts of their activities and promote climate-friendly procurement solutions, this is an area where the authorities themselves consider that they can do much more. Analyses by the Agency for Public Management and eGovernment indicate that there is a substantial potential for improvement as regards including environmental considerations in procurement processes, ensuring adequate levels of knowledge and expertise in organisations, and implementing procurement processes. To increase the proportion of green public procurement, it is important to build up expertise on how to include climate and environmental considerations in procurement processes, ensure that procurement strategies are a management responsibility, and make practical guidance easily available. It is also important that the environmental provisions of the procurement legislation are supplemented with a procurement policy that clarifies the areas where climate and environmental considerations have priority. Clear long-term priorities make public procurement more effective and provide a more predictable business climate. The Government will prepare an action plan to put a green procurement policy into practice and thus increase the proportion of green public procurement and green innovation processes.

Box 3.9 National Programme for Supplier Development

The National Programme for Supplier Development was set up to promote innovation in public procurement. Innovative procurement involves making use of the opportunities offered by the procurement legislation and policy instruments to buy better products and services. The purpose is to make services better and more effective, create industrial growth and reduce emissions. The National Programme for Supplier Development is a driver of innovative procurement by contracting authorities at central and local government level. The Confederation of Norwegian Enterprise, the Norwegian Association of Local and Regional Authorities, the Agency for Public Management and eGovernment, Innovation Norway and the Research Council of Norway are responsible for the programme. The Confederation acts as project manager and provides a secretariat. Since it started in 2010, the programme has assisted local and central government bodies with more than 150 procurement processes and developed methodology for innovative public procurement.

Source: innovativeanskaffelser.no

The Government will consider whether key bodies responsible for climate and environmental work and public procurement, including the Agency for Public Management and eGovernment can develop tools to identify the effects and costs of including environmental requirements in public procurement processes. This could promote a general, coordinated build-up of expertise and help public bodies to carry out good, effective green procurement processes.

3.5 Norway's contribution to a low-emission development pathway in other countries

Climate change is a global problem, and a global low-emission development pathway will only be possible if all countries do their part. It is clearly in Norway's interests for other countries to work to achieve and strengthen their climate targets, and Norway's policy is to promote positive drivers of a global low-emission development pathway. Norway will also work internationally to minimise negative drivers, such as fossil fuel subsidies. There are many available channels for strengthening international efforts. One of them is to play a leading role in the climate negotiations through development cooperation and regional and global cooperation.

The UN Climate Change Convention and the international climate negotiations are the main forum for developing the legal basis for international climate cooperation. Norway is a driving force in these negotiations, and has for several years played a key role in developing rules under the Convention and the Paris Agreement. As the Katowice Rulebook adopted during the 2018 climate summit is implemented and further developed, it will be important for Norway to seek to ensure that this process strengthens the Paris Agreement so that climate targets can be achieved.

Regional cooperation is another important channel for Norway's international climate efforts. Norway is making a substantial contribution to the transformation process in Europe, for example through the EEA and Norway Grants, where climate change and the environment are important priorities. Norway is also calling for an ambitious European climate policy, for example through its participation in the Green Growth Group, which brings together the EU countries that are advocating an ambitious EU climate policy.

Cooperation and the development of climate technology are important elements of Norway's contribution to global transformation. Technology development and cooperation on low-emission solutions are essential. Norway is at the forefront in several areas, including green shipping and offshore wind power. CCS technology will play an important part in efforts to achieve the Paris target. Norwegian CCS activities span the entire development chain, and are making an important contribution to technology development in this field.

The Government's ambition is to achieve a cost-effective solution for full-scale CCS in Norway, provided that this also results in technology development internationally. The overall goal of the Government's work in this field is to play a part in making CCS a cost-effective option to combating global climate change. Norway's plan is to develop a CO_2 storage site with considerably more capacity than is needed for the Norwegian full-scale project. If the project is realised, this will make it possible for other industrial operators to store their captured CO_2 in the same facility rather than having to develop their own storage sites.

People's purchasing habits and their consumption in Norway also have effects globally. Goods and services purchased in Norway require both resources and energy to produce, and generate emissions beyond Norway's borders. The public sector, individual people and companies are all consumers, and can play a part in the shift to a low-emission development pathway by demanding goods and services that result in low emissions both in the production phase and during use.

Mitigation measures introduced in Norway can also have effects in other countries. For example, imported biofuels may have negative impacts in the countries where they are produced. The Government is pursuing an ambitious biofuel policy, but is at the same time seeking to avoid a situation where Norwegian demand increases deforestation. A requirement for fuel suppliers to include a certain proportion of advanced biofuels in the mix has therefore been introduced. In 2019, the Norwegian Environment Agency began to publish detailed information on biofuel sales by different companies, and the Agency for Public Management and eGovernment has published guidance on purchasing biofuels that are associated with a low risk of deforestation.

Norway's international climate work focuses on important sectors such as forests, energy and agriculture. Through the International Climate and Forest Initiative, Norway is seeing to reduce emissions from deforestation and forest degradation. This is Norway's largest contribution to international climate action. Through bilateral agreements, the Climate and Forest Initiative pays for reductions in emissions from deforestation and forest degradation in developing countries. In addition to reducing emissions, the initiative is having positive effects in other areas such as poverty, the rights of indigenous people and biodiversity. Steps to strengthen and further develop the initiative as a key part of the global climate solution will therefore continue to have very high priority.

In the years ahead, it is developing countries that will account for the largest share of investments in infrastructure and energy systems. It is vital that these investments are based on renewable energy and other low-emission solutions. Climate finance, technology cooperation and capacity building will be vital tools for enabling developing countries to restructure their economies to combine economic growth with a low-emission development

pathway. Norway will take a broad-based, integrated approach to the use of such tools to promote a long-term global low-emission pathway. Payment by results and cooperation on emission reductions involving emissions trading (market-based mechanisms) can help to boost the level of ambition and bring about the necessary transformation.

Norway is also cooperating with developing countries such as China on emission reductions. China launched a national emissions trading system in 2017. The Norwegian Environment Agency is cooperating with Chinese authorities on preparations for its implementation. This is an important step towards pricing of emissions in China. Norway will continue to give priority to bilateral climate and environmental cooperation with important developing countries such as China, India and South Africa.

Public funding is not sufficient in itself to bring about a global low-emission development pathway, but providing public funding can be an important way of mobilising private capital. Development aid can thus be used to mobilise other and larger capital flows. The energy sector is particularly important in the transition to a low-emission development pathway, since it is responsible for a large proportion of global emissions. It is therefore vital to promote renewable energy and energy efficiency in developing countries so that alternatives to coal are developed and deployed.

Facilitating low emission development pathways may also have a range of economic and social benefits. In developing countries where the authorities' capacity is limited, it is important to take a coordinated approach to development goals and work towards several goals at the same time. For example, air pollutants and greenhouse gas emissions often share the same sources. It can be sensible to coordinate action so that both types of emissions are reduced, thus maximising the climate and air quality benefits and improving public people's health, reducing mortality and reducing emissions at the same time. Norway will therefore intensify its efforts to build up knowledge and capacity that will make it possible to coordinate work on climate change and air pollution.

Norway's bilateral climate efforts are largely related to its development cooperation, but the world is changing rapidly and new stakeholders are becoming involved, so that other constellations may become important for cooperation. In many countries, cooperation at state or regional level is important. For example, various states in the US have adopted ambitious emission reduction targets. California, which is effectively the world's fifth largest economy, has set itself the target of becoming climate neutral by 2050. In 2017, Norway entered into cooperation with California on the exchange of experience and knowledge in several fields.

1.1.2

3.6 Behaviour patterns and sustainable lifestyles as part of a low-emission development pathway

Sustainable lifestyles will be an essential element of a low-emission development pathway in line with the long-term temperature target of the Paris Agreement. This means that the choices made by individual people are important. Access to knowledge and information and financial incentives help people to choose low-emission solutions in their everyday lives. The authorities have an important role to play in facilitating this, but suppliers of goods and services, including retailers, are also important because they can provide low-emission options for people to choose.

In Norway, a range of incentives encourage behaviour patterns in line with a low-emission development pathway. Pricing of emissions is the most effective way of steering changes in behaviour patterns over time. Other types of incentives can be used to speed up the pace of change, for example incentives that encourage people to buy electric vehicles.

Consumption in Norway is growing rapidly, and the environmental pressure caused by private consumption in Norway is high in global terms. Much of what we consume in Norway is produced in other countries, and domestic consumption thus plays a part in driving greenhouse gas emissions and environmental pressure outside Norway's borders as well.

The Government aims to promote more sustainable consumption patterns, and will therefore encourage cooperation and voluntary arrangements to this end. The Government's efforts are intended to facilitate a shift to a more sustainble pathway by consumers, businesses and others. To make this possible, different stakeholders need relevant information and expertise. The Government therefore intends to take initiatives to boost knowledge in several areas.

Access to information can make it easier to choose low-emission solutions. Information on products and services must be readily available, easy to understand, objective and quality assured. Official ecolabelling schemes such as the Nordic Swan and the EU Ecolabel are intended to make it easier for people to make environmentally sound choices.

Box 3.10 The Nordic Swan Ecolabel and the EU Ecolabel

The *Nordic Swan Ecoloabel* was established in 1989 by the Nordic Council of Ministers to provide consumers with quality assured environmental information. The ecolabel makes it easier to choose the environmentally best goods and services, and sets strict requirements for reducing climate impacts, more sustainable use of resources and a non-toxic environment.

The EU Ecolabel is the EU's official scheme, and is similar to the Nordic Swan. Producers must be able to document that their products meet a range of strict health and environmental criteria.

Source: *Stortingsmelding 25 (2018–2019) Framtidas forbrukar – grøn, smart og digital*

The Government will focus on increasing knowledge about sustainable consumption through information and teaching in schools and other educational institutions. These institutions are important arenas for raising awareness about ethical issues and environmental and resource problems, and for raising the level of knowledge about consumption and sustainability.

A number of businesses are already conscious of their role here, and are involved in efforts to develop a more sustainable society. However, there is no common meeting place for commercial stakeholders such as retailers who are in direct contact with consumers, experts (e.g. environmental researchers) and other interest groups and organisations (e.g. the Norwegian Consumer Council). The Government therefore announced in a recent white paper on consumer policy (Meld. St. 25 (2018–2019)) that it will establish a cooperation forum for sustainable development. The forum will be a meeting place where private- and public-sector stakeholders can exchange knowledge, ideas and experience that can be used in developing and identifying solutions for more sustainable consumption. Information-sharing will enable the forum to promote innovation and spin-off effects by making good ideas accessible to a wider public than its participants.

Box 3.11 Revision of school curricula

The Ministry of Education and Resarch is in the process of updating and revising curricula for all school subjects. Three interdisciplinary topics are to be introduced as part of the core curriculum:

- health and life skills;
- democracy and citizenship;
- sustainable development.

These interdisciplinary topics will be included in the curricula for relevant subjects. The new curricula were adopted in autumn 2019 and will be in use from the school year 2020/2021.

Source: *Stortingsmelding 25 (2018–2019) Framtidas forbrukar – grøn, smart og digital*

Developong a circular economy can make resource use more efficient and reduce resource use in many areas. There are various examples of circular models in industrial settings in Norway. In Mo Industrial Park in North Norway, for example, heat recovery during metal production provides energy for use by other industries. The Government wishes Norway to play a pioneering role in the development of a green, circular economy that makes better use of resources.

A more circular economy can improve resource efficiency and play a part in:

- achieving a low-emission development pathway and reducing greenhouse gas emissions;
- reducing pollution;
- reducing pressure on the environment and natural resources;
- green value creation and green competitiveness.

Norway's consumer policy, together with its climate and environmental policy, is intended to drive the development of new sustainable solutions by facilitating cooperation between the business sector, authorities and civil society.