



Norwegian Government

Strategy

Better growth, lower emissions

- the Norwegian Government's strategy for green competitiveness



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Foreword

Building green competitiveness in Norway means cutting greenhouse gas emissions, increasing value creation and ensuring high employment. This document is the Government's strategy for green competitiveness, and is intended to provide a predictable framework for the transformation of Norwegian society. It lists seven principles for this process, and presents Government policy for strengthening green competitiveness and transforming Norway into a low-emission society.

In June 2015, the Government appointed Connie Hedegaard, former European Commissioner for Climate Action, and Idar Kreutzer, Managing Director of Finance Norway, as the members of an expert committee on green competitiveness. They were asked

to prepare a proposal for an overall strategy for green competitiveness, and delivered their recommendations in October 2016. The committee's recommendations and the important input it received from various stakeholders have provided an invaluable part of the basis for the Government's strategy. It will be crucial to continue the cooperation the committee established with partners in a variety of branches of industry and sectors as the strategy is implemented. Norway has a long tradition of cooperation on processes of change. The accelerating pace of fundamental change in markets and technology means that cooperation will be no less important in efforts to ensure that Norway emerges as a winner of the green transformation.



Photo: Bjørn Stuedal

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Introduction

Norway is embarking on a challenging process of fundamental transformation. Its climate targets include reducing greenhouse gas emissions by at least 40 % by 2030 and becoming a low-emission society by 2050. At the same time, it is vital to create new jobs and maintain Norwegian value creation and welfare system. In other words, our ambition is to become a low-emission society but not a low-income society.

The Government will facilitate value creation by promoting the establishment of new green jobs and encouraging existing businesses to adapt in order to compete as climate policy becomes stricter and technology development proceeds rapidly.

It is possible to combine more ambitious climate policy with continued economic growth. A recent report from the Organisation for Economic Co-operation and Development (OECD) demonstrates that in the long term, the G20 countries could both reduce greenhouse gas emissions and increase GDP by 2.5 % by combining cost-effective climate action with fiscal initiatives and sound economic reforms.¹ In addition, they would enjoy the benefits of avoided climate change impacts, which are estimated at about 2 % of GDP. In contrast, postponing the transformation process needed to achieve the goals of the Paris Agreement would be costly. Delaying climate action until after 2025 would increase the cost of achieving these goals by an estimated 2 % of GDP.

According to the Intergovernmental Panel on Climate Change (IPCC), the global mean temperature may rise by about two degrees Celsius by 2050 and about four degrees by 2100 relative to pre-industrial levels, unless the world succeeds in limiting greenhouse gas emissions.² Such a steep temperature rise would have major adverse impacts. It could trigger feedback mechanisms with very serious consequences. Other environmental problems

such as the spread of hazardous substances, the loss of biodiversity, local pollution and pressure on water resources will also be exacerbated by climate change.

Through the Paris Agreement, the world's countries are aiming to limit global warming to well below 2 °C, and have agreed to make efforts to limit the temperature increase to 1.5 °C above pre-industrial level. If we are to achieve this, greenhouse gas emissions must peak as soon as possible and then be reduced rapidly. A balance between emissions of anthropogenic greenhouse gas and their absorption in forest and oceans must be reached during the second half of this century. The Paris Agreement includes a mechanism to promote a gradual increase in the level of ambition of parties' climate targets.

A more stringent global climate policy will alter the framework for business and industry in every country. Achieving the goal of preventing dangerous anthropogenic interference with the climate system will require a shift to low- and zero-emission solutions for energy supply systems, industrial production and transport systems throughout the world. This will also change global production and consumption patterns.

Major business interests called for an ambitious climate agreement to be adopted at the Paris summit. They did this in the knowledge that rapid technological developments and a steep drop in the costs of renewable energy and battery technologies are fundamentally changing the framework for their operations. There is also growing awareness of the financial risks associated with the possibility of sudden value losses for fossil resources and fossil-based technologies.

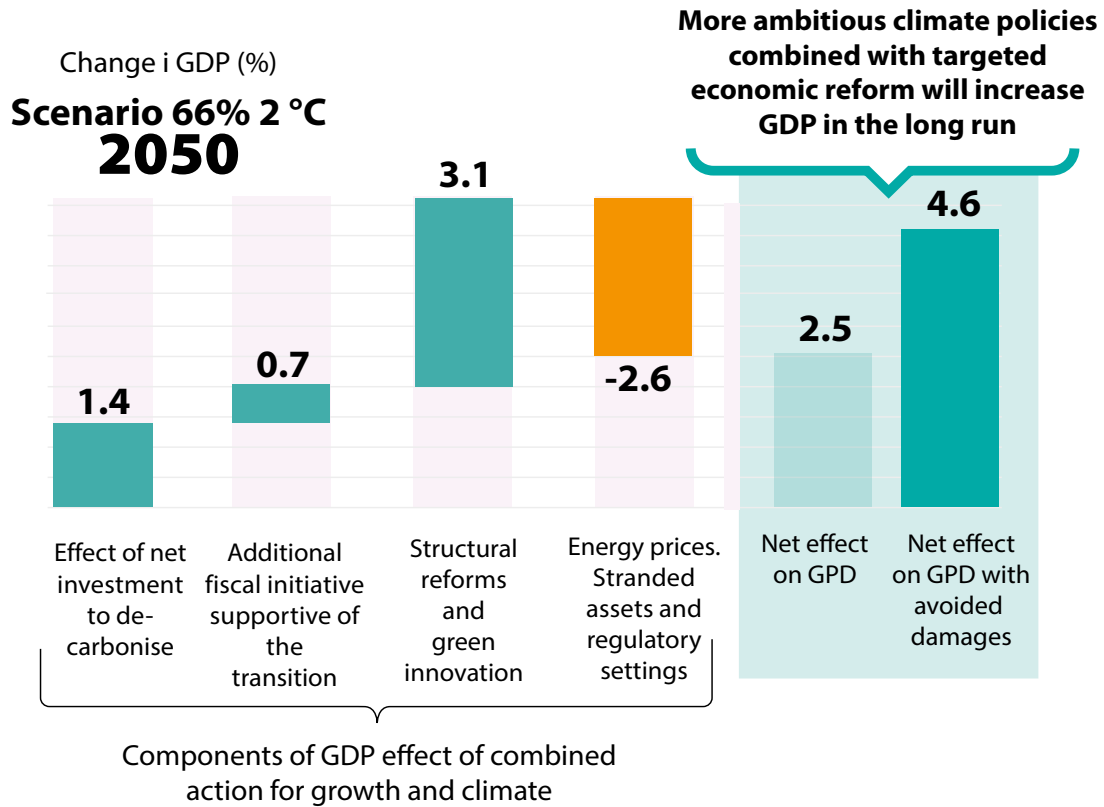
This strategy for green competitiveness is intended to provide a predictable framework for Norway's transformation into a society with lower greenhouse

¹ OECD (2017): Investing in Climate, Investing in Growth. The estimates are for the G20 countries, which is a grouping of the world's largest economies. Other analyses have reached similar conclusions. See Global Commission on the Economy and Climate (2014): Better Growth, Better Climate: The New Climate Economy Report, and Business and Sustainable Development Commission (2017): Better Business, Better World: The Business Case for the Sustainable Development Goals.

² IPCC (2014): Climate Change 2014: Synthesis Report

Figure 1: Illustration of the OECD's calculations of how rapid implementation of economic and structural reforms and climate policy in line with the Paris Agreement could boost economic activity in the G20 countries.

More ambitious climate policies will not hamper growth



gas emissions combined with full employment and a high income level. To achieve this, it is based on existing international and national policies. The Paris Agreement charts a course for climate policy and requires a gradual increase in the level of ambition. Norway already has ambitious national climate targets: to reduce greenhouse gas emissions by at least 40 % by 2030 and to be a low-emission society by 2050. Cooperation with the EU enables Norway to pursue a more systematic and predictable climate policy. Norwegian policy in other areas also underpins this strategy. A recent white paper on industrial policy is intended to promote a green, smart and innovative business sector, while the Government's strategy for export and internationalisation calls for active marketing of Norwegian green solutions. Part of its ocean policy is a high level of ambition for sustainable growth in marine and maritime industries. The Government's

bioeconomy strategy is intended to facilitate efficient and sustainable use of renewable biological resources. Research on low-emission solutions and innovation is being given higher priority. Norway's public procurement policy requires all contracting authorities to draw up a 'green plan' for their procurement activities. Norway's energy policy facilitates profitable development of renewable energy within the country. And as regards transport policy, Norway is world-leading in electrification, digital solutions and autonomous technology.

Low-emission technologies will be the winners in a world with a more stringent climate policy. The Government will actively pursue a policy to promote a green transition in the Norwegian economy and to equip business and industry for a low-emission future.



Presentation of the report on green competitiveness. Prime Minister Erna Solberg and Minister of Climate and Environment Vidar Helgesen received their copies of the report from the members of the expert committee, Connie Hedegaard and Idar Kreutzer.
Photo: Berit Roald / NTB scanpix

In June 2015, the Government appointed Connie Hedegaard and Idar Kreutzer as the members of an expert committee on green competitiveness. They were asked to prepare a proposal for an overall strategy for green competitiveness, and delivered their recommendations in October 2016.³

The committee was asked to obtain input from key stakeholders in different regions of Norway. Some of the input was in the form of roadmaps for specific branches of industry. Businesses in different sectors cooperated to review what the transition to a low-emission society will mean for their branch of industry. This cooperation fostered creativity and learning, and

resulted in the formulation of ambitious goals for the transformation process. The roadmaps identify both opportunities for and barriers to emission reductions and green competitiveness. The Government has used the roadmaps together with the committee's report as an important part of the basis for drawing up this overall strategy for green competitiveness. As one element of the strategy, the Government intends to strengthen cooperation with the business sector. This cooperation will need to take many different forms and cover a number of sectors. One important forum for dialogue in this context will be the advisory committee for the Minister of Climate and Environment on the transition to a low-emission society (*klimarådet*).

³ Summary in English: <https://www.regjeringen.no/en/dokumenter/green-competitiveness/id2518147/>



What is green competitiveness?

To achieve a transition to a low-carbon future, the world will have to make use of much more effective climate policy instruments than is the case today. The Paris Agreement also clearly recognises that this will be needed. Electricity production and heating must gradually shift to using zero-emission solutions, different modes of transport must become virtually emission-free, industrial process emissions must be drastically reduced, agricultural emissions must be cut, and absorption by forest and other land categories must be increased.

These changes will alter the framework for business and industry in every country. New technology must be developed and deployed. This will in turn shift demand towards new goods and services. To tackle this transformation process, the business sector must be able to cover its costs, including climate and environmental costs, through the prices they can obtain for their goods and services. Thus, for a business, green competitiveness means the ability to compete globally at a time when more effective instruments are being taken into use as part of climate and environmental policy.

For a country, competitiveness can be defined as the ability to make full, effective use of labour and other resources and achieve its climate and environmental policy goals, given a reasonably stable balance of payments over time and an acceptable income distribution. Green competitiveness means that a country achieves its climate and environmental targets in addition. This strategy focuses primarily on Norway's climate targets.

Full and effective use of resources is dependent on high employment, low unemployment and the highest possible income levels over time. To incorporate the global dimension, both the business sector and the authorities must take into account changes in many areas when drawing up plans and designing policy instruments. This applies particularly to the anticipated tightening of global climate policy. To achieve the transition to a low-emission society, Norway will be dependent on a similar shift in global development.

Norway's ambitious climate targets send a strong signal to the country's business sector. One of the Government's targets is for Norway to be a low-emission society by 2050. This target has now been made statutory in the Climate Change Act, which sets out the target of reducing greenhouse gas emissions by 80–95 % from the level in the reference year 1990. Under the Paris Agreement, Norway has undertaken to reduce its emissions by at least 40 % by 2030. The Government is working towards joint fulfilment of this commitment together with the EU.

In addition, the global UN Sustainable Development Goals provide a clear framework for economic, social and environmental development. There are separate goals dealing with climate and environment, which are also priority areas under other goals and a cross-cutting dimension of the sustainable development agenda.

THE GLOBAL GOALS For Sustainable Development





An integrated policy for green competitiveness

Norway is in a strong position in a world that is increasingly recognising the importance of reducing greenhouse gas emissions and preventing serious environmental damage. Its advantages include a highly qualified and adaptable labour and smoothly functioning capital markets. In the workplace, there is a high degree of employee participation in decision making, and a climate of trust and close cooperation between the social partners – employers, unions and authorities. 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 improvements, development and a transformational process.

Technologies and markets are changing faster today than they have ever done before. There is nothing new in technological change leading to social change. However, the pace of change itself can create challenges today, for example for political authorities. Digitalisation, automation, robotisation, biotechnology and the rapidly falling costs of renewable energy and battery technologies are changing the framework within which the business sector and the public sector operate. All these changes make it even more important to have a skilled workforce and an adaptable business sector. The level of knowledge in Norwegian society is high, and new technology is deployed rapidly. There are strong knowledge clusters and supplier industries based on Norwegian expertise, and we also draw on labour and expertise from other countries. Nevertheless, Norway has the potential to become even more innovative. We are still lagging behind neighbouring countries in this respect.

Practically all value creation is dependent on access to energy. A reliable electricity supply is important for all societal functions. Other countries are just starting the transition to a more climate-friendly electricity supply system; in contrast, the Norwegian electricity sector is virtually emission-free. Norway has abundant renewable

energy resources and is able to make use of them. The large overall reservoir capacity in Norway's hydropower system allows short- and long-term energy storage without large additional costs. The Norwegian power grid is well developed and covers the whole country. The Government will facilitate further development of the competitive advantages provided by Norway's renewable energy resources.

The Norwegian process industry is based on use of Norwegian hydropower, and uses cutting-edge solutions to improve energy efficiency and reduce greenhouse gas emissions. Because the electricity supply is almost entirely renewable, greenhouse gas emissions from Norwegian buildings are very low. The revolution in battery technology will make it possible for a large share of the Norwegian transport sector to run on electricity in the future. Norway is already a world leader in developing technology for the electrification of maritime transport, and has business opportunities in areas such as green data centres and battery technology. Norway should seek to use its head start to find new opportunities in the interface between technology and clean electricity.

More than 80 % of Norway's greenhouse gas emissions are priced through the carbon tax and/or participation in the EU Emissions Trading System (EU ETS), and Norway has generally strict environmental legislation. The Norwegian business sector has shown that it is possible to adapt to strict climate and environmental legislation. For example, the Norwegian maritime cluster is a world leader in the development and deployment of environmental technology. The Norwegian process industry has met global competition by developing and using new technologies that make production processes more efficient.

The business sector is dependent on a well-functioning transport system. Through its white paper on Norway's climate strategy and the National Transport Plan

2018–2029, the Government has developed a basis for an efficient transport system with low emissions.⁴

Efficient use of society's resources requires a sound general framework for value creation and business activities. Good macroeconomic governance and a stable framework provide a situation in which innovation, technology development and competence building are likely to give returns. A well-designed research and innovation system contributes to improvements in productivity and encourages the development, adaptation and deployment of low-emission solutions for the future. An uncomplicated taxation system with a broad tax base and low tax rates makes it pay better to work and to invest in new technology and jobs. International trade in goods and services provides a basis for transfers of technology and enables countries to make use of their comparative advantages. Thus, trade is an important driver of growth in income and living standards, but also makes changes necessary. General welfare schemes can make processes of change easier because they play a part in redistribution and risk sharing. It is also vital to ensure that the education system results in a well-qualified and skilled labour force.

Norway's capacity for innovation and its ability to develop and make use of new knowledge, new technologies and new solutions will be of crucial importance for continued sustainable growth. At the same time, the Government considers it important to achieve climate and environmental targets cost effectively. It is vital to provide the right circumstances to ensure high value creation and employment, as discussed earlier. This strategy focuses particularly on certain priorities for promoting green competitiveness:

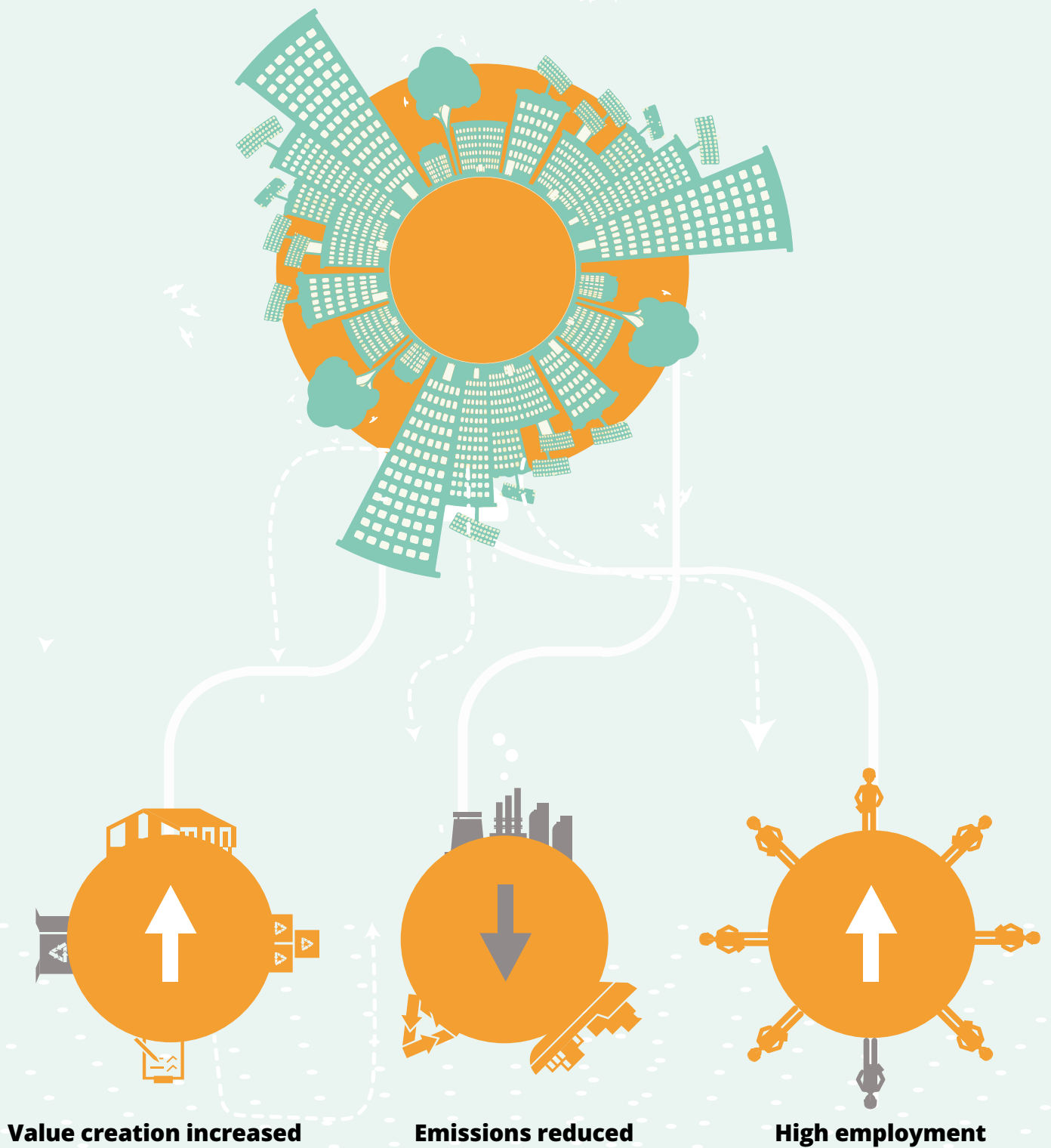
- markets for green solutions;
- green and innovative public procurement;
- research, innovation and technology development;
- infrastructure for green solutions;
- managing climate-related risks and financing;
- a circular economy;
- increasing exports of green solutions;
- continued dialogue and cooperation with the business sector.

Green competitiveness in other countries

A number of countries are now developing policies to promote green competitiveness. In Singapore, the authorities are pursuing an active policy to develop, create markets for and deploy their own green technology. Canada is seeking to diversify its economy, and has set clear goals for its green growth policy to result in cuts in greenhouse gas emissions, more jobs and economic growth. Among other things, the country has a common carbon price across all provinces (in the form of a tax or an emissions trading system), and is investing on a broad basis in innovation, research and environmental technology. In South Korea, the authorities have drawn up a green growth strategy for the next 40 years, including targets for reducing greenhouse gas emissions, improving air quality, reducing dependence on fossil fuels and ensuring economic growth. The strategy is being followed up with five-year plans that set out more specific measures, policy instruments and budgets. Denmark is actively pursuing a green transformation, with a particularly focus on export-related activities. Ensuring that green transformation, jobs and competitiveness are considered together is an explicit goal for the Danish government.

⁴ Meld. St. 41 (2016-17) Report to the Storting (white paper) *Norway's Climate Strategy for 2030: a transformational approach within a European cooperation framework* (translation in progress).
Meld. St. 33 (2016–2017) Report to the Storting (white paper) *National Transport Plan 2018–2029* (English summary).

Low-emission society in 2050





Principles of green competitiveness

Rapid decarbonisation of the world economy is needed in response to the challenge of climate change. This can only be achieved if business and industry in every country develops and starts using zero-emission technologies and solutions. However, the incentives provided by current global climate policy are too weak to promote the use of such solutions, and individual companies face a very high level of uncertainty about future market developments. A broad-based, proactive policy is therefore required to promote restructuring, innovation and green competitiveness.

This means that Norway cannot rely on one single solution or instrument to make the transition to a competitive low-emission society. An effective mix of policies and instruments is needed to help consumers and businesses throughout the country to make decisions that will lead us in the right direction.

The Government's policy for promoting green competitiveness is based on the following principles:

- 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.



Markets for green solutions

Markets where greenhouse gas emissions are priced are an essential basis for ensuring the transition to a low-emission society. The most important instruments of Norwegian climate policy are taxes and emissions trading, which are cross-sectoral economic instruments. In some circumstances, it may in addition be appropriate to make use of regulatory measures, public procurement, information and various forms of support, particularly to promote development and deployment of new technology and ensure long-term restructuring of the business sector.

Well-designed economic instruments can play a part in promoting green competitiveness, and the Government will:

- use the carbon tax and other taxes on greenhouse gas emissions as the main instrument in the non-ETS sector for strengthening markets for green solutions;
- consider the introduction of a standard carbon tax rate for all non-ETS emissions. If the carbon tax is not an adequate or appropriate instrument, other instruments that provide equally strong incentives to reduce emissions will be considered;
- continue cooperation with the EU on climate policy, and advocate a higher level of ambition for the EU ETS;
- promote the use of advanced biofuels;

Emissions trading and taxation

Currently, around 15 % of global emissions of CO₂ and other greenhouse gases are priced through taxes or emissions trading systems. China plans to introduce a national emissions trading system by the end of 2017, which will increase the proportion to well above 20 %. Countries such as South Africa, Canada and Mexico are also planning to introduce emissions trading or increase carbon taxes in the next few years. In addition, more and more international companies are using internal carbon pricing when planning their investments.⁵ The increasing use of carbon pricing will boost the market for green

solutions, and thus make it more profitable to develop low-emission technologies.

About half of all Norway's greenhouse gas emissions are included in the EU ETS. Low economic growth in Europe and other factors have resulted in a large surplus of emission allowances in the EU ETS, and low carbon prices. From 2019 onwards, a proportion of the surplus will be moved to the new market stability reserve, and from 2021 the rate of reduction in the overall annual number of emission allowances (the cap) will be increased. A progressively tighter cap can in the long term play a part in driving a transition towards more climate-friendly solutions.

The carbon tax has been an important Norwegian climate policy instrument for many years. From 1 January 2017, the tax rate was raised to NOK 450 per tonne CO₂ for most areas of use to which it applies. The tax on HFC and PFC emissions was also raised to the same level. This was one step in following up the recommendation of the Green Tax Commission that a standard carbon tax rate should be introduced for all non-ETS sectors.⁶

The Storting (Norwegian parliament) has adopted a decision requesting the Government to introduce a standard carbon tax rate for all non-ETS sectors, for the time being with the exception of the agricultural and fisheries sectors. The Government will consider the introduction of a single-rate carbon tax for all non-ETS emissions. If the carbon tax is not an adequate or appropriate instrument, other instruments that provide equally strong incentives to reduce emissions will be considered.

Developers of new technology generally have to share the benefit of the new solutions with users who have not paid for the development process. This means that in a truly free market without government intervention there may be too little research, development and innovation. A wider set of policy instruments is therefore needed and

⁵ World Bank (2017): Carbon Pricing Watch 2017

⁶ NOU 2015: 15 Environmental pricing – Report from the Green Tax Commission



'Mjøstårnet' (the Mjøsa tower) is under construction in Norway, and at 81 metres will be the world's tallest wooden building when it is completed in February 2019. Using more wood in buildings can be a way of increasing the carbon stock in long-life wooden structures.

Photo: Christopher Kunøe / Byggmesteren

has been put in place to promote research, development and deployment of new technology.

A range of instruments to promote green markets

In cases where it is difficult to put a price on environmental damage through taxes or emissions trading systems, it is appropriate to consider other types of instruments. In Norway, one possibility is direct regulation under the Pollution Control Act, for example requirements to use zero-emission solutions or the best available technology. Like economic instruments, these will play a part in creating markets for green solutions and products. Biofuel quota obligations and environmental regulation of the aquaculture industry are examples of

requirements and regulatory measures that can create markets for new solutions.

The biofuel quota obligation for road traffic is one instrument the Government is using to encourage biofuel use.⁷ The production of conventional biofuels involves a risk of indirect land use change (ILUC), in other words the risk that food production will be displaced to new areas. If these areas have large carbon stocks, the result will be to increase emissions. To take account of global climate effects, the Government will focus on the use of advanced biofuels. The biofuel quota obligation therefore includes an increase in the required proportion of advanced biofuels in the mix from 2018. This will help to increase demand for advanced biofuels from both Norwegian and

⁷ The biofuel quota obligation requires fuel suppliers to ensure that biofuels make up a minimum specified proportion of the total annual volume of fuel sold for road traffic. The system was introduced in 2009, and the required proportion was then 2.5 %. In 2010, it was increased to 3.5 % and on 1 October 2010 to 3.5 % of the total volume sold. From 1 January 2017, the required proportion was further increased to 7 %, and this increase was to be achieved entirely through sales of advanced biofuels. In the 2017 budget, the Government put forward a plan for further stepwise increases in the biofuel quota obligation up to 2020. In this connection, the Storting requested the Government to increase the biofuel quota obligation to 20 % in 2020 (8 % of the total volume to be advanced biofuels).

foreign producers. The EU is also seeking to increase the proportion of advanced biofuels, and European demand is expected to increase in the years ahead.

Advanced biofuels are currently expensive, and the technology is immature. In the long term, larger volumes of advanced biofuels will be needed in parts of the transport sector where it will take time to develop zero-emission alternatives, for example aviation, shipping and some heavy goods transport. At present, only limited amounts of advanced biofuels are produced in Norway. However, we have a good starting point for production from forest raw materials, marine resources and organic waste. Several companies have presented plans for establishing biofuel production. The biofuel quota obligation improves the prospects for profitable use of residual raw materials and by-product streams from the forestry industry, and of wood that is not used for processing in Norway today. The Government will also promote more use of wood in buildings and will consider measures that can play a part in increasing the carbon stock in long-life wooden structures.

One of the goals of Norwegian waste policy is to ensure that good use is made of the resources in 80 % of waste generated in Norway through recycling and energy recovery. Regulatory measures, especially under the Pollution Control Act and Waste Regulations, are a key way of achieving this goal. Specific goals and statutory recycling rates create a demand for new waste sorting technology and provide incentives to develop alternative ways of managing waste. Measures of this kind thus help to build a market for green solutions and technologies.

Providing reliable and comparable information on environmental impacts can influence the actions of companies and individuals. Ecolabelling makes it easier for companies to comply with environmental requirements in connection with green public procurement, in line with new procurement legislation. Ecolabels such as the EU Ecolabel and the Nordic Swan help consumers to make environmentally friendly choices. Maintaining and strengthening ecolabelling schemes is one of Norway's priorities in its cooperation with the EU.

CO₂-fund for commercial transport

The Storting has asked the Government to start talks with relevant industry organisations on the establishment of an environmental agreement and a CO₂ fund for commercial transport, with the aim of launching the scheme in the course of 2019. Regardless of the model that is chosen, establishing a fund will require reviews, negotiations and notification to the EFTA Surveillance Authority (ESA). Key points will be whether the CO₂ fund can be based on the same model as the NO_x fund, the administrative costs of different models, whether they are compatible with the rules on state aid in the Agreement on the European Economic Area (EEA Agreement), how the scheme would fit in with existing grant schemes (including those run by Enova), and the potential for and costs of emission reductions. The Ministry of Climate and Environment and the Ministry of Finance have together with relevant industry organisations commissioned reviews of these issues.

Campaign for green jobs

The social partners in Norway wish to play an active part in greening the labour market. The main trade union and the main employers' organisations are preparing a campaign to:

- raise awareness about what it is possible to do in individual workplaces;
- encourage people to become more involved in the introduction of resource-efficient and climate-friendly measures at their places of work;
- ensure close cooperation between management, employees and union representatives on what can be done.

The campaign is due to run from autumn 2017 to 2018, and will include a range of activities including conferences, media appearances, the production of information and advisory material and useful tips. The idea for the campaign came from the advisory committee for the Minister of Climate and Environment on the transition to a low-emission society (klimarådet).



Green and innovative public procurement

The Government will ensure that the public sector as a customer supports the adoption and development of new environmentally friendly technologies, products and solutions. The objective of Norway's public procurement legislation is to make sure that society's resources are put to good use and that there is real competition. In addition, the legislation promotes public sector integrity, so that the general public can be confident that procurement is organised in a way that benefits society as a whole.

Public procurement can also be used as a tool for reducing greenhouse gas emissions and other pollution if public purchasers choose solutions with less climate or environmental impact. Green and innovative public procurement can promote industrial development and efficiency in the public sector, and play a part in meeting overall climate and environmental policy objectives. There is considerable potential for this approach, particularly in the transport, construction and waste management sectors, where the public sector is a major procurer.

To encourage the public sector to contribute to green competitiveness through its procurement activities, the Government will:

- increase capacity building relating to green procurement through earmarked allocations to the Agency for Public Management and eGovernment;
- encourage the procurement of innovation through support for the National Programme for Supplier Development and an initiative for public-private innovation partnerships, including green solutions, in Innovation Norway;
- ensure that all new car ferries that are part of the national road system use low- or zero-emission systems and encourage the use of such systems in car ferries and high-speed vessels that are part of the county road system;
- consider whether to set a target for the proportion of central government funding for public procurement to be used for innovative, climate-friendly solutions.

New legislation and better advice and guidance for public purchasers

New, simpler and more flexible Norwegian public procurement legislation entered into force on 1 January 2017. The new rules implement the EU's revised procurement directives in Norwegian law. One purpose of the directives is to provide more flexibility in the use of public procurement as a strategic tool in implementing the Europe 2020 strategy for smart, sustainable and inclusive growth.

The 2016 Public Procurement Act includes a revised environmental clause (see text box) requiring buyers to ensure that their overall procurement portfolio has a green, climate-friendly profile. This means that public entities must take a strategic approach and develop green procurement practices, but also leaves them some flexibility in how they achieve this.

Public Procurement Act (Act of 17 June 2016 No. 73, section 5, first paragraph, first and second sentences):

National, county and municipal authorities and bodies governed by public law shall organise their procurement activities in such a way that they reduce harmful environmental impacts and promote climate-friendly solutions where relevant. This means among other things that the contracting authority shall take lifecycle costs into account.

Norway has also adopted new regulations under the Public Procurement Act, on public contracts in general, service contracts and concession contracts (corresponding to the three EU directives). These make it clear that environmental criteria and conditions may be included at all stages of a procurement process provided that they are relevant. In addition, all the regulations include a provision specifying that contracting authorities must seek to minimise the environmental impacts of their purchases. This means that public bodies must review the environmental impact caused by their procurement activities and identify appropriate ways of reducing this.



In a world first, an automatic wireless induction charging system and automated mooring technology have been successfully tested for the car ferry MF Folgefonn.

Photo: Wärtsilä Marine Solutions

Purchasers may choose to include an environment-related award criterion, and if they do so, the regulations state that this criterion should as a general rule be given a weighting of at least 30 %.

The new public procurement regulations also allow buyers and suppliers to cooperate on innovative procurement. This involves a new type of procurement procedure called an innovation partnership, in which an innovative solution is developed through a public-private partnership. The contracting authority can then choose to purchase the solution that has been developed.

In Norway's 2017 budget, NOK 15 million was allocated to the Agency for Public Management and eGovernment, to be used to build up capacity and develop guidance on green public procurement at national, county and municipal level.

Action to promote green and innovative procurement

The EU, the OECD and the World Bank have pointed out that as a customer, the public sector needs to be aware of its role as a market developer and should contribute to customer-driven innovation related to key issues such as climate- and environment-related problems.

First-time purchases of new and innovative solutions are often more costly, and the risks higher, than is the case for ordinary procurement processes. A buyer also needs to be experienced and knowledgeable to choose

such solutions. Until now, the few Norwegian incentives and schemes to encourage innovative, climate-friendly procurement have generally focused on risk reduction for suppliers. However, a report from Menon Business Economics shows that the level of risk perceived by public-sector buyers is the greatest barrier to the procurement of innovation.¹ The report, like the report of the Green Tax Commission, points out that the barriers to innovation can be higher for climate and environmental technology than for innovation generally.

The Government has therefore taken a number of important steps to encourage green and innovative procurement:

- Strengthening and supporting the National Programme for Supplier Development, which is intended to promote innovative procurement and dialogue with suppliers generally. The programme is run by the Confederation of Norwegian Enterprise, the Norwegian Association of Local and Regional Authorities and the Agency for Public Management and eGovernment. The Government has increased allocations to the programme by over NOK 9 million, from NOK 750 000 in 2015, so that the public sector's development needs become a driver for innovation and entrepreneurship. One of the three main priorities of the programme is to boost climate- and environment-related innovation.

¹ Menon Business Economics (2016), [Review of possible new incentives/schemes for risk reduction for innovative public procurement]. Report 2016/12.

- Procurement processes for ferries that are part of the county road system now include a requirement to use low- or zero-emission technology if this is possible given the maturity of the technology.
- In a white paper on industrial policy published in 2017, the Government announced that it would develop an initiative for public-private innovation in Innovation Norway. This will be designed to reduce the level of risk for public-sector buyers and private-sector suppliers, to encourage the formation of more public-private innovative partnerships, and to increase the number of procurement processes for solutions including an element of R&D. It should also be possible to use this approach to promote the development of environmentally friendly technologies and solutions. The initiative will supplement Innovation Norway's current existing innovation contract scheme.
- Statsbygg (the agency responsible for public construction and property management) has a strong focus on climate and environment as a way of reducing the state's environmental footprint. Statsbygg's long-term ambition is to supply sustainable zero-emission buildings by 2030.

Green public procurement in the EU

The EU is focusing increasingly on green public procurement (GPP). In 2008, the European Commission adopted the target that by 2010, 50 % of all public tendering procedures in member states should be green, measured in terms of both the number and the size of the contracts. 'Green' in this context means that the procedures are compliant with the Commission's common GPP criteria for the relevant group of products or services. Since 2008, the Commission has been publishing criteria for more and more types of products and services.

National authorities in Europe are also focusing increasingly on green procurement as a policy instrument for climate, environmental and innovation policy. However, there is some variation between countries. The Netherlands has long been one of the pioneers in this field, and some years ago adopted the goals that 100 % of central government procurement processes should be sustainable by 2010, and all procurement by public authorities at all levels should be sustainable by 2015. The goal for 2010 is considered to have been achieved, but no overall evaluation has been made of whether the criteria for achieving the 2015 goal have been fulfilled. In Germany, life cycle costs and energy efficiency are considered to be particularly important in green procurement processes. Several countries have recently adopted new procurement legislation that introduces stricter requirements for reporting of lifecycle costs (Sweden) or that gives more scope for specifying climate and environmental criteria and conditions (Finland and others).

Green and innovative procurement in the building sector

Private companies can also play a part in achieving a green shift and green competitiveness by including environmental criteria and conditions when purchasing goods and services. One example of a green and innovative approach of this kind is the roadmap for 2050 published by a group of companies in the building sector in Norway. The roadmap focuses specifically on commercial buildings, and recommends a number of measures that can be implemented immediately. At the end of September 2017, 22 companies had adopted the roadmap and undertaken to implement the list of immediate measures.

These measures include asking for building sites to be fossil-free, only buying building products that do not contain hazardous substances, requiring architects to draw up plans for how materials can be disassembled and reused when buildings are renovated or demolished, and seeking solutions and materials that minimise waste. Statsbygg, the agency that manages most government-owned buildings, has adopted the roadmap and the set of immediate measures. In addition, SINTEF Building and Infrastructure and the Association of Consulting Engineers, Norway have formally adopted the roadmap and have pledged to support efforts to find solutions that will enable the sector to achieve its goals.



Research, innovation and technology development

Norwegian business and industry and Norwegian knowledge environments are in a good position to participate in the growing global market for sustainable goods and services, low-emission technology and green solutions. Norway has high-quality research groups working in fields including energy and the process industries, and is a world leader in developing technology for the electrification of maritime transport. In addition, Norway has a solid industrial base and a great deal of expertise, giving an excellent starting point for utilising renewable biological resources from the agricultural and forestry sectors. Norway is also in a good position to play a leading role in the development of sustainable seafood production, and has expertise in many other areas that are relevant to greening the economy. Furthermore, Norway has a well-qualified labour force and a business sector with the capacity to adapt to changing conditions.

Technology development is crucial to economic growth and for achieving national climate and environment targets. However, the benefits of technology development are often greater for society as a whole than for the developers. This is a form of market failure that can justify public funding for research and development. The Green Tax Commission argued that it is particularly important to support the development of environmental technology.⁹

To promote green competitiveness through research, innovation and technology development, the Government will give priority to the following:

- developing targeted initiatives and focusing special attention on climate and environment in publicly-funded research, innovation and technology development wherever relevant;
- European and international cooperation on research and innovation;

- a long-term approach and interdisciplinary research of high quality;
- cooperation and dialogue between authorities, researchers and the business sector;
- good coordination between public agencies in the research and innovation system, including close cooperation between Enova, Innovation Norway and the Research Council of Norway;
- education and lifelong learning.

Targeted initiatives and special focus on R&D on climate and environment

The Government's long-term plan for research and higher education 2015–2024 (published as the white paper Meld. St. 7 (2014–2015)) lists climate, environment and clean energy as one of six long-term priority areas for research and higher education. The development of Norwegian technology and Norway's transformation into a low-emission society are of key importance in this context.

Funding has been strengthened along the whole chain from basic research where new ideas are generated and to markets for products and services. The public sector is now providing more funding than ever before in all parts of the R&D chain. Since 2013, the Government has increased funding for industry-oriented research and innovation by more than NOK 3 billion, including budgeted tax deductions under the SkatteFUNN tax incentive scheme. Allocations to all the key funding agencies, including the Research Council, Innovation Norway and Enova, have been increased. Among other things, the Government increased funding for research into low-emission solutions by NOK 71.5 million in the 2017 budget. There is to be a special focus on non-ETS emissions, where transport and agriculture are the most important sectors. For 2018, the Government has proposed a further increase of NOK 20 million for research on low-emission solutions and green competitiveness, giving a total of NOK 91.5 million for this area. In addition, the Government has proposed an

⁹ NOU 2015: 15 Environmental pricing – Report from the Green Tax Commission (Chapter 10 on the development of environmental technology, in Norwegian only)

allocation of NOK 10 million for enabling technologies for the future bioeconomy and low-emission society.

Norway has a broad set of funding agencies that promote the development of climate and environmental technology and green competitiveness. In addition to the Research Council, Innovation Norway and Gassnova, the following agencies have various responsibilities: SIVA, Gassnova, the Norwegian Export Credit Guarantee Agency (GIEK), Export Credit Norway, the Agency for Public Management and eGovernment and the Norwegian Environment Agency. The regional research funds, which were set up to strengthen research intended to increase and improve regional innovation and regional development, are also relevant in this context.

Projects to develop climate- and environment-related solutions can obtain funding from both thematically oriented research programmes and grant schemes whose objectives include the development of climate and environmental technology, such as the Research Council's Large-scale Programme for Energy Research (ENERGIX) and Innovation Norway's grant scheme for environmental technology. It is also possible to apply for support from programmes and grant schemes that do not have a thematic delimitation, such as the Programme for User-driven Research-based Innovation (BIA) under the Research Council.

It is important to ensure that the whole breadth of Norwegian business and industry is involved in the shift to more sustainable development and in boosting green competitiveness. In the case of industries or new growth areas that do not have their own specific thematically oriented programmes or activities, funding must be sought from the open competitive arenas run by the funding agencies. In these areas too, it is possible to stipulate clear requirements relating to the potential climate and environmental benefits of research projects in funding announcements where relevant. Innovation Norway uses sustainability criteria in its portfolio management. In its recently published sustainability strategy, the Research Council states that it will encourage Norwegian companies to incorporate sustainability as a strategic competitive advantage, include sustainability perspectives in calls for proposals targeted towards trade and industry, and/or incorporate sustainability as an element of the assessment criteria for grant proposals where relevant. The public agencies in the research and

innovation system should cooperate on the development of sustainability criteria and take into consideration the work being done in the EU.

One of the principles of the Government's policy for promoting 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. In some sectors, targeted efforts will be most appropriate, while regardless of sector, it is important to put a value on the benefits to society of the climate- and environment-related aspects of relevant projects. This is in line with the recommendations of the Green Tax Commission. The results of research and innovation may be useful both within and outside Norway.

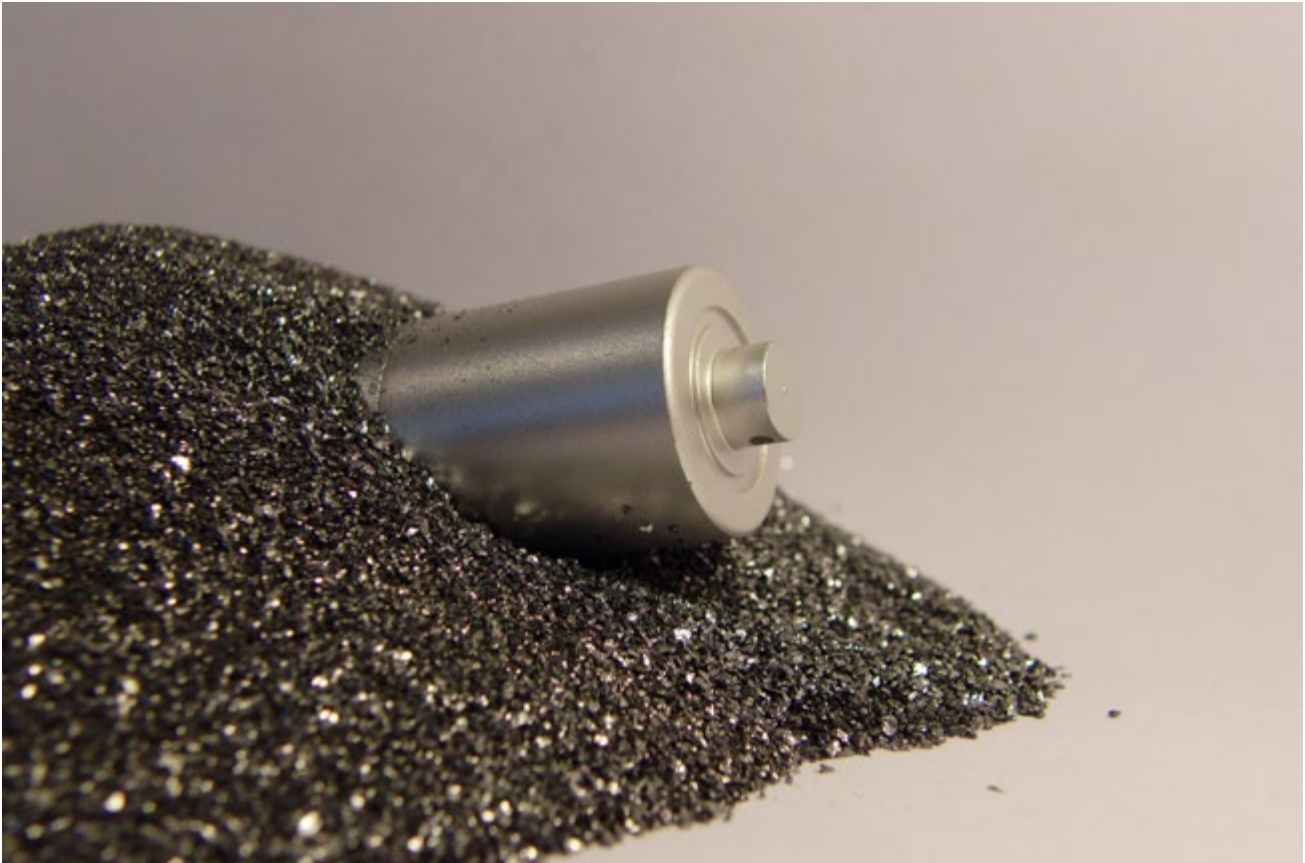
Enova

In the agreement between the Ministry of Petroleum and Energy for 2017–2020, the Government has shifted the focus of Enova's activities more towards climate-related activities and technology development. Enova offers a broad range of funding instruments to support the development of energy and climate technology, thus helping to lay the basis for a more energy-efficient and climate-friendly business sector. Special priority is being given to the development of technology with a long-term potential for widespread diffusion and for reducing greenhouse gas emissions.

Enova provides support for new technology on the path towards technological maturity. This encourages businesses to develop and test new solutions and reduces the risks for companies that wish to make use of new technology. The main priorities for Enova are reducing and eliminating barriers to new technologies and promoting permanent market change in order to encourage the introduction and deployment of energy-efficient and climate-friendly solutions. The total annual allocations to the Green Fund for Climate, Renewable Energy and Energy Efficiency Measures, which is administered by Enova, have been increased from about NOK 1.85 billion in 2014 to roughly NOK 2.7 billion in the budget proposal for 2018. This includes the revenue from an earmarked levy on the grid tariff paid by all electricity customers in Norway.

Innovation Norway

Innovation Norway's main task is to promote business development that is profitable in both business and



Elkem, together with the Institute for Energy Technology and the Sintef Group, is further developing its special silicon product, Silgrain ® eSi, for use in lithium-ion batteries. The aim is to develop a product that will make give considerably higher battery capacity than at present.. Photo: Elkem

socio-economic terms, and to unlock the potential for business development in different regions of the country. It administers several grant schemes that can also play a part in the development of innovative green solutions.

One of these is the environmental technology scheme, which is intended to promote sustainable business and industry in Norway and the achievement of Norway's climate and environmental targets by providing grants for pilot and demonstration projects based on environmental technology. Allocations to this grant scheme have been considerably increased in the last few years, and the proposed allocation for 2018 is NOK 464.5 million. Innovation Norway also administers the bioeconomy programme, which is intended to boost value creation from marine, agricultural and forestry resources, and the bioenergy programme under the national Agricultural Agreement, which has a budget of NOK 67 million.

At the end of 2015, the board of Innovation Norway

adopted a new strategy for the period up to 2020. In line with this strategy, Innovation Norway assesses projects according to criteria for profitability in business and socio-economic terms. If two projects score equally well, sustainable projects will be given priority. This means that a sustainability analysis is required for every project, in which opportunities and risks are assessed using a triple bottom line approach, in other words taking environmental and social factors into account as well as the economic dimension.

The Research Council of Norway

The Research Council published *Research for Sustainable Societal and Industrial Development*, its strategy for sustainability for the period 2017–2020, in August 2017. The strategy is intended to play a part in achieving the UN Sustainable Development Goals at both national and global level. Activities will be targeted towards areas where Norway has special advantages and potential or where there are special challenges or needs to be

The MAROFF programme

The MAROFF programme under the Research Council supports maritime companies and research institutions in further developing their knowledge-based advantages. Its target groups are shipping companies, the shipbuilding industry, service providers and equipment suppliers to all types of vessels and aquaculture facilities. The thematic priority areas of the programme are effective and environment-friendly energy use, resource-intensive maritime operations and advanced transport and logistics.

met. The Research Council will support industries' own roadmaps for green competitiveness, with a focus on those sectors with the greatest potential to reduce their environmental footprint, such as the process and petroleum industries.

Most current research activity under the Research Council that is related to low-emission technologies is in the energy field, primarily renewable energy, energy efficiency and carbon capture and storage (CCS). In petroleum-related research too, there is a focus on the development of new technologies and solutions that will improve energy efficiency and reduce greenhouse gas emissions. In addition, steps are being taken to ensure technology and knowledge transfer between the petroleum sector and other industries, for example aquaculture, the maritime sector and offshore wind power. The Norwegian petroleum industry has world-leading expertise in many areas of technology that can play a part in achieving a low-emission society.

Funding for R&D on environmentally sound energy technology through the Research Council has been increased. For example, the allocation to the Centres for Environment-friendly Energy Research (FME scheme) was increased by NOK 40 million in 2016, so that the scheme now receives an annual allocation of NOK 190 million. Eight new centres were established when the funding was increased in 2016.

The Government is supporting research and development on smart grids and smart cities through a number of funding instruments. The Centre for Intelligent Electricity Distribution (CINELDI) is one of the eight new centres under the FME scheme. It is to develop a knowledge base that can be used in making grid operations more effective and in developing new products and services.

European and international research and innovation cooperation

The Government's strategy for research and innovation cooperation with the EU establishes goals and ambitions for Norway's participation in Horizon 2020 and the European Research Area (ERA).¹⁰ Horizon 2020 is the world's largest research and innovation programme, with funding of EUR 80 billion available over a seven-

year period (2014–2020). Norway participates in the programme as a full member, and Norwegian companies and research groups can take part in the same way as colleagues and competitors in other European countries. Horizon 2020 provides major opportunities for obtaining funding for research, technology development and innovation that will promote green competitiveness.

The Government has intensified its efforts to encourage the business sector and research institutions to take greater advantage of the opportunities offered under Horizon 2020 for network building and co-funding. This is in line with its long-term plan for research and higher education. For the period 2015–2018, allocations to incentive schemes have so far been increased by about NOK 400 million. At least 60 % of the of the overall Horizon 2020 budget is expected to be related to sustainable development and at least 35 % is expected to address climate action. So far, the figures show that these goals have not been achieved. Requirements in calls for proposals were tightened up in 2017, with reference both to the Paris Agreement and to the Sustainable Development Goals. The requirements will be made even more specific in the final round of calls of proposals for 2018–2020, with references to particular SDGs. This will also apply to calls for proposals targeting industry.

The Government is playing an active part in discussions on the structure and content of the EU's next programme for research and innovation, FP9. The Government provided its first input in March 2017, focusing on the importance of green innovation, blue growth and digitalisation.¹¹

To strengthen green competitiveness and continue the development of the Norwegian knowledge society, Norway will also cooperate with countries outside the EU. The Government has drawn up a strategy for cooperation on higher education and research with Brazil, China, India, Japan, Russia and South Africa for the period 2016–2020, which is intended to play a part in this. Climate, energy and environmental issues are key areas in Norway's cooperation with these countries, and also with the US and Canada.

¹⁰ Ministry of Education and Research (2014): *Strategy for research and innovation cooperation with the EU. Horizon 2020 and ERA*

¹¹ https://www.regjeringen.no/contentassets/e643634286404426bda1ec119ae2763f/norwegian-position-paper-on-fp9_first-07.03.17-final.pdf



A longer-term approach and more interdisciplinary research

The long-term plan for research and higher education sets out three cross-cutting objectives: enhancing competitiveness and innovation, tackling major social challenges and developing research groups of outstanding quality. These are consistent with the objectives of earlier white papers on research policy, but with clearer and more specific priorities for areas where the research effort is to be intensified. The priorities for research and higher education are also linked more closely.

Since the long-term plan was published in 2014, the UN Sustainable Development Goals and the Paris Agreement have been adopted. The Government has started the process of revising the plan, and has received input from various stakeholders.

As part of the revision process, the Ministry of Education and Research requested a review of Norwegian policy for

research and higher education by the OECD. The report, which was published in June 2017, focuses strongly on the need for a long-term approach and systemic change.¹² The Government will consider the recommendations from the OECD and others for further development of the Norwegian research and innovation system as a whole during the revision of the long-term plan for research and higher education in 2018.

It is particularly important that support schemes in the research sector are based on a long-term approach and provide predictable funding. As mentioned above, the Government has increased funding for the FME scheme. The centres in the scheme can have a life span of up to eight years, but are evaluated after five years. A review of the system for allocating research funding at the Research Council carried out by an expert group in 2017 concluded that more should be done to facilitate long-

¹² OECD (2017): *OECD Reviews of Innovation Policy: Norway 2017*

Reducing food waste

In the CYCLE project, industrial partners and researchers are cooperating to find ways of using food that currently fails to reach the shops. The aim is to optimise every step in the supply chain and make full use of all resources. SINTEF Ocean is the host institution, and has received support from the Research Council's Programme on Sustainable Innovation in Food and Bio-based Industries (BIONÆR). CYCLE is an interdisciplinary project that incorporates bioeconomy perspectives, and is focusing on several value chains in the agricultural and marine sectors. Researchers are using a variety of tools including sensor and automation technology, robotics, and more environmentally-friendly processes to reduce losses during production and food waste by consumers.

Prosess21

Prosess21 is a strategic forum that will include relevant stakeholders from the industrial and research sectors. Innovation Norway, the Research Council, Enova, the Norwegian Environment Agency and Gassnova will also be involved.

The main task of Prosess21 will be to provide strategic advice and recommendations on how to reduce emissions from the process industries to a minimum by 2050 and at the same time ensure sustainable growth in the sector. Initially, the forum is being established for a three-year period. It will report to the Ministry of Trade, Industry and Fisheries, which together with the Ministry of Climate and Environment has observer status in the steering committee.

Considerable reductions have already been made in emissions from the Norwegian process industry over the past 25 years, and this has implications for what can be done in the future. Further cuts in emissions may be more dependent on the development of new technology and solutions than previously, and are less likely to be achieved by gradual improvements in technology and efficiency. Prosess21 is seeking to build on the spirit of cooperation that arose during the preparation of the roadmap for the process industry. It is intended to strengthen cooperation between centres of expertise associated with the industry and public agencies in the research and innovation system. The forum is also intended to encourage discussion on the scope of policy instruments and other relevant initiatives for reducing industrial greenhouse gas emissions and how they interact with each other. The forum will also consider smarter ways of using the public funding currently available.

term, stable funding that can promote the development of world-leading, high-calibre research groups. Among other things, the expert group highlighted the need to increase funding for established centre schemes, such as the Centres of Excellence scheme.

The institute sector has a key role to play in promoting green competitiveness. In its long-term plan, the Government set out its intention to strengthen the capacity of the research institutions to develop strategic, long-term knowledge. In the 2017 white paper on industrial policy, the Government announced that basic funding for the technical-industrial institutes would be increased. The Government will make an overall evaluation of the role of the institute sector in the research and innovation system, and of whether the sector is well enough adapted to future needs, when evaluation of all parts of the sector has been completed in 2018. .

Cooperation and dialogue between authorities, researchers and the business sector

Both the report from the expert committee on green competitiveness and the OECD's review of Norwegian policy for research and higher education point to the potential for improving cooperation between authorities, researchers and the business sector to meet the needs of society and improve competitiveness. The roadmaps that were drawn up for the expert committee have given the authorities better insight into the opportunities and challenges facing specific industries. However, today's industries will not be alone in shaping the future, and it will also be important to listen to the views of new companies and emerging industries in a dialogue on

future policy. The municipalities will also be important partners in implementing the Government's integrated strategy for green competitiveness.

The Government and the ministries can use several different arenas for dialogue with the business sector in order to improve the basis for setting R&D priorities in Norway. One of these is Energi21, Norway's national strategy for research, development, demonstration and commercialisation of new climate-friendly energy technology. Energi21 has a permanent board that is responsible for implementing and further developing the strategy. The board includes a number of members from business and industry, and also representatives of the Research Council, Enova, Gassnova and the research institutes. There are currently six main thematic areas in the strategy: hydropower, flexible energy systems, solar power, offshore wind power, energy efficiency and carbon capture and storage. In October 2016, Energi21's mandate was expanded to include energy for transport. This means that it can also consider technologies that can play a part in achieving the goal of limiting greenhouse gas emissions from the transport sector (land, sea and air transport). The Energi21 strategy is being revised and a new version will be presented in spring 2018.

The Government is now strengthening cooperation in the process industry sector between business and industry partners, the public administration and researchers, and has established a long-term strategic forum called Prosess21 (see text box).

Industries need access to the large volume of publicly funded R&D activity to be able to incorporate climate-

The PILOT-E scheme

In 2016, the Research Council, Innovation Norway and Enova collaborated on the launch of the PILOT-E scheme. Its aim is to speed up the development and deployment of novel products and services in the field of environment-friendly energy technology. Through the PILOT-E scheme, projects will be followed up and supported throughout the entire technology development pathway, providing that agreed milestones are achieved.

The first call for proposals under the PILOT-E scheme was issued in autumn 2016 and focused on solutions for zero-emission maritime transport. The Research Council and Innovation Norway together provided NOK 70 million in funding, supplemented by a flexible budget framework from Enova. In 2017, five different consortia started up ambitious projects to develop various solutions for car ferries, high-speed vessels and supply vessels using battery and hydrogen technology.

The second call for proposals through PILOT-E focused on commercial land transport and future digitalisation of the energy system, and the Research Council and Innovation Norway provided NOK 100 million. Enova is supplementing this with a flexible budget framework, and intends to finance the first full-scale commercial application that is developed.

friendly and environmentally sound solutions into their operations. It is vital that methods and findings originating from this research effort, particularly from highly qualified public institutions, are utilised to develop profitable products and processes. Disseminating and using the extensive knowledge developed in academia and research institutes enables the business sector to build up its competitiveness.

The institute sector, and particularly the environmental institutes, plays a key role by maintaining cooperation and dialogue with clients. An evaluation of the environmental research institutes published in 2015 emphasised that they should cooperate more closely with each other and with new partners in the business sector and public sectors.¹³

Close cooperation between public agencies in the research and innovation system is important to ensure that their activities are well coordinated. The agencies have established 'Forum for grønn vekst' (forum for green growth) as an arena for cooperation on issues relating to climate and environmental technology.

Education and lifelong learning

Those who are schoolchildren and students today will have to create assets and workplaces for tomorrow, and it is therefore vital that they are encouraged to develop expertise and creativity.

The core curriculum for Norway's school system has been updated and will soon be implemented. It includes

sustainable development as one of three cross-cutting thematic priorities. Technology has a strong influence on people, the environment and society as a whole. Technological know-how, sound judgement relating to technology development and an understanding of the links between technology and the social, economic and environmental aspects of sustainable development, are therefore key elements of this thematic priority.

One of the reasons businesses give for not investing more in research and development is that there are too few people in the labour force with the relevant skills and expertise. The white paper *Skilled Workers for the Future* (Meld. St. 9 (2016-2017)) published by the Ministry of Education and Research, and reviews published by the International Labour Organization (ILO) and the European Centre for the Development of Vocational Training (Cedefop) all stress that in future, vocational training should include elements relating to green jobs.

The Government's long-term plan for research and higher education 2015–2024 provides strategic guidelines for how higher education can play a part in addressing major social challenges and in supporting Norwegian competitiveness. A society needs substantial knowledge capital to succeed in adopting new technology and in innovation. The government-appointed Productivity Commission has emphasised that Norway's competitiveness will depend on a labour force with a high level of relevant skills and expertise, that is highly adaptable and that is able to participate in technology development in the future.

¹³ Research Council of Norway 2015: *Miljøinstituttene i Norge. Hovedrapport* [Norway's environmental research institutes. Full report]



Infrastructure for green solutions

Modern infrastructure and an effective transport system are of fundamental importance for a country's competitiveness, and are also vital for establishing value chains that do not cause greenhouse gas emissions or have a negative environmental impact. The Norwegian electricity supply system is already effective, reliable and virtually emission-free, which gives Norwegian companies a competitive advantage. Smart infrastructure will make it possible to improve the efficiency of the transport system. Digital infrastructure is an essential part of the transformation process that Norway must undertake.

Investments in infrastructure have a very long time frame, so that decisions taken now will have a decisive effect on the success of the transformation process in the future. It is essential to ensure good coordination of land-use and transport planning, and to make it possible to use zero- and low-emission solutions.

To ensure that Norway's future infrastructure provides a basis for green competitiveness, the Government will:

- review incentives that can increase the use of rail and sea transport;
- develop a national plan for infrastructure for alternative fuels in the transport sector and climate-friendly fuels for domestic shipping;
- facilitate testing of self-driving vehicles;
- work towards the construction of full-scale CCS demonstration facilities.

New technology in the electricity supply system

The power sector is changing. Electricity consumption is becoming more energy-efficient, but at the same time peak loads are rising. Electricity is being used in new products and for new purposes, resulting in a pattern of short periods of peak consumption. In addition, the proportion of electricity produced from intermittent renewable sources is increasing. Changes in production and consumption patterns will have major implications for grid operations and for the investments needed in the sector.

The Government wishes to obtain as clear a picture as possible of how the power supply system may be organised in the future. New technologies and market-based solutions can make it possible to develop a more efficient and flexible system. Over time, this may reduce the need for investments in the grid and reduce companies' energy costs. The Norwegian Water Resources and Energy Directorate has therefore been asked to establish a forum to assess the implications of the development of a smarter grid for grid companies' operations, and how new technology can best be deployed, used and further developed.

One example of new technology and digitalisation is advanced metering infrastructure (AMI). By 1 January 2019, all Norwegian electricity customers will have had smart meters installed. These give frequent, automatic readings of electricity consumption, which will result in better data quality.

Over time, AMI will enable the grid companies to improve the efficiency of their operations, so that their costs and the grid tariffs paid by customers will be lower than they would otherwise have been. AMS provides accurate meter readings and data on consumption, load and voltages, allowing grid companies to carry out more precise grid analyses for planning and operational purposes. With smart meters, customers have the option of hourly meter readings and settlement, making it easier for them to adjust their consumption in line with price fluctuations and the load on the grid. They can benefit by reducing their electricity bills, and there are also likely to be efficiency gains for society as a whole. Smart meters also make it possible for energy companies or suppliers of digital services to develop and offer other smart solutions, for examples ways of saving energy or managing electricity consumption.

Developing an emission-free transport system

Effective land-use policy and planning, coordinated with transport systems, can play a part in Norway's transition to a low-emission society. To ensure the necessary changes, long-term agreements are now being concluded



The Norwegian company Ziptec has developed and is delivering some of the most advanced and highest-capacity charging infrastructure for electric vehicles in the world. Photo: Ziptec

between the central government, the county authorities and some municipalities in Norway's largest urban areas. The starting point for these agreements is Norway's goal that the growth in the volume of passenger transport will be met using public transport, cycling and walking, and that there will be zero growth in passenger car traffic. One element of these agreements is that the central government agrees to pay up to 50 % of the investment costs of particularly important public transport infrastructure projects at county level.

Efficient freight transport is vital to the competitiveness of the business sector, and a transition to an emission-free transport system is essential if Norway is to become a low-emission society. The freight transport sector will have to meet major challenges in the years ahead, which include finding ways of making substantial cuts in emissions and considerable improvements in efficiency. In the National Transport Plan 2018–2029, the Government has stated that its ambition is for 30 % of goods transported over distances of more than 300 km to be transferred from road to rail and sea by the end of the planning period. Achieving such a large-scale switch will require effective economic instruments and larger

investments than those included as part of the National Transport Plan. The Government will therefore review other ways of increasing the use of rail and sea transport.

According to the National Transport Plan 2018–2029, the Government is planning investments totalling NOK 18 billion to make rail freight transport more efficient and attractive. The Government has also established grant schemes for transferring freight transport from road to rail and sea and for inter-port cooperation. In addition, a programme for maintenance and upgrading of existing railways and the opening of new stretches of track will improve punctuality, increase capacity and reduce journey times. This will make rail freight transport more competitive.

Fuel cells based on hydrogen are a zero-emission technology that could potentially become important for the decarbonisation of commercial transport, and particularly for heavy road vehicles and shipping. Some hydrogen fuelling infrastructure has already been developed in Norway, and more is being constructed with support from Enova. In addition to supporting the establishment of hydrogen filling stations for the

Attractive Nordic towns

Norway held the presidency of the Nordic Council of Ministers in 2017, and one of the priorities of its programme for the year was the Nordic region in transition. Norway launched several initiatives to promote Nordic competitiveness, a green shift, the transition to a low-emission economy, integration and better public health. One of these was a project called 'Attractive towns. Green redevelopment and competitiveness in Nordic urban regions. Towns that provide a good life for all'. The project is headed by the Ministry of Local Government and Modernisation in cooperation with the Ministry of Health and Care Services and the Ministry of Climate and Environment.

The purpose of the project is to draw up a joint Nordic strategy for how towns and their surrounding areas can become more attractive by developing a good, inclusive urban environment that is economically, socially and environmentally sustainable.

public, Enova is supporting purchases of zero-emission commercial vehicles, including hydrogen-powered trucks.

Electrification of the transport sector

Norway is a pioneer of electric transport solutions. The share of electric cars in sales of new passenger cars is the highest in the world, and Norway is a world leader in the development of electric solutions for shipping. About 80 % of rail transport (measured in train-kilometres) runs on electricity. In the maritime sector, Norway has a high level of expertise along the entire value chain and is in a good position to increase value creation in an expanding international market. As battery prices have dropped and suppliers have been required to meet new requirements as part of public procurement processes, there have been considerable progress in electrification of parts of the shipping sector, and particularly ferries, in the course of only a few years. This includes the introduction of fully electric vessels, hybrid vessels, and the provision of shoreside electrical power for ships at berth. Since 2015, Enova has been promoting these developments, among other things by providing about NOK 480 million in support towards the development of charging infrastructure for ferries. This support has been vital in encouraging the county authorities to begin the process of replacing their ferries with low- and zero-emission vessels. In addition, Enova has so far provided NOK 340 million for the establishment of 50 onshore power supply systems for ships at berth. The shoreside electrical power projects will both reduce greenhouse gas emissions and improve air quality in Norwegian port cities. Enova has launched another call for proposals for shoreside electricity projects and the awards are likely to be announced by the end of 2017.

The Government will develop a national plan for infrastructure for alternative transport fuels. This will include sufficient charging infrastructure for electric modes of transport and filling stations for hydrogen and biogas given the quantitative targets for zero-emission vehicles that apply up to 2030, and climate-friendly fuels for domestic shipping. Public agencies in the research and innovation system, including Enova, will support market developments at an early stage. However, the intention is for the development of infrastructure for zero-emission fuels to become market-driven as quickly as possible, so that public-sector support is not needed. The provision of charging infrastructure for shipping, combined with measures such as the inclusion of requirements to use low-emission solutions in public contracts and concession contracts, will help to create a domestic market for new maritime technology. On the supplier side, upgrading the power supply system and developing charging infrastructure may open up a number of opportunities for Norwegian companies. The Government will consider how the anticipated demand for alternative fuels should be taken into account in planning for the power grid, roads and other infrastructure.

Norway has made much more progress than other countries in developing infrastructure for electric vehicles, including both fast-charging and normal charging points. Enova is supporting the establishment of charging infrastructure in municipalities where there are fewer than two fast-charging points, and has been promoting the development of a network of fast-charging points between the larger towns. Enova has awarded grants totalling NOK 50.5 million for the establishment of 230 fast-charging stations. In addition, some urban

municipalities have established support schemes for the establishment of charging stations in town centres.

Facilitating the development of infrastructure at an early stage of the electrification process has been a key element of Norway's policy. Norway is becoming a laboratory for green solutions in the transport sector. In an international context, this is a good example of how it is possible to develop well-functioning infrastructure for electrification of transport. Norway's pioneering role in this area may open up new opportunities for Norwegian businesses.

Digitalisation and autonomous technology

Digitalisation is another development that will be vital for future transport and energy solutions. Norway's National Transport Plan 2018-2029 refers to studies suggesting that digitalisation may lead to the development of transport systems that are radically different from those in use today.

Digitalisation of the transport sector may improve traffic flows and reduce emissions, and also alter the modal split of transports. Using digital solutions may make it safe for more vehicles than today to use the same stretch of road or track, partly because better communications can make it possible for vehicles to drive closer together without increasing the risk of accidents. New options for collecting and analysing large amounts of data will provide a basis for better traffic control and for providing

services that are better tailored to user needs. At the same time, new business models are being developed that can boost innovation and result in a wider range of transport services. Mobility is becoming a more and more important concept in transport policy, because providing better information and improving the organisation and integration transport can make it possible to offer more varied and attractive transport services, partly by making better use of the existing physical infrastructure. The Government will build up knowledge about the implications of technological advances. This will be vital for ensuring that the investment choices made for the future are robust and sustainable.

Autonomous vehicles can play a part in making the transport system more effective, with better use of resources and lower emissions. The Government considers it important to ensure that the legislation facilitates sound use of new technology, and intends to make arrangements for testing of autonomous vehicles in Norway. The Ministry of Transport and Communications has therefore been reviewing the legislation with a view to removing legal barriers to testing vehicles with various levels of autonomy, and has submitted proposals for legislative amendments on testing of autonomous vehicles to the Storting.

However, a good deal remains to be done before fully autonomous vehicles can be widely used in normal traffic. The growth of integrated and intelligent transport

World's first test bed for autonomous shipping in the Trondheimsfjord

The Norwegian Coastal Administration and the Norwegian Maritime Directorate, in cooperation with the maritime technology sector and research groups, all played a role in the designation of part of the Trondheimsfjord as the world's first test bed for autonomous shipping technology. The authorities will use experience gained from trials in the area in the further development of legislation, services and infrastructure.

A committee has been appointed to carry out an overall review of Norway's Act relating to ports and navigable waters with a view to improving maritime safety and providing a good framework for effective, environmentally sound transport. The Ministry of Transport and Communications will look at ways of promoting further technology development in its follow-up of the committee's work.

Freight transport by sea is generally more energy efficient than other modes of transport. The lowest costs are achieved by using large vessels, which provides an economic incentive to develop a system based on large ships and few calls at port. However, this gives road transport by truck a competitive advantage, since it is more flexible. Using autonomous vessels may make it possible to operate a larger number of smaller ships, thus making maritime transport more competitive with road transport in terms of flexibility.



The Yara Birkeland is an autonomous electric container vessel that will be able to replace about 40 000 truck journeys per year between Yara's fertiliser plant on Herøya and Brevik and Larvik, which are the ports of shipment. Illustration: Kongsberg/Sintef

systems, involving extensive sharing of data between units in the system, will require robust, high-capacity digital infrastructure that can transmit large quantities of data in real time. It may be necessary to install digital equipment and devices as part of the road network, but it is not clear what the optimal scale of this will be.

Autonomous vessels offer a great deal of potential for improving operational efficiency, and may be in use within the next few years. Norway is at the forefront of research on autonomous ships. Segments such as short sea shipping, ferries and offshore vessels are of interest in this context. Unmanned systems and vessels will increase the need for new solutions for hulls and machinery, new maintenance models, and infrastructure solutions and

legislation that supports these developments. These changes may open up new business opportunities in Norway.

Carbon capture and storage

Carbon capture and storage (CCS) can be used to reduce greenhouse gas emissions from Norwegian industry. If the costs of CCS are reduced sufficiently and the international carbon price is high enough, using CCS technology will be a way of improving the competitiveness of the industrial sector in a low-emission society. In the long term, using CCS can help companies to maintain the competitive position of their primary products such as cement, mineral fertiliser and natural gas. If investments are made in storage infrastructure, this may open up

Hydrogen offers new opportunities

Hydrogen can be produced from both fossil and renewable energy sources. For Norway, the methods of most interest for hydrogen production with no or very low CO₂ emissions are electrolysis of water (based on renewable electricity production) and reforming of natural gas with subsequent CO₂ capture. Hydrogen is a key product at large processing plants in Norway, for example Mongstad and Tjeldbergodden, which have more than 20 years' experience of the safe production and handling of large quantities of hydrogen.

There are many areas of use for hydrogen. The manufacturing sector accounts for the largest proportion of hydrogen consumption today, but it may also become important in the transport sector and for the production of electricity, heating and cooling. Hydrogen can also replace fossil intermediate inputs in industrial processes. Hydrogen is a clean energy carrier, and its use does not result in CO₂ emissions.

Hydrogen is a suitable fuel for ferries, aquaculture service vessels and high-speed vessels. Hydrogen-driven vessels will have a much longer range than purely battery electric vessels. Hybrid systems combining batteries and hydrogen fuel cells could meet the needs of many types of ships and operations. There is a great deal of R&D activity on hydrogen-driven vessels in Norway, and Norwegian partners are engaged in a project to develop the world's first ferry using hydrogen fuel cell propulsion. Apart from the fuel cells themselves, all parts of the ferry will be supplied by Norwegian companies. The authorities are supporting the development of hydrogen as a fuel by providing research funding and through public procurement policy.

Norway has energy resources and an industrial base that give considerable potential for value creation from hydrogen. NEL Hydrogen can deliver complete hydrogen filling stations based on electrolysis. Hexagon Composite has through its US subsidiary developed world-leading light-weight composite pressure cylinders for transport and storage of gases, including hydrogen. Statkraft and other companies in the renewables sector are considering options for using hydrogen. Yara is a major global producer of hydrogen, which is used directly in the manufacture of ammonia and mineral fertiliser. Statoil is considering options for large-scale conversion of Norwegian natural gas into hydrogen, combined with carbon capture, for use in European markets as a replacement for fossil fuels to produce electricity and heat, and for maritime transport.

Norwegian value creation from hydrogen can be based either on technology exports or on exports of hydrogen produced from renewable sources and from natural gas. According to SINTEF, in an international context hydrogen applications could become Norway's greatest contribution to a low-carbon future.

opportunities for the establishment of new industries in Norway.¹⁴

According to the IPCC and the International Energy Agency (IEA), it will be very difficult and much more costly to achieve the two-degree target without making use of CCS. The Government's ambition is the construction of at least one full-scale CCS facility by 2020, and the roadmap from the process industry highlights CCS as an essential basis for achieving the sector's zero-emission ambition for 2050 while at the same time doubling production levels.

¹⁴ The Government presented its CCS strategy in the 2014 budget proposal from the Ministry of Petroleum and Energy (Prop. 1 S (2014-2015)).

Norway has devoted considerable resources to the development of CCS solutions and technology, for example through the CLIMIT research and demonstration programme, the Centres for Environment-friendly Energy Research (the FME scheme) and the Technology Centre Mongstad (TCM). A number of research groups and companies have also built up a great deal of expertise in this field. Norwegian business and industry is in a good position to supply technology and solutions if CCS is taken into use on a large scale internationally.

At present, global carbon prices are so low that industries will not implement CCS solutions without substantial support. There is still a need to scale up and test new technologies. New projects will provide experience of

the construction and operation of integrated plants and infrastructure for carbon capture, transport and storage, and the lessons learned can help to reduce the costs of subsequent projects. CCS will only become an important mitigation measure when it is being used at a large number of plants throughout the world. According to the Global CCS Institute, there were 15 operational large-scale CCS facilities globally at the end of 2016, with a total capture capacity of almost 30 million tonnes CO₂ per year.

Efforts to achieve full-scale CCS in Norway have already involved several phases, including a pre-feasibility study in 2015 and feasibility studies in 2016. The purpose of the feasibility studies was to demonstrate at least one feasible full-scale CCS value chain, with cost estimates. They showed that several CCS options are technologically feasible. Planning and investment costs will depend on how much CO₂ is to be captured and where, how many vessels will be needed for transport and how much CO₂ is to be stored and where.

On the basis of the result of the feasibility studies, it was decided to continue the planning process, as announced by the Ministry of Petroleum and Energy in its 2016 budget proposal Prop. 1 S (2016-2017). Gassnova has awarded contracts for conceptual studies of carbon capture with an option for front-end engineering and design (FEED) to three facilities. The three, Norcem

(cement plant), Yara (ammonia factory) and the energy recovery plant Klemetsrudanlegget are to deliver their reports in autumn 2017. In addition, Statoil has been awarded a contract for conceptual studies of CO₂ storage. According to plan, the choice of concept for the storage part of the project will be made in summer 2018.

The conceptual studies will provide updated cost estimates for CO₂ capture and transport, a better understanding of the risks of the different projects, and thus a better general picture of costs and risks for the Norwegian state. At the same time, the companies involved, Gassnova and the Ministry of Petroleum and Energy are reviewing the benefits of the project. The main objective of the project is to achieve learning effects and cost reductions for subsequent CCS projects. The conceptual studies will provide new information on both costs and benefits associated with a full-scale CCS project in Norway. The Government will therefore present the Storting with a complete account of the status of work on full-scale CCS in Norway once the results of the conceptual studies have been reviewed, and at the latest in connection with consideration of the revised national budget for 2018. This will include an evaluation of the contributions from the industrial operators, the overall costs and risks at state level, and the potential for cost reductions and technology dissemination to projects in other countries.



Better management of climate risk and funding of green solutions

In order to achieve green competitiveness, it is vital that both the business sector and the authorities make decisions based on relevant, up-to-date and comparable information on how climate change and action to address climate change may affect profitability in the future. It is desirable to improve our understanding of how a stricter climate policy and rapid technological change may affect the Norwegian economy.

Most of the funding for Norway's transformation into a competitive low-emission economy will have to come from private sources. This means that the financial sector will play an important part in the development of Norway's green competitiveness. In addition, the market has a role to play in reducing loss and damage by pricing climate-related risks.

To facilitate sound management of climate risk, the Government will:

- appoint an expert committee to assess climate-related risk factors and their importance for the Norwegian economy;
- consider the recommendations made by the Task Force on Climate-related Financial Disclosures appointed by the Financial Stability Board and their implications for the Norwegian economy, efforts to promote financial stability and the management of the Government Pension Fund Global;
- consider the development of standards or guidelines for the climate and environmental reporting required under the Accounting Act to improve its quality and relevance and ensure that material information is reported.

Climate risk

Both climate change and action to reduce emissions influence the framework for and risks associated with economic activity. For example, higher average temperatures, changes in precipitation patterns and

higher sea levels will have consequences for water supplies, agricultural activities and production and consumption patterns more generally. More frequent extreme weather events will result in different patterns of damage and create a challenging situation for the insurance industry.

Action to curb climate change also has consequences. Technology development, carbon pricing and regulatory measures can change the global market conditions for carbon-intensive goods and services. There will be adverse effects on profitability if long-term investments are locked into business areas that experience a sudden fall in prices and capital value or a permanent reduction in demand as a result of changes in climate policy and rapid technological change. A shift away from fossil energy carriers may trigger a drop in the value of capital and fossil fuel reserves, which may in turn disrupt the activities of banks and other financial institutions. Major changes over a short period of time may threaten financial stability.

As one way of improving knowledge about climate-related risk factors and their significance for the Norwegian economy, the Government has appointed an expert committee. It has been tasked with assessing the most appropriate ways of analysing and describing climate risk at national level, identify key global climate risk factors and assess their significance for the Norwegian economy and financial stability. The committee will also consider possible methodologies that can give private and public entities, including financial institutions, a better basis for analysing and managing climate risk.

The recognition that there are various forms of climate risk has increased demand from the business sector itself for decision-relevant information on the climate footprint of companies and organisations. Many financial institutions are in the process of incorporating climate- and environment-related considerations into their core activities in order to maintain their long-term profitability.

Financial Stability Board

In 2015, G20 leaders asked for a task force to be established under the Financial Stability Board to identify ways of improving climate-related financial reporting and making it more consistent. The task force was chaired by Michael R. Bloomberg, and was to develop a framework for uniform reporting on the financial risks posed by climate change. The purpose of their work was to improve the transparency and efficiency of markets by providing investors, banks and other financial institutions with better, more accessible and more comparable disclosures as a basis for investment decisions. The task force has pointed out that the transition to a low-carbon economy present significant risks, but also offer opportunities for investors. It recommends that climate-related financial disclosures by companies and investors should include information on how climate-related risks are taken into consideration in strategic processes, and how these risks are identified, assessed and managed. The task force encourages stress testing of companies' business models for different climate-related scenarios, including one that achieves the goals of the Paris Agreement.

On 29 June 2017, a task force appointed by the Financial Stability Board established by the G20 presented a report containing recommendations on how companies' climate-related financial disclosures can be reported in a better and more consistent way on the financial risks associated with climate change. The G20 took note of the report.

The Task Force took a forward-looking approach in its recommendations. Their reasoning was that in addition to reporting on their current climate footprint, it is vital for companies and organisations to describe the scenarios they use in their planning and how they plan to deal with potentially abrupt, large-scale market changes resulting from stricter climate policy and rapid technological change. Companies and financial institutions that have already declared their support for the recommendations include Royal Dutch Shell, Dow Chemical and the Axa Group, and DNB, Norsk Hydro and Storebrand from Norway.

The Government will consider the implications of the report from the Financial Stability Board for the Norwegian economy, efforts to promote financial stability and the management of the Government Pension Fund Global. The Ministry of Finance will discuss relevant issues in this connection in the 2018 white papers on financial markets and the management of the Government Pension Fund Global, which are to be published in the first half of the year.

Funding of green solutions

Mobilising private capital for a climate-friendly transformation process will require the right framework, and above all, pricing of emissions, regulatory measures

and targeted support for research and development. Norway's target of becoming a low-emission society by 2050 and the goals of the Paris Agreement provide a clear long-term signal for private investors.

The Government will use public funding in ways that can also trigger private investment where there are real barriers or market failures. The Government is already using a range of financial instruments to supplement the financial market, and loans, guarantees, grants and tax deduction schemes are encouraging innovation and change in the business sector.

The Government is in the process of setting up a new investment company to be called 'Fornybar AS', which will be used to bring about direct and indirect cuts in greenhouse gas emissions. The company will invest mainly in companies that are not listed on the stock market and through 'fund of funds' structures, mainly targeting new technology at the transition stage from development to commercialisation. Fornybar AS will invest on the same terms as the private co-investors, and will give priority to low- and zero-emission solutions.

The new company will be established as a wholly state-owned limited liability company, with headquarters in the Stavanger region. In the 2018 budget, the Government has proposed an investment ceiling of NOK 400 million for 2018. It proposed that the company should be seeded with an allocation of NOK 200 million, and that authorisation should be granted to pledge future investments up to a ceiling of NOK 200 million. Increases in the allocations will be proposed at a later date on the basis of the company's operations and investment prospects.



Heavy rain and flooding caused serious damage in Utvik in Sogn og Fjordane on 25 July 2017. Per Inge Verlo (58) is looking at the damage around his home. Boards and other material were carried down by the river from a timber merchant further upstream. Photo: HALLGEIR VÅGENES, VG

General steps to improve access to risk capital

- The Government has reduced the wealth tax rate, increased the tax value of secondary dwellings and reduced the tax value of shares and fixed assets. This has made the taxation of real property less favourable, promoting the use of Norwegian private capital for commercial activities.
- The Government has introduced a tax incentive scheme for long-term investments in start-ups. Personal taxpayers can claim a deduction from their general income of up to NOK 500 000 per year for share contributions to start-up companies.
- Various instruments will be considered to improve companies' access to capital during the growth phase, including an increase in the loss reserves for national innovation loans established by Innovation Norway.
- The Government has appointed a committee to examine access to capital for Norwegian business and industry, including whether access to capital is good at an early stage for potentially profitable projects, and the extent to which the capital market is facilitating a green shift.
- The Ministry of Finance is holding a public consultation on proposed amendments to the legislation to remove the quantitative limit on the stake a life insurance company may hold in non-insurance companies. They are currently not permitted to engage in non-insurance activities, but may nevertheless own up to 15 % of non-insurance companies. Amendments in line with the proposals could improve access to capital, for example for infrastructure development.



A circular economy

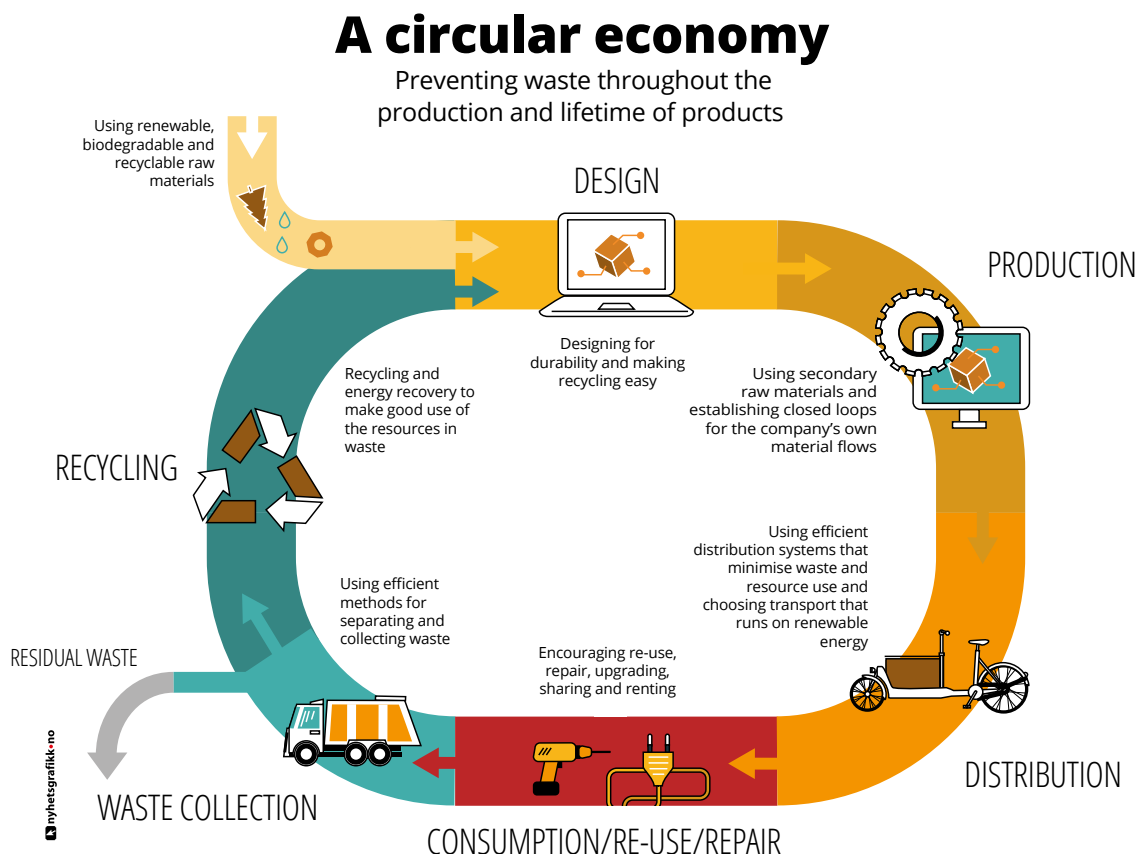
Using resources efficiently is the essence of a sound economy. A circular economy takes a wider perspective on what should be considered as resources and how they can be used as efficiently as possible. The growing pressure on natural resources in the world today makes it essential for the good of the climate and environment to use and re-use resources more efficiently. And since efficient resources use makes good economic sense, an active policy to promote the development of a circular economy can also strengthen the green competitiveness of the business sector.

In a circular economy, resources are used in a way that maximises the value and benefits to society for as long as possible. This can be achieved by designing products to be more durable and easier to re-use, repair, upgrade and recycle, and circulating products and materials in a way that minimises losses. Companies that focus on resource efficiency can achieve both direct and indirect reductions in costs, find new sources of income and boost their reputation.

To promote the transition to a circular economy, the Government will:

- seek to strengthen markets for secondary raw materials in cooperation with the manufacturing and waste sectors;
- further develop and clarify the legislation to promote the useful and environmentally sound use of waste and slightly contaminated masses;
- increase recycling rates: consider the introduction of requirements to separate wet organic waste and plastics and extended producer responsibility for more waste types;
- strengthen demand for circular solutions by maintaining the current guarantee schemes, and cooperate with the EU to strengthen labelling schemes that encourage greener consumption patterns.

Figure 2: In a circular economy, resources are used in a way that maximises the value and benefits to society for as long as possible.





Electrical cables from the seabed of the Oslofjord have been transported to the specialist recycling company MT Gjenvinning AS, where 99.9% of the materials in the cables are recovered for re-use. The copper alone is worth around NOK 33 million.
Photo: RENAS / Thomas Haugersveen

A circular economy will alter the competition framework

The EU adopted its Circular Economy Package in December 2015. The main goals were to ensure more stable access to certain resources, promote economic growth and more sustainable development, and create new opportunities for employment. Several EU countries are pursuing increasingly active policies for a circular economy and resource efficiency. For example, Denmark has in the last few years launched a strategy for 'Denmark without waste', is promoting circular public procurement, and offers support schemes and assistance with brand building, all including circular solutions. The Netherlands is aiming for a 50 % reduction in the use of primary raw materials (minerals, fossil and metals) by 2030.

Because Norway is a party to the EEA Agreement and the EU is Norway's largest export market, the EU initiative for a transition to a circular economy may have major implications for Norwegian business and industry. Companies will have to be prepared to compete within a framework of increasingly strict rules on resource efficiency, and will need to take more responsibility for their products along the whole value chain. Precisely because the EU is one of Norway's most important

The Eyde Cluster and circular business models

The Eyde Cluster includes large process industry companies such as Elkem, Hydro and Eramet and a number of small and medium-sized knowledge institutions. In 2015 it became the Norwegian Centre of Expertise for Sustainable Process Industry, giving it a national position in the development of the industry. The members of the cluster work closely together to ensure innovation, develop their human resources and develop new business models. The purpose is to maintain their competitiveness in the transition to a low-emission society, strengthen and develop value chains associated with the process industry, and develop and disseminate world-leading low-emission technology for the process industry.

The Eyde Cluster has established routines for developing joint innovation projects involving member companies. Some of their research, development and innovation projects that deal with the circular economy are:

- **Waste to Value** – the main objective is to find ways of manufacturing commercial raw materials based on by-product streams. The idea is to make use of materials in new products rather than disposing of them as waste.
- **Eyde Bio Karbon** – the project is developing sustainable biocarbon based on Norwegian timber to replace fossil sources. The aim is to build up a process industry based on Norwegian wood resources.
- **Eyde Battery** – the objective is to develop tailor-made materials for use in lithium-ion batteries, with a view to establishing battery production in Norway.
- **Eyde Heat Energy** – the project will make it possible for the companies in the Eyde Cluster to use more waste heat internally or to supply others.
- **Eyde Energi** – by sharing their expertise, the companies have been able to reduce overall energy consumption (measured as specific energy consumption) by 17 % in the past five years.

The circular economy in the roadmaps for green competitiveness

Several industries have drawn up roadmaps dealing with the need for a transition to a circular economy in their sectors and presented them as input to the expert committee on green competitiveness. They include waste management and recovery, the process industry, the wholesale and retail sector and the building sector.

The roadmap for the waste management and recovery sector sets out a vision of becoming a catalyst for the transition to a circular economy by shifting from primarily collecting and treating waste to producing, distributing and selling recycled raw materials and fuels.

The building sector's roadmap for 2050 includes recommendations for both immediate and longer-term measures that building owners and the authorities can implement. The most important of these is to ensure that buildings are flexible, so that they can be adapted to new needs without major alterations. The Federation of Norwegian Construction Industries has also drawn up a policy document for the period up to 2030 describing how the sector will contribute to more sustainable use of resources and play a leading role in the transition to a circular economy. This will include drawing up goals to make resource use more effective throughout the value chain, from raw materials to waste management and recovery; developing product design and production processes with a view to greater flexibility; using more durable products and solutions that are easier to repair, upgrade and develop further; and developing a set of tools to influence consumption patterns and the market with the aim of developing a circular economy.

export markets, its vision for a circular economy opens up opportunities for Norwegian companies that can offer new smart, green solutions and technology that will improve resource efficiency.

More robust markets for secondary raw materials

A targeted policy for the best possible use and re-use of the resources in waste is one of several elements of a competitive green economy. At European level in particular, more recycling of waste is expected to play a part both in reducing greenhouse gas emissions and in the development of new business opportunities and workplaces. In addition to ensuring safe management of hazardous waste, Norway's waste policy is intended to maximise the use of the resources in waste through ambitious targets for recycling and energy recovery to ensure sound resource use.

Stable access to and production of high-quality secondary raw materials will be essential to ensure that Norwegian businesses have incentives to use them more widely. Among other things, this means that production processes must not result in the spread of priority hazardous substances, and secondary raw materials must be free of such substances. Suitable technology must be developed and deployed to ensure this. Market participants will also need to draw up clear criteria for secondary raw materials and communicate them to manufacturers. The Government will take steps to strengthen the market for secondary raw materials in cooperation with the manufacturing and waste management sectors. These issues were discussed in a recent white paper on Norway's waste policy and the

circular economy.¹⁵ A stable framework is also needed to create more robust markets for secondary raw materials. The white paper includes proposals for ambitious targets for recycling and separation of waste and steps to increase useful and environmentally sound use of waste and waste-based products.

Sustainable use and export of sustainable biological resources

Sustainable utilisation of biological resources is an important part of a circular economy, and the market for them is growing. Norway has important competitive advantages in its abundant supplies of biological resources and the fact that it has the industrial base and expertise needed to exploit their potential. One sector where there has been substantial growth is the biomarine industry, which is based on advanced biorefining of marine raw materials such as marine oils and kelp. Several of the largest industrial companies globally in this segment are now established in Norway. Initiatives to increase sustainable use of renewable resources and the development of new products and solutions based on them can contribute to the restructuring of the Norwegian economy. The Government's bioeconomy strategy, which was published in 2016, describes how Norway can ensure that renewable biological resources are produced and harvested sustainably.¹⁶

¹⁵ Meld. St. 45 (2016-2017) Avfall som ressurs – avfallspolitikk og sirkulær økonomi [Waste as a resource – Norway's waste policy and a circular economy].

¹⁶ Nærings- og fiskeridepartementet (2016). Kjente ressurser – uante muligheter. Regjeringens bioøkonomistrategi. Ministry of Trade, Industry and Fisheries. *Familiar resources – undreamt of possibilities. The Government's Bioeconomy Strategy*. English summary



Increasing exports of green solutions

Sustainability, climate and environment is becoming an increasingly important issue for the business sector and financial institutions, and is also expected to become a more significant factor for exports in the longer term. Norway has ambitious climate and environmental targets and one of the cleanest energy systems in the world. Norway also scores highly on measures of sustainability. This boosts confidence in Norwegian companies and products and makes Norway an attractive country to trade with and invest in.

To promote exports and the internationalisation of climate and environmental technology, the Government will:

- establish an initiative to profile and market Norwegian green solutions under Innovation Norway and organised in cooperation with the business sector;
- seek to ensure that Norwegian capital and expertise on electrification and renewable electricity production is used in the large-scale expansion of renewable energy that is expected in developing and middle-income countries;
- follow up Norwegian priorities in the WTO environmental goods negotiations;
- cooperate with export-oriented business on contributions towards the achievement of the UN Sustainable Development Goals.

Coordinated profiling of Norwegian green solutions

Norway is in a good position in several areas to take the lead in technology development and in finding solutions for the green shift. These include the process industry and electrification of the transport sector. Norway is already a world leader in developing technology for the electrification of maritime transport. Sustainable aquaculture is another possible growth area. The bioeconomy, circular economy and smart buildings

and towns are other areas that offer opportunities. The Government wishes to give extra support to business sectors that offer green solutions and that have good prospects in international markets.

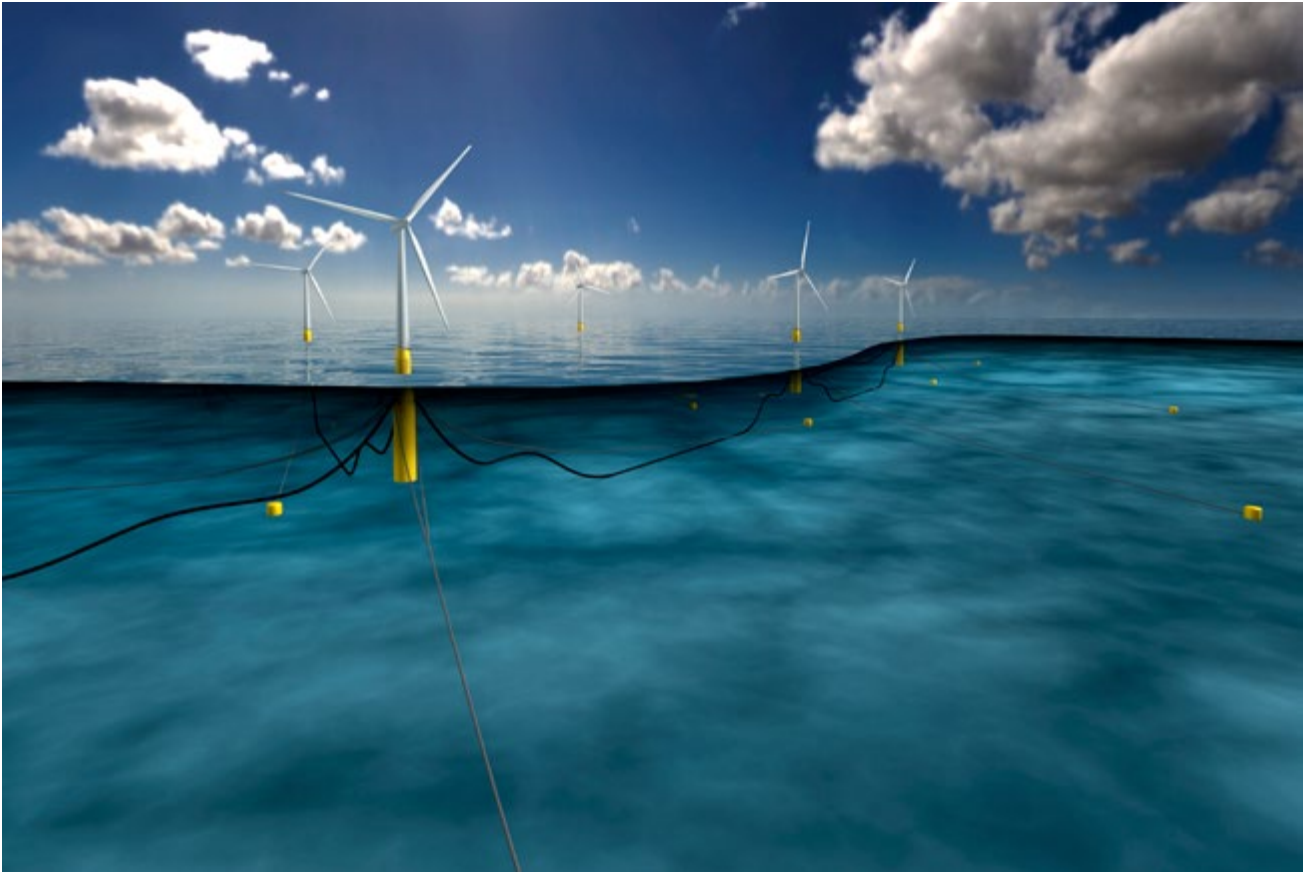
The Government would like to see a coordinated initiative to profile and market Norwegian green solutions in order to boost exports and attract international investors to Norway. Innovation Norway is to establish cooperation with the private sector to this end. It has been tasked with creating more arenas for cooperation and improving profiling and marketing to boost exports of Norwegian green solutions. One important tool of the initiative will be the development and maintenance of a website to act as a digital gateway for information.

The initiative is inspired by the Danish State of Green, a public-private partnership established in 2009 to profile, spread information on and build a brand for Danish climate and environmental solutions. The success of an initiative of this type in Norway will depend on close cooperation between the authorities and the business sector, and between relevant funding agencies. The business sector will therefore be invited to take part in both designing and helping to fund the initiative. In 2017, the Ministry of Climate and Environment allocated NOK 4 million to Innovation Norway for preparations for the initiative with a view to full start-up in 2018. The Government has proposed an allocation of NOK 10 million for the initiative in 2018 from the Ministry's budget.

The 2018 budget proposal includes an allocation of NOK 34 million to Norwegian Energy Partners, which supports the export activities of the Norwegian energy industry.

International transfers of technology

Norway will be able to play a part in improving the framework for exports of climate and environmental technology through cooperation with developing countries under the Paris Agreement and in the WTO environmental goods negotiations. Technology transfer



Hywind Scotland is the world's first floating wind farm. It is located 25 km from land, off Peterhead in Scotland, and has five turbines, each with a capacity of 6 MW. The wind farm will produce enough electricity for about 20 000 UK households. Illustration: Statoil

is a key element of the Paris Agreement, and Norway is contributing both by providing a high level of climate finance for developing countries (one of the highest in the world measured per capita) and by taking the lead in facilitating technology cooperation with developing countries. Norway is also the largest donor to and a member of the Advisory Board of the Climate Technology Centre and Network (CTCN), which is the operational arm of the UNFCCC Technology Mechanism.

Negotiations on an Environmental Goods Agreement began in 2014. This initiative within the WTO system now includes 18 participants (the EU counts as one participant). The purpose of the agreement is to reduce or eliminate tariffs on environmental goods and thus promote their use. In the negotiations, Norway has nominated Norwegian environmental technology such as battery-powered ferries, solar-powered lamps, various goods for water purification and waste water treatment, aquaculture equipment, turbines for the hydropower industry and insulation materials for inclusion in the agreement. Since December 2016, it has been unclear

how and when the negotiations on the agreement will be resumed. When the negotiations do continue, Norway's team will continue to follow up national priorities, and will nominate new types of goods if there is room for this.

Norway has valuable expertise in the energy sector. This will make it possible to share in the value creation that is anticipated with the expansion of the renewable energy sector globally. Indeed, Norwegian companies such as Statkraft and SN Power have been investing in hydropower developments in various countries for some years already. And Scatec Solar, KLP and Norfund have entered into partnerships on solar power developments in South Africa and Egypt. Partnerships of this kind build competitiveness in emerging markets. In a recent white paper on Norway's development policy, the Government announced that it would increase funding for renewable energy in its development cooperation, and promote public-private partnerships in order to maximise synergies between public-sector development aid and private-sector funding.¹⁷

¹⁷ Meld. St. 24 (2016-2017) *Common Responsibility for Common Future - The Sustainable Development Goals and Norway's Development Policy*

Risk mitigation schemes

Norway provides funding for a range of national and international risk-mitigation instruments. The guarantee schemes administered by the Norwegian Export Credit Guarantee Agency (GIEK), particularly the Developing Countries Guarantee Scheme, are of key importance. The purpose of this scheme is to promote investments in and exports to countries that the OECD defines as lower middle-income, low-income or least developed countries. The scheme is used to meet demand for guarantees for loans with a higher level of risk than is acceptable under the General Guarantee Scheme, and encourages Norwegian exporters to take part in projects that promote development.

Export Credit Norway, which administers the public export credit scheme, is also part of Norway's system for long-term export financing. The company offers loans both to exporters and to buyers of goods and services from Norwegian exporters.

Norfund is Norway's development finance institution, and is wholly government-owned. It provides risk mitigation, for example by taking an ownership share in companies. Its core tasks are to assume country risk in challenging markets and to ensure that its investments are additional, in other words that they are used to fill the gap between what is needed in poor countries and what the private sector provides. Norfund invests about half of its annual capital of roughly NOK 1.5 billion in renewable energy. In addition, companies can apply to Norfund for funding to cover up to half the costs of evaluations of whether energy projects in developing countries should be carried out. This scheme is intended to reduce risk in the early phase of projects.



Towards sustainable travel and tourism in Norway

The Norwegian travel and tourism industry presented its roadmap *Towards sustainable travel and tourism in Norway* to the Ministry of Climate and Environment in August 2017. It describes a vision for achieving sustainability by 2050, and sets out proposals for how the vision can be achieved and the role of the travel and tourism industry in this process. The roadmap also describes long- and short-term choices that tourism enterprises will have to make if they are to play a part in Norway's move to a sustainable society by 2050, and to maintain their own competitiveness in a very different future. The UN proclaimed 2017 as the International Year of Sustainable Tourism for Development.

The industry's vision is that by 2030, Norway will have consolidated its position as one of the world's preferred destinations for sustainable tourism based on the natural and cultural heritage. Up to 2050, most of the growth of the Norwegian tourism industry will focus on providing memorable experiences for tourists in unspoilt natural and cultural settings. Transport to and from destinations will be as climate and environmentally friendly as possible. The tourism and travel industry will, in close cooperation with the public sector and other sectors, strive towards and encourage low-emission solutions and sound waste management, offer local food specialities, minimise food waste and focus on green value creation.

VEIKART FOR GRØNN KONKURRANSEKRAFT
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SILVANA 4
SILVANA 5
SILVANA 6
SILVANA 7
SILVANA 8
SILVANA 9
SILVANA 10

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SØKART FOR GRØNN KYSTFART

EIENDOMSSEKTORENS VEIKART MOT 2050

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MOT ET BÆREKRAFTIG REISELIV

Skiløp i Hvalerangerfjell

Continuing the dialogue with the business sector

Achieving long-term development of green competitiveness is dependent on a private sector that sees the opportunities offered by greening the economy. In line with its mandate from the Government, the expert committee on green competitiveness therefore established an open, dynamic work process, in close dialogue with business and industry. In addition to holding meetings with companies, organisations and academia, the committee gave them the challenge of showing how they could contribute to Norway's transformation to a low-emission society. A number of different sectors developed roadmaps that were presented to the committee.

These roadmaps demonstrate that many sectors of Norwegian business and industry intend to seize the opportunities offered by a transformation to a low-emission society. Another example of this willingness to change is provided by the Norway 203040 coalition, in which a number of Norway's largest companies are cooperating on the business contribution to achieving Norway's climate targets for 2030. They are seeking sustainable solutions that are also commercially viable. The coalition's starting point is that a global low-carbon transition will result in increased demand for zero-emission products throughout the value chain, from inputs to production to transport and markets.

The Government will continue its constructive dialogue with the business sector and build on the momentum achieved during the production of the roadmaps. The Government also wishes to encourage cooperation across sectors. In addition, it is important for the authorities to

maintain a dialogue with the business sector on where challenges are foreseen.

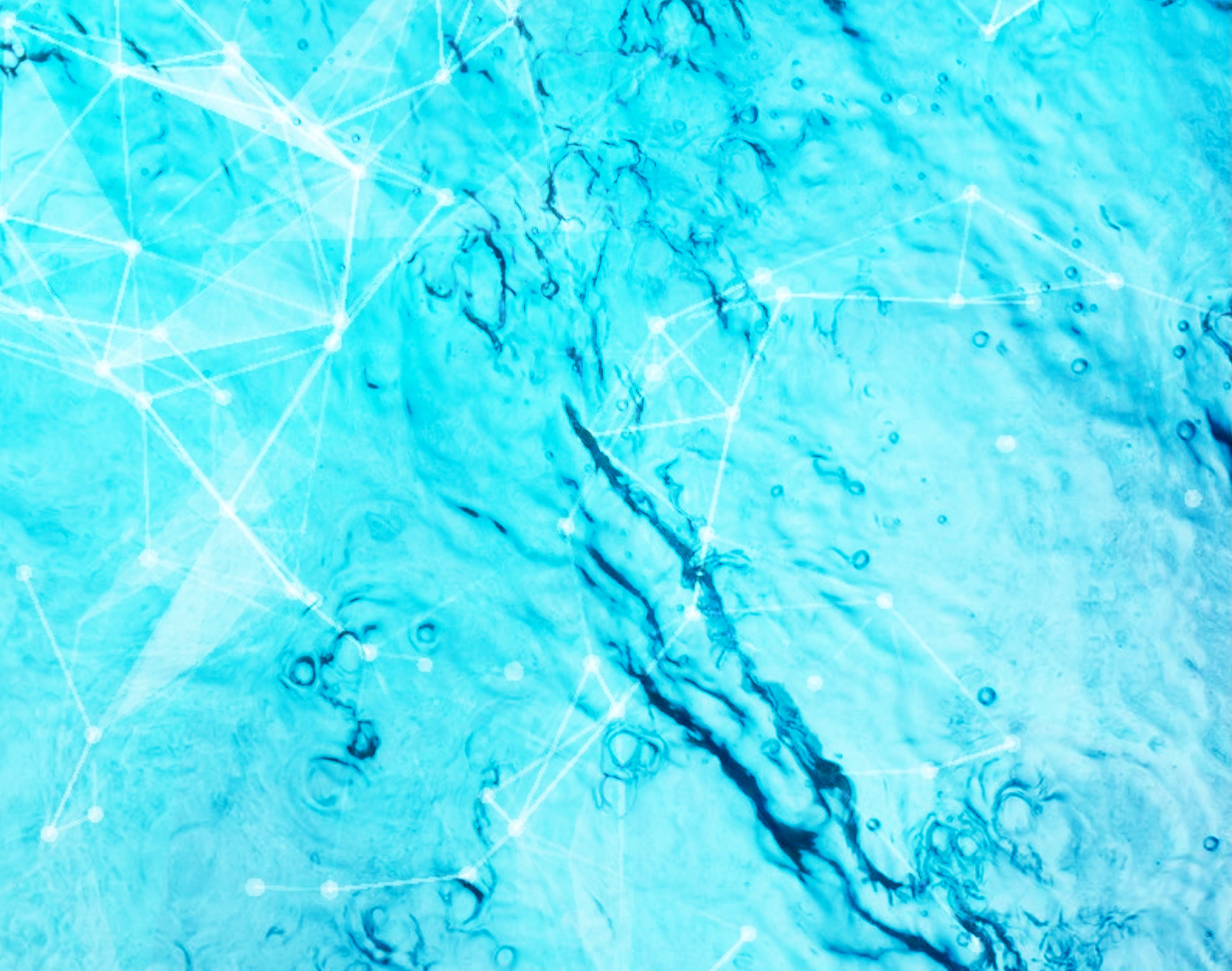
As a direct response to the roadmap for the process industry, a strategic forum called Proses21 has been established to strengthen cooperation in the process industry sector between business and industry partners, the public administration and research groups and institutions. Proses21 will provide strategic advice on how the process industries can grow but at the same time reduce their greenhouse gas emissions to a minimum over time. The Government will make use of existing cooperation forums involving the authorities and industry representatives to ensure a constructive dialogue with other industries on the further development of their roadmaps. Examples of such forums are Bygg21 for the building industry and the Green Coastal Shipping Programme.

The advisory committee for the Minister of Climate and Environment on the transition to a low-emission society (*klimarådet*) is an established arena for maintaining a dialogue on climate policy. The committee meets up to four times a year and includes representatives from business and industry, the social partners, environmental organisations and researchers. Other ministers also attend the meetings when relevant. As the Government continues to develop policy and policy instruments for green competitiveness, it will use the committee as a meeting place for strategic discussions with the business sector. The number of business and industry representatives will be increased to ensure that key actors from different branches are invited to attend when relevant.

Roadmaps for green competitiveness

Sector/Theme	Participants	Vision/ambitions
Coastal shipping	Green Coastal Shipping Programme (more than 30 participants from the Norwegian coastal and short-sea shipping sector). DNV GL headed the work.	Norway will establish the world's most efficient and environmentally friendly coastal shipping fleet, run partly or entirely on battery power and environmentally friendly fuels. By 2030, greenhouse gas emissions from domestic shipping will be cut by 40 % compared to current levels, and zero emissions will be achieved by 2050.
Process industries	Working group with representatives from Hydro, Alcoa, Elkem, Norcem, Yara, Borregaard, INOVYN and the Eyde Cluster.	To combine growth for Norwegian process industries, driven by higher production and development of new processes and products, with reducing greenhouse gas emissions to zero by 2050
Green trade	Wholesale and retail companies and trade unions for the sector	Take action to make the sector fossil-free and climate-neutral. Ensure that we buy and use products that satisfy environmental and ethical standards and close loops to keep materials in use, avoid using hazardous substances and prevent waste generation.
Commercial property sector	Grønn Byggallianse (network of private- and public-sector property owners) and Norsk Eiendom (association of private property owners)	Norway will be climate-neutral in 2050; 40 % cut in emissions by 2030; closed material loops by 2050; zero emissions of hazardous substances by 2050.
Smart transformation	Knowledge-intensive service sector, headed by Abelia	Based on a vision of a green, sustainable future. Businesses that do not adapt to change are likely to fail. The winners will be those that find a way through the transformation process. Many new companies and new industries will be created.
Circular economy	Waste management and recovery sector	Sustainable development up to 2030, combining welfare improvements and economic growth with cuts in resource use and greenhouse gas emissions. A circular economy will be essential for competitiveness and value creation, and the waste management and recovery sector can act as a catalyst.
Commercial transport	Initiated by the Confederation of Norwegian Enterprise, involving 13 different organisations	Environmentally and climate friendly commercial transport by 2050. The aim is to reduce greenhouse gas emissions by at least 50 % by 2030 and towards zero in 2050.

Sector/Theme	Participants	Vision/ambitions
Norwegian continental shelf	Norwegian Oil and Gas Association, Federation of Norwegian Industries, trade union organisations and industry associations	Maintain its position as Norway's largest industry and increase the average recovery factor to at least 60 %. The Norwegian shelf will continue to be world-leading as regards low CO ₂ emissions. The sector will develop and use technology and solutions to reduce average CO ₂ emissions per unit produced in 2050 substantially from the 2030 level.
Agriculture, food and drink	Several industry and farmers' organisations	By 2050: Norway will be world-leading in climate-smart food production; zero emissions from transport and processing; fossil raw materials for products and processes replaced with renewable materials; 100 % of all raw materials used; make use of overall potential for biomass production.
Water sector	Norsk Vann (national association for Norway's water industry)	The water industry can play an important role in the transformation to a low-emission society and in boosting the green competitiveness of Norwegian business and industry.
Forestry and wood industry	Oslo School of Architecture and Design, forestry, wood industry and bioenergy organisations, industry associations and trade unions	The market prefers wooden and forest-based products, and they play a key role in the Norwegian bioeconomy. The potential of Norway's forests is used sustainably; raw materials are processed in Norway, giving high value creation.
Norwegian aquaculture	Federation of Norwegian Industries	Norwegian salmon farming will be the most efficient and environmentally sound form of industrial protein production in the world.
Renewable energy industry	Energy Norway (industry organisation)	To double the industry's value creation by 2050 in a smoothly functioning market.
Travel and tourism	Tourism enterprises, industry organisations, trade unions, conservation organisations	Up to 2050, most of the growth of the Norwegian tourism industry will focus on providing memorable experiences for tourists in unspoilt natural and cultural settings. Transport to and from destinations will be as climate and environmentally friendly as possible. The tourism and travel industry will, in close cooperation with the public sector and other sectors, strive towards and encourage low-emission solutions and sound waste management, offer local food specialities, minimise food waste and focus on green value creation.



Published by:
Ministry of Climate and Environment

Public institutions may order additional copies from:
Norwegian Government Security and Service Organisation
E-mail: publikasjonsbestilling@dss.dep.no
Internet: www.publikasjoner.dep.no
Telephone: + 47 222 40 000

Publication number: T-1562 E
Design: Melkeveien Designkontor AS
Print: MFA Hustrykkeriet
06/2018 – Impression 50