Norwegian Ministry
of Trade, Industry and Fisheries

Norwegian Ministry
of Petroleum and Energy

Strategy

New Growth, Proud History

The Norwegian Government's Ocean Strategy

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Table of Contents

Cover photo: Eco Leader. Photo: Awilco. Offshore Aquaculture. Illustration: Ocean Farming. Ekofisk. Photo: ConocoPhillips. Lofoten fishery. Photo: Mittet & Co

Norway – a Leading Ocean Economy

Norway is currently one of the world's leading ocean economies. Our coastline is one of the longest in the world, and we control expanses of ocean more than six times larger than the area of our land. Every day hundreds of thousands of Norwegians go to work in the ocean industries, which together represent about 70 per cent of our export income. Norway is one of the world's largest producers of oil and gas. We are one of the world's largest and most advanced seafaring nations. We are the world's second largest exporter of fish and seafood. In addition we have a world class service and supply industry. Norway is also at the forefront of marine research and responsible management of marine resources.

Long and proud traditions

For generations, our forefathers lived on the rich fish stocks along the Norwegian coast. The tools improved continuously, knowledge of the ocean kept growing. Since the time of the Hanseatic League, the bustling Lofoten fishery was vital to the rise of both Bergen and Trondheim as trade centres. Cargo traffic from Northern Norway to the south lasted for centuries, helping establish new industries and opportunities. Sailing improved in step with technological development. This created a bridge to the proud era of sailing ships in the 19th century, when Norway became the world's third largest seafaring nation. We moved from sails to steam, and went on to become a modern ocean industry, which in turn formed the basis of the Norwegian oil boom. Today we see new bridges being built. Petroleum technology is at the centre of the development of ocean-based aquaculture and ocean-based renewable energy.

Based on proud traditions we can say that Norway is currently one of the world's leading ocean economies. Through the years, Norwegian men and women have refined this heritage, adapted the knowledge and further developed the technology of their time.

Together the traditional ocean industries represent the waves of technological change that have formed much of the basis for modern, technologically advanced Norway. Now it is our generation's turn to pass the torch. Our goal is for Norway to be the top ocean-based economy. In order to reach this goal we must use our advantages and build on our existing knowledge and experience.

The ocean as a source of growth for the entire coast

There is much we don't know about the future. What we do know is that the ocean will be an important contributor to future prosperity and growth. The OECD estimates that ocean-based industries could double their contribution to the global economy by 2030. At the same time the ocean is already under pressure as a result of climate change, overfishing and pollution. Future growth in the ocean economy requires that we manage to harvest resources sustainably, and that we see the ocean holistically.

The Norwegian ocean industries are to be developed on the basis of existing industries, their interaction and where they intersect. We will continue developing the ocean industries where we have competitive advantages, while stimulating research, innovation and technological development in order to see new

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industries emerge. This will ensure Norway's position as one of the world's leading ocean economies. The focus on ocean industries is vital in order to maintain and develop strong local communities. The starting point is good. We have highly competent workers, businesses, clusters, and knowledge and research communities in the ocean industries along the entire coast.

In the three northernmost counties, the seafood industry holds a unique position. In Finnmark king crab is harvested and served in restaurants in New York and Tokyo only hours later. Marine research and technology development are strong: In Vesterålen in Nordland the company BioMar uses algae in its production of fish feed. In Tromsø we have a research community searching for valuable, biologically active components from maritime organisms through marine bioprospecting. These components can be used in anything from foodstuffs to pharmaceuticals.

The western counties Rogaland, Hordaland and Møre og Romsdal are particularly important to the ocean industries. Here the petroleum industry and the maritime industry represent a considerable percentage of employment and value creation. Some of the world's most technologically advanced vessels are sailing under the Norwegian flag and are built and equipped at Norwegian shipyards, with equipment and technology from Norwegian suppliers. An example is the new Hurtigruten vessels to be built at Kleven shipyard in Ulsteinvik. The company Nordic Wildfish in Giske has equipped the trawler "Molnes" with hydrolysis technology in order to improve utilization of marine by-products from fishing.

In Central Norway, we find an outstanding research environment which has brought about the world's first test area for autonomous vessels in collaboration with businesses and authorities. The maritime technology centre at Tyholt in Trondheim has helped place Norwegian industry at the forefront of ship building, shipping, offshore oil and gas, fisheries and aquaculture for generations.

Eastern Norway is also important to the ocean industries. Among other factors, many specialised service providers and financial institutions are established here. Oslo is the largest shipping exchange in Europe and the second largest in the world. Along the route Notodden – Kongsberg – Drammen – Oslo we also find Subsea Valley, with businesses developing and producing a wide range of subsea products and services.

Southern Norway also plays a central part as an important service provider for the petroleum and maritime industries. One example is the GCE NODE network there, with a number of businesses asserting themselves in their fields in the global market.

Exporting Norwegian ocean know-how

The ocean is about more than just creating jobs and further growth. The ocean will also be vital in meeting many of today's major global challenges. By 2050, the world population is expected to surpass 9 billion. A rapidly growing population means increased demand for both food and energy.

At the same time global greenhouse gas emissions must be reduced considerably in order to avoid the major adverse effects of climate change. Sustainable fisheries and aquaculture will play an increasingly

important part in global food safety and nutrition. During the next decades, oil and gas will be very important energy sources. However, the ocean as a source of renewable energy will also be important when facing climate challenges. Shipping is an energy efficient transport alternative for cargo, and in the future we can gain access to new natural resources such as minerals and metals from the sea bed.

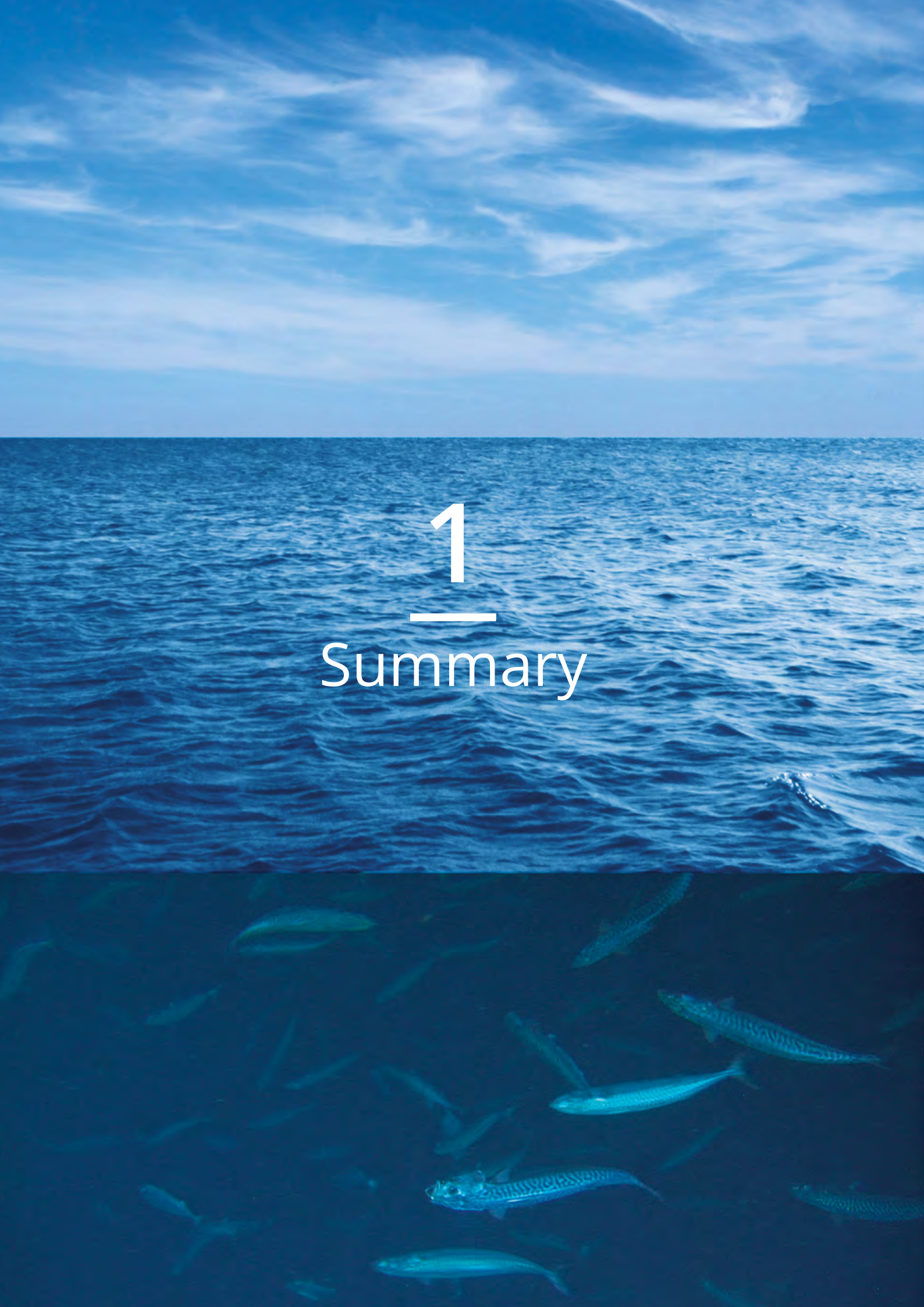
One of the great challenges of the future will be to balance the need for increased production with the requirements for stronger protection of the ocean resource base. Norway must ensure sustainable ocean development in collaboration with other countries. A central ambition is to take on a leading international role in important ocean matters, as Norway has a strong interest in securing a healthy and productive ocean. This spring the government will present a white paper on oceans, which will address the role of the ocean in Norway's foreign and development policy.

Norway has important competence to share with other countries. We have a long tradition of maritime research. Norway also has strong traditions in fisheries management. Knowledge of sustainable management and resource utilization from the ocean is an export product in itself. The goal is for Norway to become the ocean economy the world looks to, and to become the preferred partner for collaboration on ocean matters.

Blue growth through green restructuring

The world is changing rapidly. New technology, more digitization and new production methods require that we are constantly ahead of development. We have long-standing traditions for doing this in Norway. However, we need to be better at attracting the brightest minds. Therefore, we will make sure that Norway becomes a more attractive destination for investments in ocean industries and facilitate more research collaboration across borders. We will also help more Norwegian ocean businesses reach world markets by focusing on internationalization, export financing, and better market access.

For generations, the ocean-based industries have demonstrated amazing adaptability, innovation, and technological development. We will use this as a basis for further growth and development. This strategy is the first comprehensive strategy that looks at the ocean industries in context. The Government's goal is for Norway to become the world's foremost ocean economy. We will achieve this by facilitating blue growth through green restructuring.



1

Summary

The Government will contribute to the greatest possible sustainable value creation and employment in the ocean industries.

Considerable growth in the global ocean industries is expected. The Organisation for Economic Co-operation and Development (OECD) demonstrates in its report "The Ocean Economy in 2030" that economic activity in the ocean is growing rapidly, and estimates that the ocean economy will provide 40 million jobs and double its contribution to global value creation by 2030. Much of the growth is expected to take place in industries where Norway already has important advantages.

At the same time, development in the global ocean economy is limited by the ongoing deterioration of the state of the ocean. One of the great challenges in the future will be to balance the need for increased productivity with the need for stronger protection of marine resources.

The Ocean Strategy acknowledges that Norway is a considerable ocean economy, and that the petroleum industry, the maritime industry, and the seafood industry all have internationally leading players. The strategy also recognizes that if we are to ensure that Norway remains a leading ocean economy, public authorities must facilitate further growth of established ocean industries, the development of new industries, and, not least, that sector specific knowledge is shared and utilized across the industries. The policy measures put forward by the strategy will contribute to furthering and strengthening the efforts for increased transfer of knowledge and learning across the ocean industries, and to facilitate collaboration. The Government will lay the foundation for this through regulation and the alignment of policy instruments.

The main objective of the Norwegian Government's Ocean Strategy is to contribute to the greatest possible sustainable value creation and employment in the ocean industries. In order to achieve this, the Government will work along three tracks:

First of all, the Government will contribute to a strong regulatory framework by furthering and further developing efficient, predictable and knowledge based regulation of the ocean industries.

In order to attain this goal, the Government will facilitate further development of the ocean industries and the development of new, profitable ocean industries within a sustainable framework, make sure legislation does not hamper innovation and the transfer of technology and experience across the ocean industries, and strive to secure technology neutral regulations that help promote technological development.

Secondly, the Government will facilitate the development of knowledge and technology in the ocean industries through research, innovation, education, and competence.

In order to attain this goal, the Government will strengthen fundamental knowledge of the ocean, further and strengthen the development and knowledge in current ocean industries, and strengthen collaboration across industries and academic environments. Furthermore, the Government will help facilitate new industries, ensure a good and relevant education system which helps cover the ocean industries' need for competence, as well as promote recruitment to maritime research, education and professions.

Thirdly, the Government will strengthen the competitiveness of the Norwegian ocean industries by assisting in efforts to improve market access, internationalization, and profiling of the ocean industries.

In order to attain this goal, the Government will strengthen the efforts of ensuring a global, predictable and competitive regulatory framework and help more businesses step out into the world and succeed, and make sure that Norway consolidates its leading global position as a hub for the development of ocean-based technology.

2

The Norwegian Ocean Industries

Norway has longstanding ocean traditions. Fishing and shipping have been important industries for Norway for centuries, while the fish farming pioneers did not begin to explore salmon and trout farming until the 1950s and 60s. At the same time, oil and gas exploration on the Norwegian continental shelf started.

The ocean industries share the ocean as their economic basis, but are still fundamentally different. The seafood industry and the petroleum industry are based on the extraction of resources in and under the ocean. These industries use the bounties of the sea as direct input in their production. The maritime and supply industries deliver goods and services supporting the seafood and petroleum industries.

Another important common feature is that the ocean industries are international, export oriented and cyclical. The ocean industries operate in a globalized market with tough competition for market shares and contracts, and they are particularly influenced by developments in the global economy and other international matters. At the same time, there are strict requirements as to how the industries may impact ocean life, either directly through extraction of resources, or indirectly through emissions and physical impact on the environment.

However, the most important factor is that the ocean industries are an important source of value creation and employment in Norway. These industries will continue to underpin a considerable part of Norwegian welfare, and they are vital to Norway's future.

2.1 Strong ocean industries

The ocean industries can be divided into three main industries: the petroleum industry, the maritime industry and the seafood industry. Many players have a hand in more than one ocean industry. This is particularly true for businesses in the associated service and supply industry, which deliver goods and services to various ocean industries.

Norway's most important ocean industries[1)]

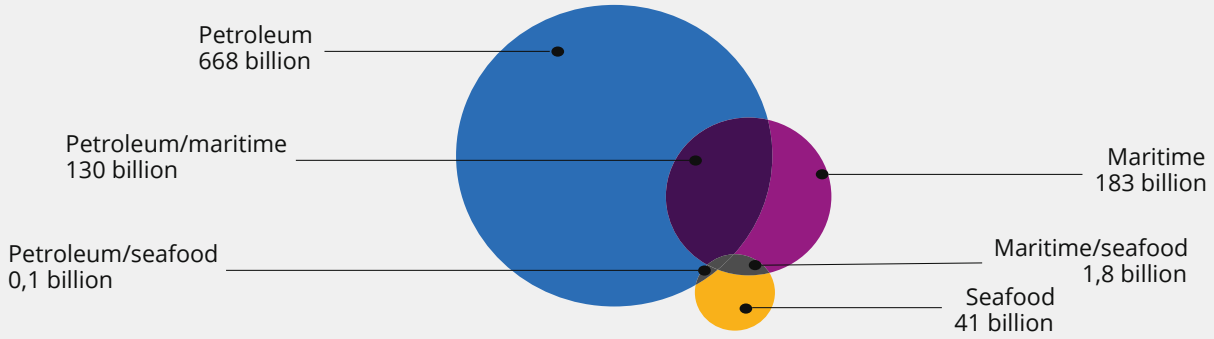
The petroleum industry comprises oil companies and the service and supply industry. The latter is defined as businesses supplying goods and services to the upstream oil and gas industry, either directly to oil companies (operators) or indirectly to other suppliers.

The maritime industry comprises all businesses owning, operating, designing, building or supplying equipment or specialized services to all types of vessels and other floating devices.

The seafood industry comprises fisheries, fish farming (aquaculture), and seafood processing and export, as well as suppliers of equipment and services

1) Reve, T. and Sasson, A. (2012), «Et kunnskapsbasert Norge».

Value creation in the ocean industries in 2014 (in NOK)



Source: Menon (2016)

Value creation and employment

The three traditional ocean industries represent a considerable share of Norwegian employment and value creation. According to calculations made by Menon Business Economics, the total value creation in the ocean industries in 2014 constituted NOK 760 billion, while employment included 256,000 people. As a percentage of the total value creation and employment of the business sector in the same year, this represented 37 per cent and 14 per cent, respectively.[2)]

In this picture, the petroleum industry is by far the largest contributor with a total value creation of NOK 668 billion and 193,000 employees. The maritime industry comes second with a value creation of NOK 183 billion and 110,000 employees, and the seafood industry follows with a value creation of NOK 41 billion and 29,900 employees.

Several players could be said to belong to more than one ocean industry. The petroleum industry and the maritime industry are particularly closely intertwined. This is because the petroleum-oriented part of the maritime industry includes offshore shipping companies, rig companies, equipment suppliers and shipyards. If upstream companies are excluded, a total of 70 per cent of the value creation in the maritime industry overlaps with the petroleum oriented supply industry. The overlap constitutes a total of NOK 130 billion in value creation and about 76,000 employees in 2014.

The overlap between the seafood industry and the maritime industry is relatively small and constitutes only NOK 1.8 billion. This for example includes shipyards with a large percentage of deliveries to the seafood industry. The overlap between the seafood and the petroleum industries is just under NOK 0.1 billion, and consists mainly of suppliers to aquaculture installations.

There are large variations in value creation from one year to another, especially due to fluctuations in oil prices. Since 2014, value creation in the petroleum and maritime industries has dropped due to lower oil prices, while value creation in the seafood industry has increased, among other things due to a weaker NOK and increasing demand. Employment is more stable, but also here there are variations from one year to another. The number of employees in the petroleum and maritime industries has fallen since 2014, while employment has increased somewhat in the seafood industry.

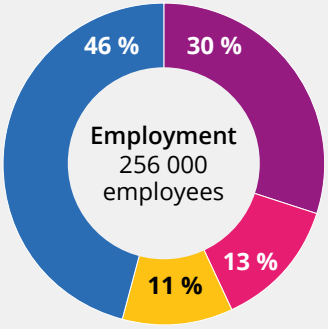
Tax revenues of the ocean industries

The ocean industries, with petroleum at the head, are also contributing to a considerable portion of government revenue, and have laid much of the basis for the Norwegian welfare state. Estimates show that government tax revenue from the three ocean industries in 2014 constituted a total of NOK 435 billion.[3)] Here the tax revenue from the petroleum industry constitutes NOK 386 billion. Due to the extraordinary profitability

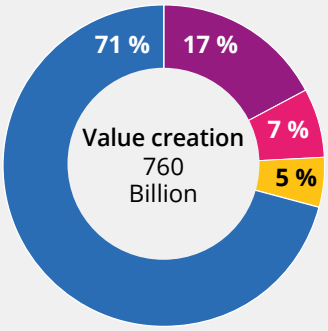
2) Menon's accounting and activity database contains full accounts figures for all enterprises reportable to the business register. Value creation in an industry is the sum of value creation in each business (calculated as wage costs + earnings before interest, taxes, depreciation and amortization (EBITDA)). Public sector is not included.

3) Menon (2016) Corporate income tax and payroll costs from the Menon accounting and activity database are included in the calculations. For the petroleum industry, this is supplemented by figures from the Norwegian Petroleum Directorate and the Ministry of Petroleum and Energy, where environmental and zoning tax, net cash flow from the SDFI, as well as the revenue from Statoil, are taken into account. Personal tax is estimated on the basis of average wage costs.

Employment and value creation by industry



Industry	Employees	Billion
Petroleum	117 200	537
Maritime/petroleum	75 600	130
Maritime	33 000	51
Maritime/seafood	1 100	1,8
Seafood	29 000	40
Seafood/petroleum	100	0,07



Source: Menon (2016)

of upstream petroleum operations, the operations are subject to a particularly high tax rate. For this reason, a large portion of value creation has accrued to the Norwegian state and benefited the entire community.

Regional significance

Existing ocean-based industries are found along the entire Norwegian coast. The western counties Rogaland, Hordaland and Møre og Romsdal are particularly important. Here the petroleum industry and the maritime industry represent a considerable percentage of the total employment. Oslo and Akershus are also important, since, among others, many specialized service providers and financial institutions are established here. Many major players also have their headquarters in these counties. Also, value creation as a percentage of local value creation in each county shows how important the ocean is to Western Norway. Here the role of Southern Norway as an important service provider for the petroleum and maritime industries becomes more visible.

In this picture, the importance of the ocean in the three northernmost counties is also clarified, especially Finnmark, where the ocean industries represent 39 per cent of the county's total value creation. In Northern Norway, the seafood industry holds a unique position. The oceans in Northern Norway have high biological production, which in turn forms the basis for important fisheries. Aquaculture has been established in the North for a long time, and there are good opportunities for further growth. An arctic petroleum and maritime industry is also being developed here, which will help reinforce the industrial development of the northernmost counties in the future. From 2016 on both gas and oil are being produced in the Barents Sea.

Petroleum industry

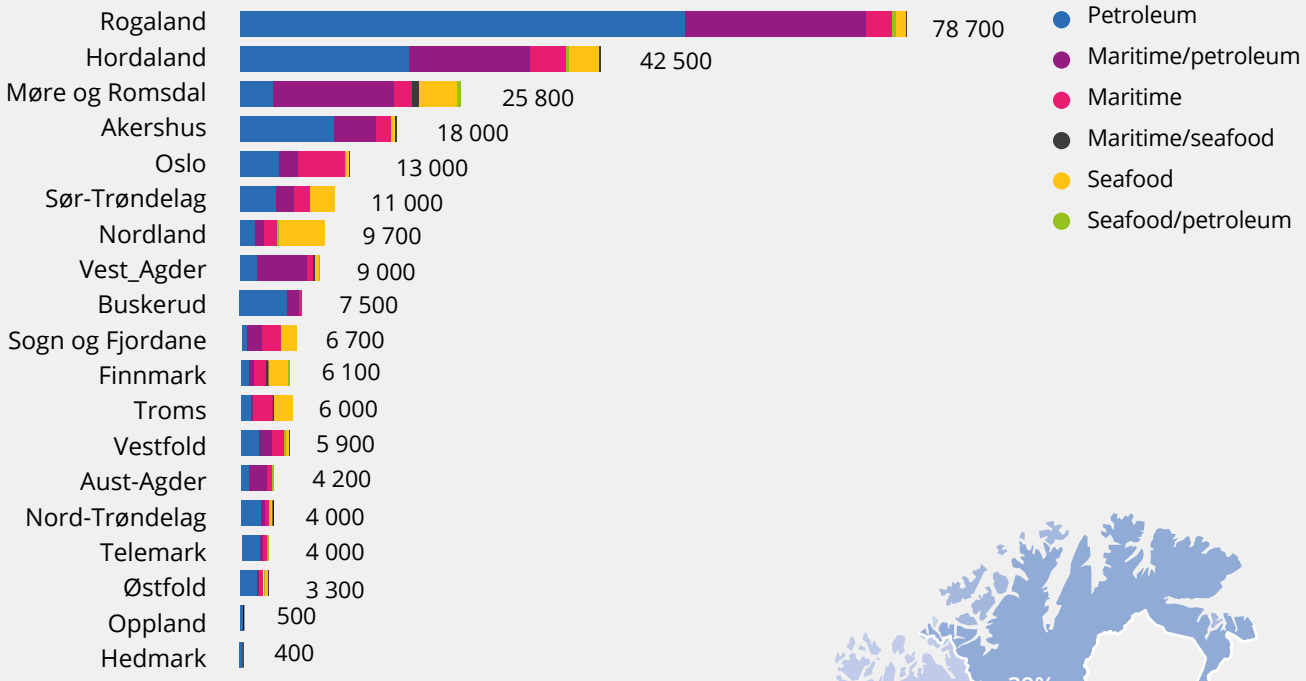
More than 50 years of petroleum operations on the Norwegian continental shelf have given an overall value creation of about NOK 13,000 billion measured in current value.[4)] The government has secured a large share of these values through direct ownership in fields and taxation. A large portion of the revenue from the past 20 years is invested for future generations through the Government Pension Fund Global (SPU). The production and sale of petroleum and the associated supply industry currently constitute Norway's largest industry measured by value creation, investments, export value, and government revenue, and the industry contributes considerably to employment numbers all over the country.

Since production started in 1971, oil and gas have been produced from more than 100 fields on the Norwegian shelf. There are currently about 80 fields in operation, and new projects and field developments are maturing. In 2016 the Ministry of Petroleum and Energy (MPE) received five new plans for development and operation (PDO), and more are expected in 2017. There are several ongoing developments, for example the Johan Sverdrup field, which is Norway's largest industrial project in recent times. The initial stage of construction alone represents investments of about NOK 100 billion.

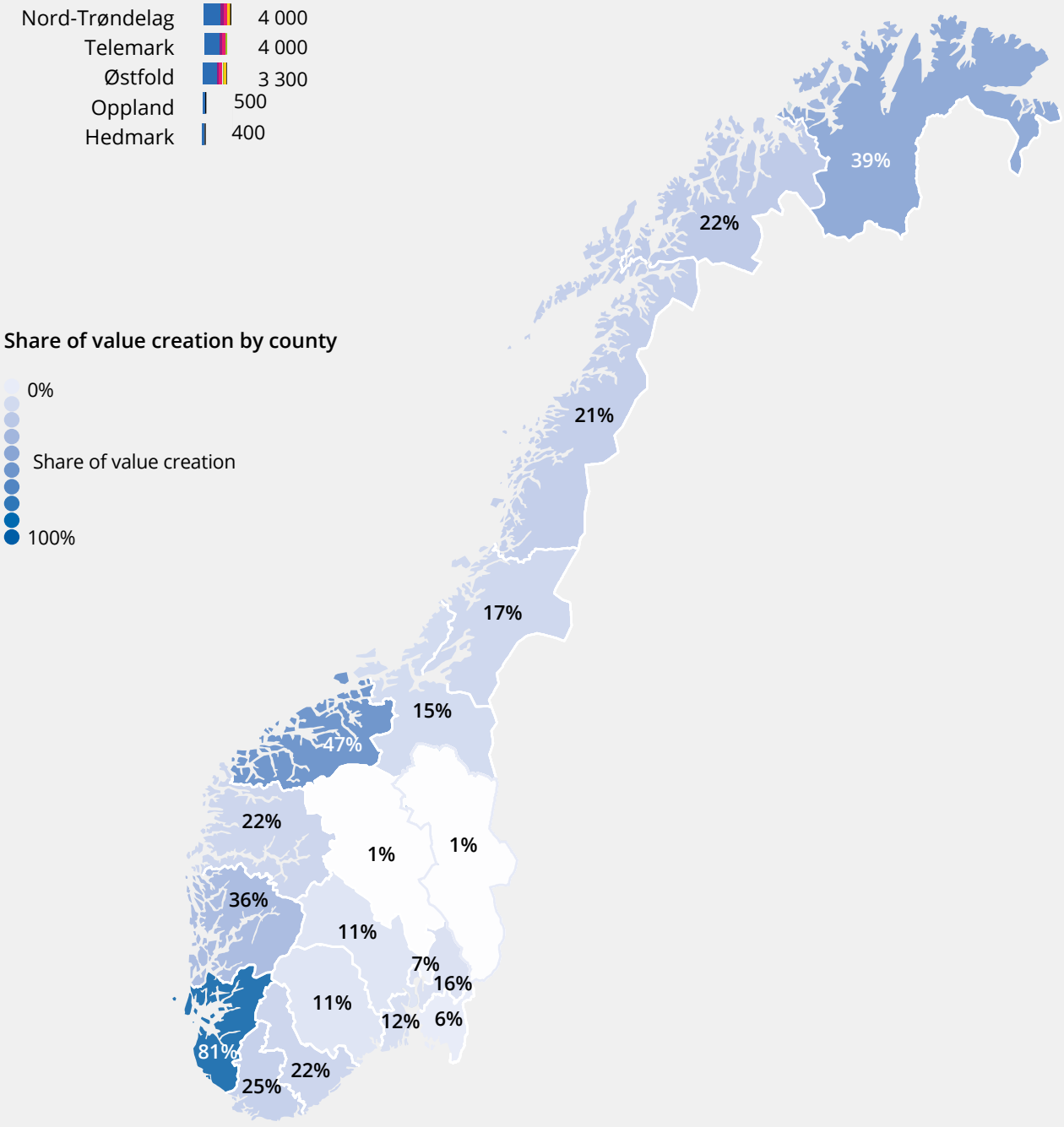
4) The National Accounts (table 9). The figure includes the extraction of crude oil, natural gas and pipeline transport, and is inflated with CPI. Estimates from the 2017 National Budget are used for 2016. Associated supply industry is not included.

Employment and value creation in the ocean industries by county

Employment in the ocean industries

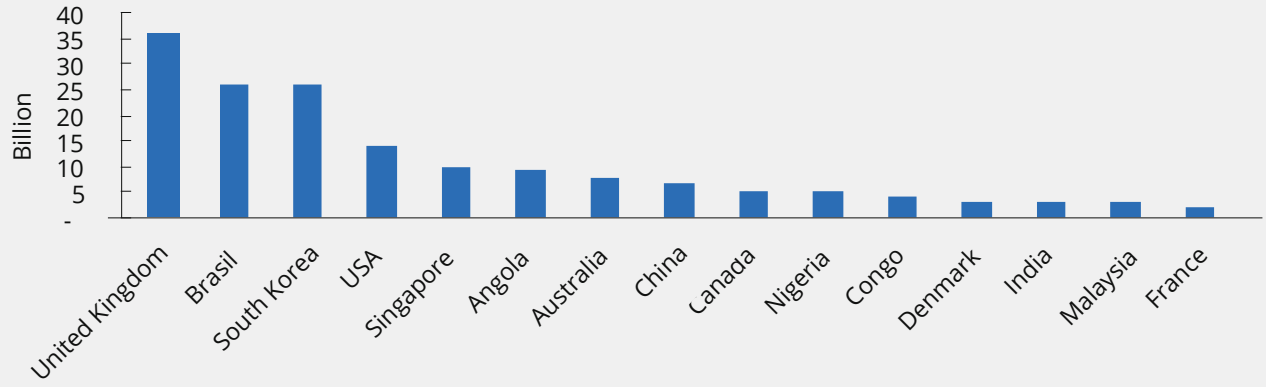


Share of value creation by county



Source: Menon (2016)

International revenue for the Norwegian supply industry in 2015



Source: Rystad Energy (2016)

Meanwhile, new discoveries are made. In 2016, 18 discoveries were made, of which most were near existing fields.This allows for short lead times of profitable developments and secure time-critical utilization of existing infrastructure. The Maria project is one example (see text box), where the discovery was made in 2010 in the Norwegian Sea.

Petroleum oriented supply industry

The Norwegian continental shelf is still one of the world's largest offshore markets, and it has served as a laboratory for technological development in the Norwegian supply industry. Knowledge and experience from shipping, fisheries, mining, hydropower and process industry – interspersed with adaptability and innovation – have formed the basis of a highly competent, technology intensive and internationally competitive industry, which had 40 per cent of the revenue in international markets

in 2015.[5)] Norwegian businesses are world leaders in, among other things, subsea systems, drilling technology, seismology, and offshore supply vessels.

The petroleum oriented supply industry contributes to employment and value creation all over the country, and is the largest employer among the ocean industries. In many local communities along the coast, from Agder to Nordmøre, a significant portion of the population is employed in or is associated with the supply industry.

Several businesses in the supply industry also serve other ocean industries, such as aquaculture and offshore wind, which can help businesses diversify their operations. There are already several examples of technology and competence from the petroleum industry being used in other areas. One example is the Salmar aquaculture facility Ocean Farming (see chapter 4 for details). However, the oil and gas sector will remain the most important core market for most supply businesses.

The Maria project

The Maria project is a good example of the importance of exploration near existing infrastructure, and how a cost-effective development can be obtained by using free capacity and extensive use of Norwegian suppliers.

The Maria development in the Norwegian Sea, with expected investments of about NOK 15.7 billion, creates activity in an industry facing a challenging market situation. The development plan was approved in 2015 in a time of low oil prices. Despite this, a profitable development project is established, contributing to employment and value creation several places. The operator, Wintershall, is well under way with the project implementation. More than 90 per cent of the contracts so far have been awarded to Norwegian suppliers, such as TechnipFMC (previously FMC Kongsberg Subsea) with operations in Kongsberg and Ågotnes, Aibel in Haugesund, Subsea 7 with operations in Stavanger

5) Rystad Energy (2016), «Internasjonal omsetning for norske oljeserviceselskaper».

Höegh Tracer. Photo: Höegh Autoliners

and at Vigra, Odfjell Drilling in Bergen, Halliburton in Stavanger, Reinertsen in Trondheim, DNV-GL at Høvik, and DeepOcean in Haugesund. The supply base/ activities related to logistics is Vestbase in Kristiansund.

The total employment effect of the development and operation phase of the Maria field will be between 34,000 and 35,000 FTEs in the period 2015 to 2040. The planned production start-up is in 2018.

The Maria project illustrates a type of development that will be more visible on the Norwegian shelf in the future. Many discoveries are near existing infrastructure, where it is possible to link to fields with extra capacity, and thus obtain profitable development projects. This can also help increase extraction and prolong the service life of the host platforms, as well as make it more attractive to prove additional resources

The maritime industry

Shipping is one of Norway's oldest industries. The maritime industry currently consists of shipping companies, equipment suppliers, service providers, and shipyards distributed along the coast in regional clusters. Norwegian maritime businesses have largely specialized in high-tech market segments, such as dry bulk, chemical tankers, offshore vessels, and car transport, and are also world leaders in the development and use of clean energy solutions, such as liquid natural gas (LNG) and batteries.

Höegh Autoliners

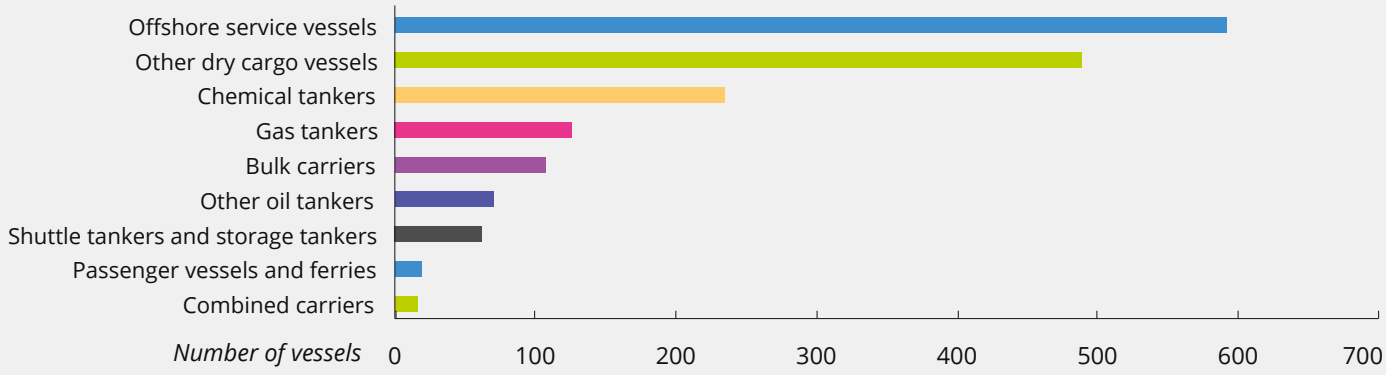
Höegh Autoliners is a Norwegian global provider of transport and logistics services in the Roll-on Roll-off (RoRo) segment. In 2015 and 2016 the company ordered the delivery of six new Post Panamax vessels (so-called Horizon vessels), which are the world's largest "Pure Car and Truck Carriers". The new Horizon vessels have the capacity to carry 8,500 car units, and they have a completely new design that makes them superior in their class. Modern design and the latest technology on board ensure that the new Horizon vessels are more reliable, efficient and environmentally friendly than traditional car carriers. Höegh Autoliners is the shipping company with the most vessels in NIS. All the new Horizon vessels are now sailing under Norwegian flag.

An important characteristic of the maritime industry is that it is international in nature with a large export of goods and services. The most important destination countries for Norwegian shipping companies are European countries, the US, Brazil, China, and Australia, and on board Norwegian controlled vessels about 18,000 Norwegians are employed among about 32,000 employees[6] from more than 60 countries. The shipping companies are behind the greatest value creation in the industry. There are about 600 Norwegian controlled vessels in domestic traffic, and 1,700 in international traffic. This makes Norway the world's 7th largest shipping nation in terms of number of vessels, and the world's 11th largest shipping nation in terms of tonnage.[7]

6) Maritimt Forum (2016), «Maritim verdiskapingsbok 2016»

7) UNCTAD (2016), «Review of Maritime Transport 2016».

The Norwegian-controlled foreign-going fleet composition as of 1 January 2017



Source: Norwegian Shipowners' Association

Norway is one of the few high-cost countries still building vessels. In return, these are very high-tech and advanced, which gives shipyards an important competitive advantage. Value creation in the shipyard industry tripled during the last decade.

Companies in the maritime supply industry are world leaders in their fields. The industry's service providers are world leaders in design, insurance, brokerage, classification, and finance. This segment is behind 1/5 of the overall value creation in the maritime industry, and has seen strong growth in the last decade. Equipment suppliers provide products in mechanics, electronics, and operational and management systems. The Norwegian shelf is of particular importance to these, and the Federation of Norwegian Industries estimates that about 60 per cent of equipment deliveries are for the offshore market.

The maritime industry has been focused on petroleum operations for a long time, and the decrease in oil prices and the decline in activity on the Norwegian shelf have had considerable consequences. The current situation and the upheavals in the world economy in recent years still affect shipping. A declining investment level on the Norwegian shelf has sent many offshore vessels into layup, jobs have been lost, and the order books at Norwegian shipyards are reduced.

The seafood industry

The seafood industry is important to value creation and employment in coastal areas, especially in the northernmost counties, and Norwegian seafood products are highly sought after on the international market. Norway is the world's second largest exporter of seafood, with an export value reaching NOK 91.6 billion in 2016. This is the highest export value ever, and constitutes a 23 per cent increase from 2015.[8)]

The seafood industry is traditionally divided into three sectors; the fishing industry, the aquaculture industry, and the seafood processing industry. There is also the associated supply industry, which delivers equipment and services to the seafood industry.

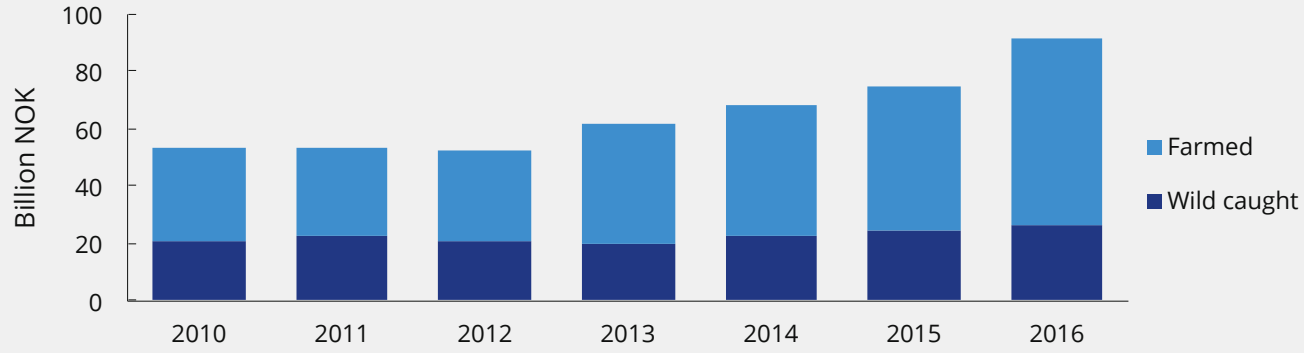
The fishing industry

The fishing industry stands for the traditional catching of fish. Norwegian waters are clean, nutritious and the home of many internationally traded species of fish, such as mackerel, herring, cod, pollock, haddock, blue whiting, etc. In the past 30–40 years, the development has gone from virtually free fishing towards more efficient and highly regulated fishing, with fewer fishermen and vessels. In 2016 the fisherman census counted about 11,240 fishermen and slightly less than 6,000 vessels.[9)] Total catches have remained stable under 2.5 tonnes. However, the value creation in fisheries is positive. This is due to streamlining of the fleet as well as increased prices of wild caught fish.

8) Norwegian Seafood Council AS (2017) "Nøkkeltall for sjømateksporten 2016".

9) The Norwegian Directorate of Fisheries (2016), The Directorate of Fisheries' statistics bank.

Norwegian seafood exports 2010 – 2016 (nominal values)



Source: Norwegian Seafood Council (2017)

The aquaculture industry

Norway is the world's leading producer of Atlantic salmon with a yearly production of about 1.2 million tonnes in 2016. In addition, approximately 80,000 tonnes ofrainbow trout[10] as well as smaller quantities of a number of other species were produced. The aquaculture industry has in later years been the largest contributor to value creation in the seafood industry, mainly due to high prices on salmon. The Norwegian salmon and trout farming industry comprises about 100 companies. In addition to this there are businesses farming other species. The industry consists of many large and small businesses distributed all over the coast, where some larger players have also established operations in other countries. Many players are fully integrated and control the entire value chain from production to sale. Some also own their own well boats.

The seafood processing industry receives landings of wild caught and farmed fish, which is processed and refined. This part of the industry comprised over 420 businesses in 2015. In addition to this, wholesale trade of seafood constitutes about 170 businesses. Nearly half the businesses in the seafood processing industry are located in the three northernmost counties and closely associated with the traditional fisheries. In this segment, there is development towards fewer and larger companies, but the sector still consists mainly of small and medium sized businesses.

The biomarine industry

The biomarine industry utilizes various types of marine produce, such as fish oil, marine by-products, and kelp as specialized ingredients directed towards food, health food, feed, cosmetics and pharmaceuticals. Combined, the marine ingredient industry had a total value creation of NOK 2.1 billion in 2013.[11] The industry has grown alongside the aquaculture industry, providing a stable access to marine by-products and a solid basis for building processing plants for cleansing, refining and processing, which has so far been world leading.[12]

The seafood supply industry

A wide range of businesses deliver equipment to various parts of the seafood industry, from equipment on board fishing vessels, to assembly lines in the processing industry, and equipment and services to the aquaculture industry. Especially in recent years there has been an increase in the undercurrent of suppliers to the aquaculture industry, where Norway possesses world leading businesses, for example in feed, vaccines, production equipment, services, and technology for the prevention and treatment of salmon lice. For many supply businesses, Norway is the most important market, but many have also found markets abroad.

10) Preliminary figures based on the Norwegian Directorate of Fisheries' statistics in 2016.

11) SINTEF (2014) "Norsk marin ingrediensindustri".

12) SINTEF (2013) "Faktaark. Marin ingrediensindustri – fortsatt spennende utvikling".

Minister of Trade and Industry Monica Mæland opens algae greenhouse at Mongstad. Photo: Andreas R. Graven/Uni Research

Algae greenhouse at Mongstad

The algae pilot at Mongstad will utilize photosynthesis, the process that makes plants live and grow using nutrients, water, daylight, and CO2. The greenhouse gas supplied from the technology centre for CO2 capture at Mongstad (TCM) is used to find out which marine algal strains produce the highest level of Omega 3 fatty acids. The aim is to find algae which can be included in future production of fish feed for the aquaculture industry. A total of 18 million is invested in the pilot plant, which will be operated by the company CO2Bio AS. The national budget, the University of Bergen, the Fishery and Aquaculture Industry Research Fund, Hordaland County Municipality, and Nordhordland Industry Association fund the project.

Other ocean-based growth industries

Ocean-based tourism

Cruise traffic along the Norwegian coast is increasing and becoming more and more important to local tourism. In 2015, Norwegian ports had almost 2.5 million day visiting cruise tourists, distributed on 511,000 cruise passengers, which is 29 per cent more than in 2009[13]. Fishing is also a popular activity among tourists, and in the last decades many tourism businesses have emerged along the coast, facilitating this. The extent of tourist fishing is not determined, but the activity is increasing.

Offshore wind

The revenue of the Norwegian renewable industry was NOK 22 billion in 2013.[14] NOK 2.3 billion of this was associated with offshore wind, of which NOK 1.9 billion was exported.[15] Internationally, offshore wind is a rapidly growing industry, especially in oceans near Norway. Most of the current capacity has been developed in the past decades, and the rate of development has been increasing. However, the markets for Norwegian equipment and services in offshore wind will initially be abroad because Norway has more cost-effective power resources on land. Norway currently has one floating wind turbine, the demonstration project Hywind outside Karmøy.

CO2 deposits

Norway has more than 20 years of experience in handling CO2.[16] Europe's two only full scale CO2 handling facilities in operation are located in Norway in association with gas fields Sleipner and Snøhvit. Here CO2 is separated from natural gas and returned for storage in reservoirs under the seabed. Since the start-up in 1996, up to 1 million tonnes of CO2 has been stored under the seabed annually at Sleipner.[17] Acclaimed Norwegian research communities also have broad experience from the technology centre at Mongstad, the world's largest and most advanced demonstration plant for CO2 capture.

13) Innovation Norway (2016) "Nøkkeltall cruise 2015. En oversikt over norsk cruisenæring".

14) Multiconsult (2014) "Omsetning og sysselsetting i den norskbaserte fornybarnæringen (ekskl. Verdien av energisalg)".

15) Multiconsult, Analyse & Strategi (2014) "Omsetning og sysselsetting i den norskbaserte fornybarnæringen".

16) Capture and storage of CO2, or CCS (Carbon Capture and Storage).

17) Norway's sixth main report under the United Nations Framework Convention on Climate Change (2014).

Mackerel fishing. Photo: Norwegian Seafood Council

Mineral extraction on the seabed

Besides extraction in coastal areas, there is currently no extraction of mineral resources on the Norwegian continental shelf. Considerable technological challenges must be met before this becomes financially profitable, for example in exploration, extraction, and processing. The potential can be considerable. Both the Geological Survey of Norway and the NTNU estimate that there may be large deposits of copper, zinc, silver, and gold along the Atlantic Ridge on the Norwegian shelf.[18)] Here volcanogenic "black smokers" send out mineral water with temperatures up to 400 °C, which on coming in contact with the cold water of the Atlantic deposits minerals and metallic sulphides on the seabed.

18) Research news from NTNU and SINTEF (2013) "Store mineralverdier på Norges havbunn".

The gas processing plant on Melkøya isle in Hammerfest
Photo: Øyvind Hagen/Statoil

3

Future Prospects for Norwegian Ocean Industries

The ocean offers many solutions in a world where the need for food, energy and medication is both growing and changing. The potential for growth is considerable, with a number of opportunities for future business development. At the same time, the climate and environmental challenges, as well as the increasing activity, put more pressure on the oceans. In order to reach the UN sustainability goals, progressive management, which facilitates new jobs and responsible utilization of the ocean's resources, is required. With our natural resources and knowledge, technology and management expertise, Norway is well equipped to meet these opportunities and challenges, with good prospects for sustainable growth and value creation in the Norwegian ocean industries. There is a potential in utilizing synergies and strengthening the interaction between established industries, sectors, and disciplines.

3.1 The world needs more food, energy, and transport

The Organisation for Economic Co-operation and Development (OECD) estimates that the ocean economy can more than double its contribution to global value creation by 2030, from about USD 1.5 billion in 2010 to USD 3 billion, and employ about 40 million people.[19] Globally, the OECD expects growth especially in aquaculture, offshore wind energy production, fish processing, shipbuilding and ship repair.

The expected growth in the ocean industries is mainly driven by global population changes, development in world economy, increased pressure on arable land and fresh water, climate changes, and technological development. The world population is estimated to increase from 7.3 billion in 2015 to 8.5 billion people in 2030.[20] The middle class will have more than doubled in size by 2030 to near 5 billion people with increased purchasing power, and an increasing proportion of the world population will live in large cities, often in coastal areas.[21] At the same time, the population in many countries is ageing. The changes in global population and ever-increasing levels of welfare contribute to changes in global demand for food, energy, goods and services. Towards 2030, global energy consumption is expected to increase by about 18 per cent, and more and more people will have access to modern energy sources.[22]

Ocean resources will be important for providing enough food to satisfy the nutritional needs of the growing world population. Fisheries and aquaculture already play an important part in global food security and nutrition. Seafood contains essential fatty acids and nutrients that are important to health and development. Seafood is also one of the most important sources of high-grade animal protein.[23] There is potential for increasing the ocean's contribution to food security, both through sustainable fishing and growth in aquaculture, as well as utilisation at lower trophic levels, the use of leftover raw materials and feed development. Clean oceans are a prerequisite for the production of safe food.

19) OECD (2016), "The Ocean Economy in 2030".

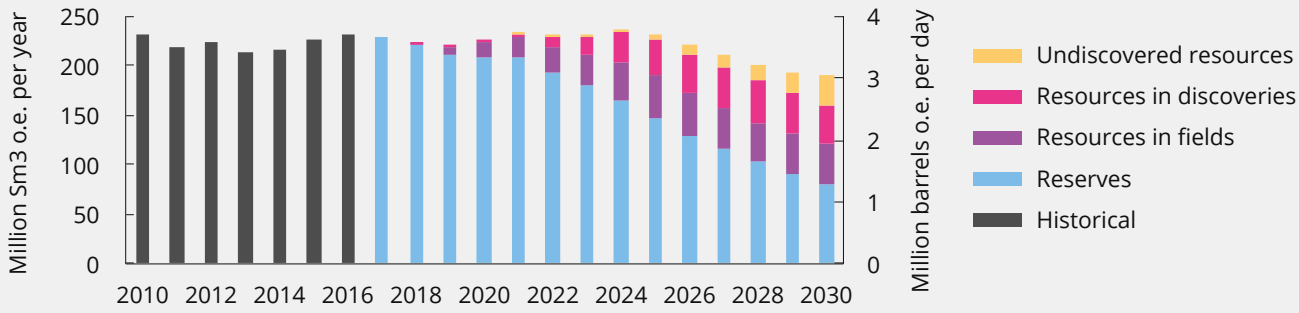
20) United Nations (2015), "World Population Prospects: The 2015 Revision".

21) OECD (2016), "The Ocean Economy in 2030".

22) International Energy Agency (2016), "World Energy Outlook 2016".

23) In 2013 seafood represented 17 per cent of the world's intake of animal protein according to FAO (2016) "The State of World Fisheries and Aquaculture".

Production forecast for oil and gas



Source: Norwegian Petroleum Directorate

The ocean is also a central source of energy. Oil and gas will continue to be very important energy sources in the next decades. However, the ocean is also a source of renewable energy and may also prove to be important when facing climate challenge. Large amounts of CO2 can be stored under the seabed. And the ocean's importance as a transport route will increase as global shipping grows in step with world trade. There is also reason to believe that the world's enormous and largely unexplored ocean areas have the potential to supply us with minerals and a number of other hitherto undiscovered resources in the future.

The basic condition of Norwegian waters is good. The OECD report shows that the development of the global ocean economy is limited by the ongoing deterioration of the state of the ocean. Emissions of greenhouse gases and pollution change the oceans gradually. The full consequences of these changes are still unknown. However, due to increased CO2 emissions, the oceans become more acidic, the water becomes warmer, and the ocean level rises. The ocean and coast are fed pollution and waste.

Future value creation in the ocean industries requires that we ensure sustainable use of the ocean and its resources to an even greater extent. Reducing emissions of greenhouse gases requires changes in energy production and consumption. It requires all industries to become more efficient and cleaner.

One of the great challenges in the future will be to balance the need for increased productivity with the need for stronger protection of the ocean resource base. In this area Norway has a great deal of knowledge and experience to share with other countries.

3.2 Opportunities for development in the Norwegian ocean industries

A large part of the growth in the ocean economy is expected to take place in industries where Norway already has great advantages. Norway has built world leading centres of expertise in the petroleum industry, the maritime industry and the seafood industry. Also, Norwegian waters, especially outside Northern Norway, are among the world's most productive. This gives rise to substantial resources, such as healthy and nutritious seafood, but also to energy and minerals.

Norway is at the forefront of formal and practical knowledge of the ocean, its resources and the processing of these, with world leading research and innovation communities and businesses. One of our main competitive advantages is our knowledgeable oil engineers, process operators, seafarers, fishermen and fish farmers with high operative skills at utilizing the ocean

The political and administrative framework in Norway also provides a strong basis for developing the Norwegian ocean economy further. Norway is characterized by political stability, an efficient business community, high and evenly distributed wealth, and a well-developed welfare system. In Norway, the close collaboration between employees, employers and authorities is important for the Norwegian business community, and also for the development of the ocean industries.

Installation of subsea module at Åsgård oilfield in the Norwegian Sea. Photo: Øyvind Hagen/ Statoil

Also, the Norwegian business community is characterized by flat and relatively non-hierarchical structures. Research shows that such structures are beneficial for learning and innovation.

The petroleum industry

Norway possesses considerable petroleum resources in relation to its population. After 50 years of petroleum production, half the expected recoverable resources of oil and gas still remain on the Norwegian shelf. 49 per cent of these resources are linked to existing fields, 14 per cent are in proven discoveries, while about 37 per cent are yet to be discovered.[24] In 2016, the oil production increased for the third consecutive year, and the sale of gas from the Norwegian continental shelf reached record volumes. [25]

It is expected that production will stay on approximately the same levels as today in the next decade. The new fields coming into operation compensate for lower production from existing fields. In the long run, production depends on the development in the oil and gas markets, on new discoveries being made, on profitable discoveries being developed, and on profitable projects for increased extraction at existing fields being carried out. In the past few years, an extraordinarily high activity level at the shelf has led to high growth in investments and operating costs. The high oil prices up until 2014 made investments very attractive, however, this also meant that costs rose considerably. This trend has shifted, and the activity and cost levels are reaching a more sustainable level.

The supply industry has experienced a challenging market situation over the past few years. All the important offshore provinces are affected by the decline in oil prices and the investment cuts of the oil companies. The Norwegian supply industry has taken measures to maintain its competitiveness, and is currently in a good position. 2017 is expected to be another difficult year, while many believe that the market will turn around in 2018 and grow again towards 2020.

Norwegian supply industry is world leading in subsea technology

The rapid development in subsea technology makes petroleum operations possible in deeper waters and further from the shore. Subsea solutions will play an important role in the development of new discoveries on the Norwegian shelf and internationally.

The breakthrough in subsea compression in Norway constituted a quantum leap in subsea technology. Two compression projects have been implemented on the seabed on the Norwegian shelf – Åsgard and Gullfaks. This technology can be installed on existing fields in order to increase extraction rates and prolong long-term production in a cost-effective way.

24) The Norwegian Petroleum Directorate (2016), "Ressursregnskapet for norsk kontinentalsokkel per 31.12.2015".

25) The Norwegian Petroleum Directorate (2017), "Sokkelåret 2016".

Edda Fauna in action on offshore wind farm. Photo: Østensjø Rederi

Norway has large wind resources even at sea, and has considerable competence in maritime industries and offshore wind. Internationally growth is considerable. Norwegian players have considerable experience from building and operating offshore installations, and on the basis of these skills and experience, there are good opportunities for Norwegian equipment and services in the international offshore wind market.

Carbon Capture and Storage (CCS) may also prove to be an important ocean industry in the future, and it could help reduce greenhouse gas emissions. So far, however, CCS is too expensive for the industry to make use of such technological solutions without financial support beyond the existing projects in the petroleum sector. Therefore, there is still a need for cost reduction, upscaling and testing of technology in order for CCS to become an important industry in Norway and the rest of the world.

The maritime industry

Increased business activity offshore will provide opportunities for growth across the entire maritime industry. Maritime knowledge is vital to the development of the seafood industry, changes in the petroleum sector, and for development and utilization of technology in the ocean.

A considerable portion of future growth in the maritime industry is expected to take place in the traditional shipping sector and in connection with other industries, such as aquaculture and offshore wind. Maritime players are currently orientated towards new possibilities and future operations in the ocean. Norwegian shipping companies are delivering an increasing number of services to offshore wind, and Norwegian shipyards' order books have gone from being almost exclusively offshore oriented towards a more diversified portfolio, including segments such as aquaculture, fisheries, ferries, cruise, yachts, and offshore wind. The building of new types of vessels also creates new opportunities for equipment suppliers. For example, offshore fish farming opens a number of new markets in need of a service and supply industry.

Norway is leading the development of environmentally friendly technology in shipping, where there is an increasing focus on alternative energy sources and emission reduction through battery technology, hybrid solutions, hydrogen and fuel cells. Also, in the development of automated and unmanned vessels, Norway can draw on a unique maritime cluster with strong innovative research and competence communities in anything from satellite communication and automated control systems to vessel design and construction.

Østensjø Rederi

Østensjø Rederi is a Norwegian offshore shipping company with more than 40 years of experience in markets all over the world. Due to a reduced number of assignments in the offshore market, Østensjø Rederi has been looking for new markets where the company can use its vessels, crews and competence in offshore operations. Renewable energy has proven to be a segment where this competence is useful. The layout and specifications of the subsea vessels meet the requirements of the industry, and the crews have the knowledge and skills to perform this type of operations.

> One of our main competitive advantages is our knowledgeable oil engineers, process operators, seafarers, fishermen, and fish farmers with high operative skill in utilizing the ocean

The seafood industry

Norwegian marine resources are among the world's richest. Our long coastline is well suited for the production of living marine resources, and our ecosystem based management methods are world leading. Norway is an attractive partner, both in research and in the development of seafood industries and establishment of good management regimes for various countries. This includes monitoring systems to ensure documentation of environmentally friendly, healthy and safe seafood. At the same time, there are still undiscovered species and unexplored areas in our own ocean areas. The great biodiversity gives expectations of finding marine organisms with various biochemical properties and with chemical compounds that can be utilised for a number of different purposes. It is assumed that there is an untapped potential in improving the knowledge of harvesting at a lower trophic level and in harvesting other, underutilized species. Low-trophic species may be used in fish feed, as a source of bioenergy or other industrial purposes, as well as in products for human consumption. There might also exist a large potential for increased value creation in better utilization of marine by-products and for increased refining and processing from the fishing sector. A potential six-fold increase in revenue for the marine industries towards 2050 has been estimated.[26)] This presupposes that the climate change will not be more dramatic than expected, that the current challenges in aquaculture are met, as well as a predictable regulatory regime.

Aquaculture will represent a large portion of this growth. Norway has unique advantages for leading the development of an industrial and sustainable seafood production. Norway is the world's largest producer of Atlantic salmon, and is a world leader in skills and technology for industrial seafood production. The supply industry associated with fish farming is growing rapidly. In the future, Norwegian aquaculture will probably include more species than salmon, including algae, such as seaweed and kelp.

Mineral resources

There are currently shortages of many mineral resources on land, and minerals from the seabed will be more relevant in the future. For example, sulphides containing several interesting metals have been found on the Mid Atlantic Ridge, between Jan Mayen and Svalbard on the Norwegian continental shelf. The area is being surveyed.

It is assumed that mineral extraction from the seabed can potentially contribute to great value creation both nationally and internationally. However, methods and technologies must be developed further, and the environmental consequences must be assessed.

Altogether this gives Norway a unique position for further investment in the ocean industries. At the same time, there are still a number of critical factors which will be crucial to further sustainable growth and value creation in the Norwegian ocean industries.

26) Sintef (2012), "Value created from productive oceans in 2050".

Source: United Nations

3.3 Critical factors in the development of the Norwegian ocean industries

The ability to continue managing and utilizing ocean resources sustainably will be crucial to future profitable Norwegian business activity in the ocean. It will also be necessary to have updated regulations and good framework conditions at all times, closer collaboration across sectors, stronger skills and knowledge of the ocean, development of new technologies, and access to global markets.

The climate and environmental challenges are among the greatest challenges the world is facing. Norway has set ambitious climate goals. In 2030, Norway has assumed a contingent liability of at least 40 per cent emission reduction compared to 1990.[27] The Government strives to attain the climate goal for 2030 together with the EU. In addition Norway aims to become a low carbon society by 2050. The Paris agreement is the first legally binding climate agreement with real participation from all countries. The goal of the agreement is to keep the rise in average global temperature well below 2 degrees Celsius compared to pre-industrial levels, and to strive to limit the temperature rise to 1.5 degrees Celsius. The agreement also says that the goal is to achieve balance between emissions from anthropogenic sources and uptake of greenhouse gases within the second half of our century. Climate policy and the development of low emission solutions in sectors such as energy and transport will be of great significance for the use of and demand for fossil fuel in the long run. This will also affect the ocean industries.

Ongoing deterioration of world oceans, population growth and economic activity put increasing pressure on resources and areas already under great stress. It is necessary to regard climate, environment, economy, and society as a whole and in line with the UN sustainability goals and the obligations in the Paris agreement. Climate change requires great changes in energy production and consumption, new and environmentally friendly energy solutions in shipping, and emission free production methods in industry, wherever technically and financially possible.

The UN sustainable development goals

The UN General Assembly adopted 17 new sustainable development goals in the autumn of 2015. The ambition is that the goals are to be attained no later than 2030. The sustainability goals constitute a comprehensive set of goals, and many of the sustainability goals are important to the ocean industries.

Ocean matters are given special mention in goal 14 on preserving and using oceans and marine resources in a way that promotes sustainable development. The sustainability goal illustrates a strengthened international support for the significance of the ocean.

The targets of sustainability goal 14 emphasize sustainable management, obtaining more knowledge of the ocean, preserving at least

27) Government White Paper 13 (2014–2015) “New emissions commitment for 2030 – towards joint fulfilment with the EU”.

Close collaboration and the transfer of knowledge have been important to the development of the Norwegian ocean industries.There may be a great potential for new jobs and value creation in increasing the transfer of ideas and technology between the ocean industries.

10 per cent of the coastal and ocean areas, avoiding overfishing, fighting illegal fishing, reducing pollution, marine littering and the proliferation of microplastics. Preventing and reducing pollution, marine littering and the proliferation of microplastics are identified as an important challenge, and this is also a prerequisite for continued safe and healthy seafood.

Through a set of management plans for marine areas, Norway facilitates value creation through sustainable use of resources in the ocean areas, while maintaining the structure, behaviour, productivity, and biodiversity of the ecosystems. It is vital that we continue to ensure sustainable management of ocean resources as well as the Norwegian ocean and coastal areas.

Current management and regulation of the ocean industries is largely sector-driven, where integration of new ocean industries is handled through existing public regulations. It is vital that the fundamental framework gives the various ocean industries approximately the same requirements and opportunities, and that it keeps pace with development and does not fall behind. The same applies to regulatoßry systems.

Close collaboration and the transfer of knowledge and skills have been important to the development of the Norwegian ocean industries. Changes in the petroleum industry and the growth in the seafood industry have triggered a number of new initiatives for technology transfer between the industries. Sintef and Marintek have identified the potential for synergies between the ocean industries.[28] According to the report, there may be a large potential for new jobs and sustainable value creation in systematizing and increasing the transfer of ideas and technology between the established ocean industries, and from established to new industries utilizing resources in, on and under the ocean. The opportunities are assumed to be particularly great for transferring offshore technology to other ocean-based industries, especially to aquaculture. The potential for technology transfer is also strongly emphasized in the Government's bioeconomic strategy. Several sector-oriented reports also point out the need for more collaboration across industries, specialty fields and competence communities. Reports from Maritim21, OG21, Hav21, and Energi21 emphasize intersectoral and interdisciplinary research, development and innovation (see chapter 5).

Technological development is happening at a fast pace. Like other countries with a high standard of living, Norway must compete on knowledge as the basis for innovation and productivity. In order to maintain the welfare state, it is important that Norwegian employers are able to pay high wages. In order for knowledge and innovation to give lasting competitive advantages, we must develop and use new knowledge continuously. The need for knowledge and skills is in part specific to individual industries; however, there are also shared challenges and potential for collaboration and transfer of skills across industries. New industries, such as renewable ocean energy, mineral extraction on the seabed, and the harvesting of biomarine resources at lower trophic levels, require considerable knowledge and innovation.

28) SINTEF, Marintek (2016) "Potensialet for utvikling av tverrgående teknologier og teknologisk utstyr til bruk I marin, maritime og offshore sektorer".

> The authorities will help design terms and conditions that stimulate development and value creation in the ocean industries effectively.

The Productivity Commission points out in its report that Norway is facing great changes in the business sector and the job market in the coming years.[29)] Major demographic changes, stronger international competition, lower oil production, as well as fast and extensive technological changes, make new requirements to skills and knowledge. Attracting the right skills will be vital to the further development and long-term competitiveness of the ocean industries.

The development of new enabling technologies, such as bio- and nanotechnology, as well as innovation in digitization, autonomy and systems for processing large amounts of data, could prove to be so pervasive that they lead to great changes in society.[30)] Technologies enabling this are currently widely applied in all the ocean industries, and may play an important part in the development of the industries in the coming years.[31)]

The Norwegian ocean industries are closely linked to the global markets, and Norwegian businesses are world leaders in oil and gas, the maritime industry, and seafood. In order to further develop and maintain the position of the ocean industries globally and safeguard future export opportunities, Norwegian companies depend on equal and predictable framework conditions globally as well as access to international markets.

3.4 The role of the authorities

The opportunities that the industries are faced with will not come into fruition on their own. They require long-term efforts from various players. The authorities will help design terms and conditions that stimulate development and value creation in the ocean industries effectively.

On this basis, the Government has identified three central areas where a broad set of instruments linked to management and the public support system is reviewed.

Chapters 4, 5, and 6 contain a review of the authorities' efforts and the measures relevant to further development and value creation in the ocean industries, as well as specific actions to contribute to fulfilling our ambitions in these areas. Chapter 4 contains a review of the management of the ocean and the legal framework for ocean ased businesses. Chapter 5 reviews important instruments and focus areas in knowledge and skills, while chapter 6 discusses the Government's efforts with regard to market access, internationalization, and profiling of the Norwegian ocean industries.

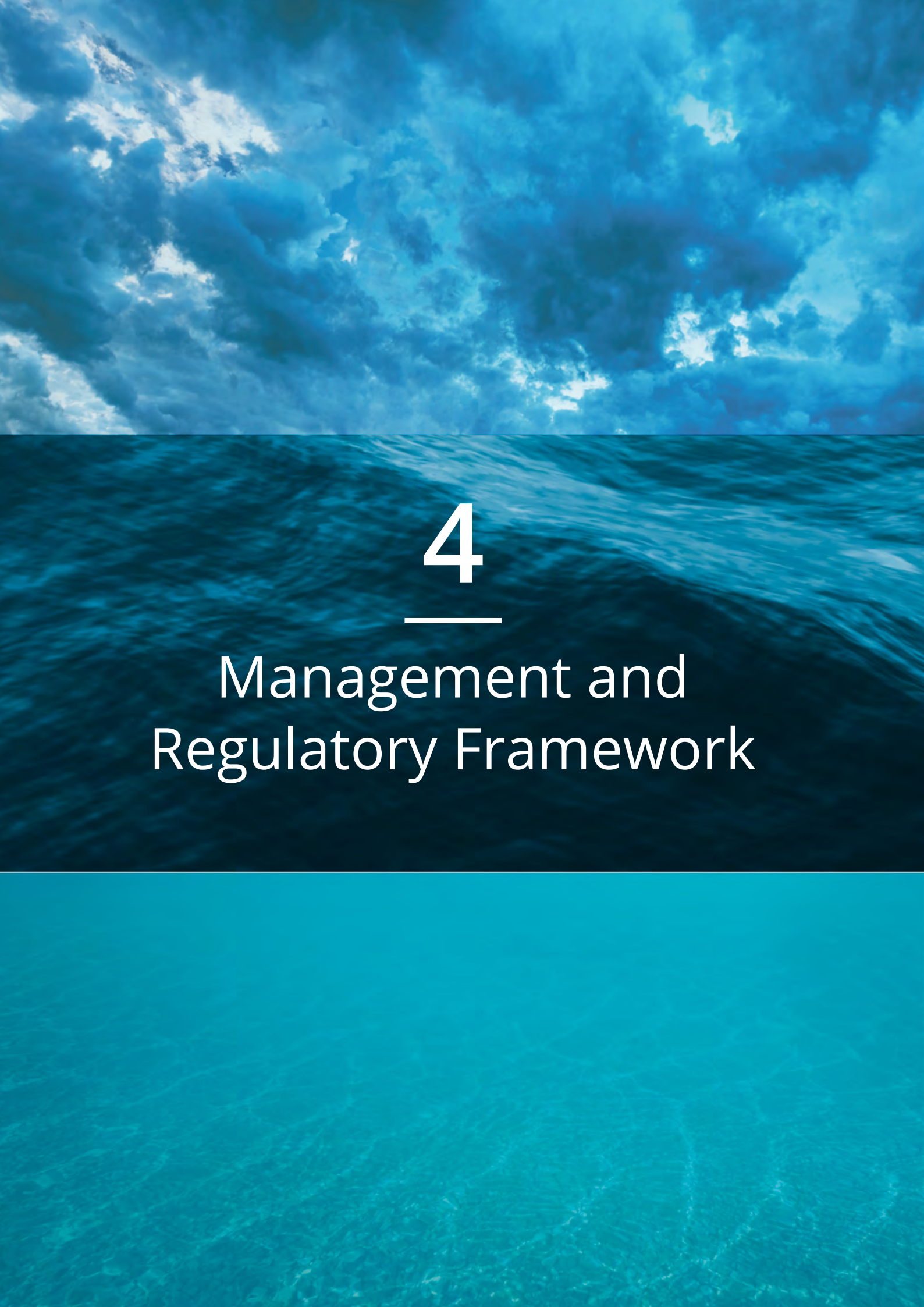
29) NOU 2016: 3 (2016) "Ved et vendepunkt: Fra ressursøkonomi til kunnskapsøkonomi – Produktivitetskommisjonens andre rapport".

30) The Ministry of Education and Research (2014), White paper no. 7 (2014–2015) "Long-term plan for research and higher education 2015–2024".

31) SINTEF, Marintek (2016) "Havteknologi – Potensialet for utvikling av tverrgående teknologier og teknologisk utstyr til bruk i marin, maritime og offshore sektorer".

Government Policy for Future Value Creation and Employment in the Ocean Industries

Photo: Anna Julia Garnberg/Maritimt Forum



4

Management and Regulatory Framework

The Government will contribute to a conducive regulatory framework by continuing to develop efficient, predictable and knowledge based regulation of the ocean industries.

It is the authorities' responsibility to facilitate increased value creation and business development in the ocean industries. This calls for efficient utilization of the resources we are currently using, as well as facilitating profitable utilization of new resources. New industries can create new jobs, and it is vital that the authorities constantly monitor technological development in order to ensure flexible regulations and a good and responsible management of resources and the environment, which take into consideration both sustainable use and conservation.

Increased activity at sea require continued coexistence between industries. With this strategy, the Government aims to facilitate increased coexistence and collaboration at sea. By updating the management plan for the Norwegian Sea in the spring of 2017, the Government continues a long-term and comprehensive marine environmental policy to facilitate value creation while protecting the marine and coastal environment in the Norwegian ocean areas.

In order to attain the goal of this strategy, the Government will do the following with regard to management and regulatory frameworks:

- facilitate further development of the ocean industries and the development of new, profitable ocean industries within a sustainable framework.
- make sure legislation does not hamper innovation and the transfer of technology and experience across the ocean industries, and
- strive to secure technology neutral regulations that help promote technological development.

4.1 Responsible area use and collaboration

There are many users of the ocean, and the goal is to ensure a good and responsible management of maritime resources.

Out to 1 nautical mile off the end of Norwegian waters, the area use is planned through the area planning procedures in the Planning- and Building Act. The local authorities are responsible for managing these coastal areas and defining areas for various activities through their municipal land-use plans. Growing industries and new industries could challenge the area use of established activities. The potential of aquaculture is large, but in order to achieve it, the way must be paved for more areas where such activity can take place.

In parts of the country, the Armed Forces have large areas for various types of shooting and training which are used to a varying degree. Efforts have been initiated to liquidate shooting and training areas that are no longer needed, and to assess joint use with aquaculture in fields the Armed Forces will continue to use. The efforts also include formalizing fields the Armed Forces will continue to use in collaboration with affected municipalities.

In order to reduce conflicts in coastal areas, solid planning is required on the part of municipalities, in collaboration with county municipalities, to secure both current and future needs. The Government will prepare good instructions and map utilities for coastal area planning, and facilitate active planning in counties and municipalities along the coast. Among other things, this means preparing better tools for the planning

authorities to use for the placement of aquaculture businesses, etc. in the coastal areas, including better current models, as well as knowledge of the spread of infection and environmental effects. The Government has been working diligently to secure faster planning processes and fewer objections.

Through coordination efforts, the Government has given the Governors of twelve counties the responsibility of coordinating objections from government authorities, and has also established an interministerial planning group with the purpose of strengthening and coordinating the ministries' work on the Planning and Building Act. Legislative changes to the Planning and Building Act have also been implemented and proposed in order to ensure faster processes and better participation. The purpose of the Government's efforts is to facilitate dialogue early in the planning processes in order to have better plans as well as fewer and better justified objections.

Outside areas managed by the municipalities, government authorities plan and define the area use through sector regulations and overall management plans for ocean areas.

Management plans for Barents Sea-Lofoten, the Norwegian Sea, and the North Sea-Skagerrak cover Norwegian waters. The management plans contribute to clarity in the overall framework, coordination, and priorities in the management of ocean areas. The plans are updated and revised regularly.

The OECD highlights ocean industries and well-functioning marine ecosystems as the two equal main elements in a model for ocean economy. Norway's policy for the ocean areas reflects this through management plans and sectorial legislation, which promote both sustainable use and ecosystem preservation. Management plans are important for the fulfilment of UN sustainability goal 14.

Alongside growth in existing activities, it is also expected that ocean areas will be used for value creation such as, for example, other production of seafood, ocean energy, and extraction of minerals. The need for comprehensive and coordinated planning of area use and offshore conservation measures has become even more relevant through the increased focus on the importance of the ocean for future food production and other value creation. In this perspective, it is important to strengthen the basis for coordinating activities and preventing potential area conflicts.

Ramform Vanguard collects seismic data. Photo: PGS

Seismic surveys

Seismic surveys are necessary in order to map petroleum deposits and to ensure efficient utilization of proven resources.Seismic surveys are an important tool in all phases of petroleum operations, from the opening of an area to when the field is in production, in order to monitor the development in the reservoir. At the same time the collection of seismic data occupies areas, and may, for example, affect fisheries.

In order to ensure the best possible use of the areas, the Ministry of Petroleum and Energy and the then Ministry of Fisheries and Coastal Affairs published a guide for the implementation of seismic surveys on the Norwegian continental shelf in 2013. The guide explains the importance of the two industries, and it describes the regulations that apply to seismic surveys.

In the past few years there has been strong dialogue between the fishing and petroleum industries. Meeting places have been established where mutual information is shared. This has made an important contribution to improved coexistence and mutual understanding of each other's operations.

4.2 Good infrastructure

A suitable infrastructure must form the basis for ocean industries to be able to operate as efficiently and environmentally friendly as possible, as well as develop further.

National Transport Plan 2018–2029

The ocean industries depend on a well-functioning and safe maritime infrastructure. The ocean industries also generate transport on land. Every year, more than 1.3 million tonnes of seafood, among other things, are shipped from Norway to the EU. Most of this is transported on roads, and safe and efficient transport routes from production sites which are often not easily accessible, and out to the markets in Europe, are important to the industry.

In the national budgets for the years 2014–2017, the Government has increased the allocations for transport purposes, which has led to increased development, operation and maintenance for the transport infrastructure. This has facilitated reduced transport costs, improved competitiveness for the business sector, as well as a well-functioning labour market all over the country.

It is a priority for the Government to catch up with the maintenance backlog, as well as to improve and renew the transport infrastructure. Maritime infrastructure and maritime safety services will be developed further in order to ensure good navigability and continued safety for larger vessels and increased maritime traffic. The Government's overall transport policy for the coming years will be presented in the white paper on the National Transport Plan 2018–2029, which will be presented to the Storting in the spring of 2017.

The European environmental satellite Sentinel 1 Source: The European Space Agency

Maritime transport

Shipping clearly represents the largest share of transport work. Between 75 and 80 per cent of all cargo transport (measured inn tonne kilometres) on Norwegian territory takes place at sea. This is mainly large bulk transports over long distances.

The Government strives to increase transport of cargo at sea, and has implemented several measures to achieve this. The Norwegian Coastal Administration has been strengthened as harbour and transport agency through elevation of the agency's competence in transport analysis and planning. The user funded pilot programme has been streamlined, and the fees reduced. The development of Norwegian harbours in line with changes in use is important for the competitiveness of maritime transport. In 2015, a grant scheme for harbour collaboration was established. This scheme can improve utilization of existing harbour infrastructure, and thus give lower costs for maritime transport. The Government will facilitate more maritime transport of cargo, and in 2017 a temporary, three-year pilot scheme will be established, with grants for transferring cargo from road to sea.

Digital infrastructure

Having safe, robust and user friendly electronic communication services is vital to the business community. In White Paper 27 (2015–2016) "Digital Agenda for Norway – ICT for A Simpler Everyday Life and Increased Productivity", the Government presented the National Plan for Electronic Communication (the Ecom Plan). This plan discusses, among other things, mobile and broadband coverage, robust ecom networks, market regulation, and safety in ecom networks and services. It is the Government's goal that good ecom networks are a competitive advantage for the business community all over the country. The Government will facilitate the development of ecom infrastructure, cf. the Ecom Plan in White Paper 27 (2015–2016).

International collaboration is important in order to reduce data collection costs and improve quality of ocean monitoring. For example, Norway participates in the European meteorological organization EUMETSAT, the navigation programme Galileo, and the earth observation programme Copernicus. The satellites in the earth observation programme Copernicus monitor and provide information on things like waves, currents, sea level, vessel activity, oil spills, algal blooms, and sea ice.

The Government will facilitate use of new technology in monitoring and data collection associated with the management of our ocean areas where this is practical. The Government will present a separate space strategy in 2017.

Existing systems offering satellite communication in ocean areas north of 72–75 degrees have limited performance and capacity. This can be a challenge for example in search and rescue operations. Good communication solutions are important for maintaining sovereignty, and for research and climate and environmental monitoring. A robust communication system could also facilitate increased value creation in the Northern areas. The Government is therefore implementing a concept study in order to assess needs and the possibility of a satellite-based communications system in the Northern areas.

The Norwegian AIS satellites monitor maritime traffic in Norwegian and international waters. The satellites pick

Oslo Stock Exchange. Photo: Innovation Norway

up Automatic Identification Signals (AIS), which communicate a vessel's identity, location, speed, and direction. Since 2010, the Norwegian Defence Research Establishment, the Norwegian Space Centre and the Norwegian Coastal Administration have performed satellite-based maritime ocean monitoring using satellites AISSat-1 and AISSat-2. Norway's capacity for satellite based vessel monitoring will be strengthened further in the coming years with AISSat-3, and NorSat-1 and NorSat-2.

Access to capital

As in the business community in general, access to capital is an important prerequisite for development of the ocean industries. Capital is used to establish new operations, to operate, develop or restructure existing operations, to generate new technology and innovations, or to reach new markets. A common feature of the ocean industries is that they are capital intensive. Another common feature in that many ocean industries are distinctly cyclical, which is associated with risk and may at times have special impact on capital supply.

Banks, investors and other suppliers of capital in Norway seems to have good knowledge of the ocean industries. This provides a good basis for suppliers of capital to be able to assess the risk and expected revenue of various projects in the ocean industries, and facilitates efficient connections between capital seekers and capital possessors.

Through the Oslo Stock Exchange, Norwegian companies and investors in the ocean industries have access to a leading marketplace for oil and gas, shipping and seafood.

The Oslo Stock Exchange has also established a marketplace for new and smaller businesses with fewer administrative requirements, Merkur Markets. In terms of the number of companies, the Oslo Stock Exchange is the second largest in Europe for energy in general, and the second largest in the world for petroleum service in particular. Oslo is the largest shipping exchange in Europe and the second largest in the world. The Oslo Stock Exchange is the world's largest financial marketplace for the seafood sector. There are also other marketplaces in Norway. One example is the OTC list, a marketplace for unlisted shares.

There are great differences within and between ocean industries with regard to which capital sources are most important. Small and medium sized, unlisted companies, particularly common in the seafood industry and the supplier industry, can have limited access to international capital markets. For these businesses, bank funding and capital from their own business owners are particularly important. Larger, listed companies usually have access to several capital markets also outside Norway, and can make use of the bond market.

The Government also offers a number of instruments to improve access to capital, especially for businesses in the initial phase. The capital instruments will help trigger commercially and socioeconomically profitable projects which would not have been realized without government support. This happens both through direct support and through the fact that direct support triggers private investments. When private investors find it profitable to participate in the projects, this could work as a quality assurance of the projects being supported. The Government has strengthened the capital instruments to trigger private investments, such as pre-seed funds and seed funds.

Svalbard Exercise 2016. Polarsyssel is the vessel of the Governor of Svalbard. Photo: The Norwegian Coastal Administration

The capital instruments are broadly aligned in order to support the best projects, regardless of origin. The ocean industry is an active user of several instruments, such as the low risk loan scheme in Innovation Norway, which is used, among other things, to co-finance investments in fishing vessels and operating equipment. Low risk loans trigger other funding because they are mainly granted to projects together with loans from private banks on market terms.

The Government is committed to well-functioning capital markets. In the White Paper on Industry, the Government wishes to discuss various aspects of the capital markets in Norway, and follow up on the Storting's request to perform an overall assessment of the access to both public and private venture capital in Norway.

4.3 Safety and efficient preparedness

In order to prevent accidents at sea and avoid pollution of Norwegian waters, it is important that vessels trafficking the coast are in good technical condition and highly operational, and that the crews have the necessary skills.

The Ship Safety and Security Act and the Ship Labour Act, with associated regulations, are key legislation for safe and environmentally friendly vessels. High safety depends on a maritime administration that can be at the forefront of developing regulations associated with new technical solutions.

The maritime administration plays an important and central part in safeguarding and facilitating the development of maritime operations.

The Government's ambition is that Norwegian petroleum operations remain world leading in Health, Safety and Environment (HSE), and has initiated a new White Paper to the Storting on the topic. The White Paper will offer a broad review of the HSE situation in the industry and an assessment of supervisory monitoring and regulations. The White Paper is scheduled to be presented in winter 2018. The Government will pursue a high level of safety in Norwegian petroleum operations.

A high level of navigational safety and good preparedness against acute pollution are other important matters. In 2016, the Government presented White Paper 35 (2015-2016) "On the right track. Preventative maritime safety and preparedness against acute pollution." In this report, the Government has, based on assessments of future maritime transport and environmental risk, described several measures to maintain and strengthen maritime safety in Norwegian waters and secure good preparedness to efficiently prevent and limit environmental damage caused by acute pollution. This includes further development and modernization of navigational infrastructure in order to provide better navigation guidance and reduce operation and maintenance costs. The report further states that the Government will strengthen maritime traffic monitoring at Svalbard in order to give the Norwegian Coastal Administration and other agencies a continuously updated maritime overview, and the service area is considered extended to the maritime traffic centrals on the West coast.

The Government will also facilitate development and implementation of intelligent transport systems in order to strengthen maritime safety. Preparedness against acute pollution is to be adapted and dimensioned to the current environmental risk. Among other things, measures to strengthen preparedness against acute pollution at Svalbard and Jan Mayen will be considered, as well as establishing national preparedness for the use of chemical dispersants to combat emissions of bunker oil in coastal areas.

Maritime operations in the Northern areas are changing and moving into more challenging areas in terms of preparedness. National preparedness against acute pollution should be adapted to the current risk situation. The Government will maintain and strengthen a high level of maritime safety and maintain strong preparations against acute pollution, cf. White Paper 35 (2015–2016). The Government also wants Norway to continue to be at the forefront with regard to preparedness for emergency search and rescue in our ocean areas.

The acquisition of new rescue helicopters with higher load capacity, range and speed will be a vital contribution to better preparedness in our port areas, and thus secure increased business activity.

In the 2017 budget, it is envisaged expedited acquisition of three new coastguard vessels, from 2020 to 2018. The acquisition is regarded to fall under the exception in article 123 of the EEA agreement, and will thus be reserved for Norwegian industry due to national security.

The armed forces maintain sovereignty, exercise authority, and manage resources and emergency preparedness on a daily basis. The capacities of the armed forces, such as the coast guard and maritime patrol aircrafts, are important resources in search and rescue operations. The Air Force also operates the Ministry of Justice and Public Security's rescue helicopters. The rescue helicopter service is a dedicated operative element in the Norwegian national search and rescue service as its primary responsibility.

4.4 Mapping resources and sharing information

A first version of a digital area tool for the management plans for the marine areas has been developed. This tool is to give a comprehensive, overall view on maps of human activity, environmental values and regulations. The area tool will support good management sand area planning in ocean areas and be useful to any authorities involved, various business interests and NGOs, other users of the ocean areas, and the public. The area tool is being developed in close collaboration between the Forum for management plans and BarentsWatch. The Government will develop the digital area tool for ocean areas further.

BarentsWatch

BarentsWatch is a monitoring and information system which is to give access to quality assured information on the Northern oceans and coastal areas. Various government institutions could exchange and make available information and data more easily using the system.

BarentsWatch consists of a closed and an open part. The open part is a portal offering user friendly compiled and processed information on things like climate, environment and maritime transport to all users of the ocean. The closed part is a system for public administration with operational responsibility offshore, and is to contribute to a common, evaluated situational overview as the basis for improved operational management.

Knowledge of depths and seabed conditions is important for planning and for facilitating activity in the Norwegian ocean industries. We obtain such knowledge for example through the mapping programme MAREANO, which is discussed in detail in chapter 5.

In order to safeguard national security, there are currently certain statutory restrictions for recording of and access to detailed information on depths and seabed conditions. Current regulations mean that all mapping of the seabed with higher resolution than 50 x 50 metres, is classified, regardless of depth. Those who wish to collect this information, or have existing information released by the authorities, must apply to Norwegian authorities. The Ministry of Defence is currently reviewing these regulations in consultation with other relevant ministries. The goal is, among other things, to make the highest quality and quantity of information possible available for use for various socially useful and commercial purposes, as long as such access does not affect national security. A lot less information will be classified, while information also will have a lower classification level. There are also ongoing efforts to simplify the process of releasing and processing collected depth information in order to meet stakeholders' needs for access to information and greater accuracy. A legislative proposal is already prepared, and there is ongoing work on an underlying regulation. Both will provide a positive effect for industry players and society at large. Guidelines are also being prepared, which will simplify the application process for the release of information on seabed condition. The Government will present a proposal for a regulation that will liberalize the current classification regime for collecting and using detailed depth data.

Drilling at the Johan Sverdrup field. Photo: Kjetil Eide/Statoil

4.5 Efficient resource management in the petroleum industry

The main goal of the petroleum policy is to facilitate long-term profitable production of oil and gas.[32] Activities are to be performed with high standards of health, environment and safety, as well as in close interaction with other users of the ocean. A high, stable level of activity where profitable resources are produced is important in order to secure good resource management, high value creation and business opportunities for the supply industry and other associated industries all over the country. The activity level is affected by developments in the global market for oil and gas, but also by cost developments and other national factors. Therefore, the regulatory framework is formulated to be robust in times of both high and low oil prices. A multitude of players in exploration, development and operation is positive for securing good commercial decisions in all phases of the activity.

The petroleum framework is written to both ensure predictability for companies and good resource management by facilitating profitable production and contributing to competition. The considerations for environment and climate are also an integrated part of the Norwegian petroleum policy and framework, and a wide range of policy instruments have been adopted.

Continuous improvement of the framework is important in order to maintain these goals and meet new challenges. Lack of interest on the part of existing licensees in utilizing all the business opportunities on the Norwegian Shelf in the early 2000s led to the implementation of the prequalification scheme, establishment of annual licencing rounds in predefined areas (APA) and implementation of the exploration reimbursement scheme.

Prequalification offers new companies wishing to become licensees or operators on the Norwegian Shelf a pre-assessment before the company would spend resources on evaluating specific business opportunities on the Norwegian Continental Shelf. The overall requirement for new companies is that they must be able to contribute to value creation and fulfil their obligations as a licensee on the Shelf. Since the implementation of these new policies there has been a lot of interest, and companies that made use of the scheme, have been diverse in terms of size, nationality and experience. The Government will continue to facilitate more diversity in the petroleum sector, and continue to offer prequalification to ensure strengthened competition in the years to come.

The exploration reimbursement scheme was implemented in order to ensure equal tax treatment of exploration costs for companies in and outside tax position. The scheme gives a company outside tax position the opportunity to choose to have 78 per cent of the exploration costs reimbursed in the following year instead of deducting exploration costs from the tax base. Existing licensees in tax position can

32) Sverdrup PDO and status on the Norwegian shelf Prop. 114 S (2014–15)

deduct exploration costs on a continuous basis, and thereby obtain a 78 per cent reduction in tax payments. Companies outside tax position could alternatively have losses carried forward with interest and possibly have the tax value of losses reimbursed on termination of activity on the Norwegian Shelf. Thus, the exploration reimbursement scheme is not a subsidy. For companies not yet in a taxable position, the reimbursement scheme gives a lower capital tie and thus a better cash flow. Therefore, the reimbursement scheme is important in order to equalize companies and reduce barriers to entry the petroleum activities on the Norwegian Shelf.

In mature areas, the annual licencing round with allocations in pre-defined areas (the APA) is important in order to ensure efficient and timely exploration in mature areas. Mature areas are characterized by known geology, fewer technical challenges, and developed or planned infrastructure. The scheme ensures quick and timely exploration, so that established and planned infrastructure in an area can be used to capacity over time, and that time-critical resources can be produced. The scheme contributes to predictability for the oil companies through annual allocations of new acreage. The APA has also helped strengthen the diversity and competition in exploration on the Norwegian Shelf. The scheme has also helped maintain exploration activity in mature areas, so that profitable resources continue to be proven and produced. The APA area is expanded as areas on the Continental Shelf mature.

In the 23rd licencing round, areas in completely new exploration areas were made available to oil companies for the first time since 1994. In May 2016, offers were made for ten new production licenses in the Barents Sea.

This provides good future opportunities for value creation and employment in the Northern areas. The 24th licencing round has started, and a two-year run with allocations during the first half of 2018 is foreseen. The Government will maintain a high and predictable pace in awarding areas for petroleum activities in order to contribute to exploration and good use of resources on the Norwegian Shelf.

Norway's petroleum policy has provided good results for the country. Over the past few years the Norwegian Continental Shelf has gained many qualified companies and a considerable increase in number of operators. Since 2009, the number of operators has almost doubled from 8 to 15 companies. New licensees have also contributed to many commercial discoveries, and many new projects are now maturing or have already been developed. Even in a time of low oil prices, plans for development and operation are being submitted to the Ministry of Petroleum and Energy for approval, and several new development projects are expected in the years to come. Not only does this ensure good resource management on the Shelf, it also provides business opportunities in the onshore economy and for the supply industry.

In the 23rd licencing round, areas in completely new exploration areas were made available for the first time since 1994.

Petroleum activity is managed within acceptable limits, and considerations for the external environment must be maintained. A wide range of policy instruments helps the various players consider the environment and climate in all phases of their activities, from exploration to development, operation and termination. Norway implemented the CO2 tax in 1991. Since 2005, Norway has also been associated with the European quota market (EU ETS), and petroleum activity has been associated with EU ETS since 2008. The total of CO2 tax and quotas for petroleum operations is higher than in other sectors in Norway, and very high compared to the prices on emissions of greenhouse gases in many other countries.

With regard to the legal framework for CO2 storage, the EU CCS directive is implemented in Norwegian legislation through CO2 storage regulations. The purpose of the London Protocol of 2006 is to protect the maritime environment and implement all practical measures to combat marine pollution as a result of human activity. In 2009, the protocol was altered to allow transport of CO2 across borders for injection in geographical formations under the seabed. In order for this change to take effect, more than 30 out of 47 parties in the protocol must ratify. So far, only three countries have ratified these changes. The Government will continue its efforts to influence more countries to ratify this change to the London Protocol.

4.6 Sustainable growth and value creation in the maritime industry

In 2015, the Government presented an ambitious maritime strategy with policy measures that have helped strengthen the competitiveness of the Norwegian maritime industry. Norway is a considerable maritime nation, and the Government has facilitated further growth and value creation in the maritime industry.

In order to maintain and further develop the Norwegian maritime industry, it is vital to ensure a considerable and competitive fleet under Norwegian flag as well as high quality maritime competence. The Government has secured the maritime industry a competitive regulatory framework. The most important one is the grant scheme for seafarers and a competitive tax regime through the tonnage tax regime. Despite very challenging times in many maritime segments, we see an increase in the number of vessels both in the Norwegian International Ship Register (NIS) and in the Norwegian Ordinary Ship Register (NOR). Through the maritime strategy, the Government has strengthened its focus on environmentally friendly shipping, strengthened the access to well qualified personnel in the Norwegian maritime industries, and has supported the efforts on a new research and innovation strategy for the maritime sector (Maritim21). We also know that a competitive maritime administration is important to maintain a position as maritime world leaders.

A long-term and strategic focus has made Norway a world leader in the use of liquid natural gas (LNG), and now also battery and hybrid systems in shipping.

The maritime strategy also pointed out the need to see Norway's ocean industries in context, and emphasize the synergies between the industries. The maritime industry delivers goods and services to all of the ocean industries and will continue to do so in the years to come. This means that the regulatory framework needs to be a partner in the industry's efforts in developing in new products and solutions, while at the same time safeguard the employees' needs.

Framework

The Ministry of Trade, Industry and Fisheries is the authority responsible for regulating vessels and mobile installations, their operations and their crew. The Ministry of Climate and Environment is the authority responsible for the areas of climate and environment. Regulation takes place mainly through the Ship Safety and Security Act and the Ship Labour Act. Current maritime regulations are detailed and experience based, but they still contain options for using alternative, equivalent solutions. Development in the maritime industry happens rapidly, and the authorities are facing completely new concepts for aquaculture, automation, and climate and environmentally friendly solutions. One example is the construction and design of new aquaculture facilities, which push the boundaries of current regulations between vessels, movable installations, barges and their area of operation (see subchapter 4.7).

Development of future regulations should mainly focus on goals and functional requirements, and not provide fixed, prescriptive solutions. Good national solutions that open for innovation and new business should be promoted in forums where international regulations are negotiated, such as the UN International Maritime Organization (IMO). International regulatory collaboration is discussed in more detail in chapter 6.

Vessel automation

There is considerable focus on the development of technology for vessel automation in the maritime industry. Automation is part of the current shipping industry. For example, most vessels in the petroleum sector use dynamic positioning in their operations, and some movable drilling installations use only dynamic positioning, not anchors, during drilling operations. This has contributed to better safety for vessels, crew and operations. Automation can cause any degree of changes in vessel operations, for example remote operation or pre-programming (autonomous vessels). The technology can, for example, help optimize vessel operation. On the other hand, a larger degree of automation will make other operation requirements and crew skills on board. Remote operation and autonomy give considerable financial, safety and environmental opportunities, and they are part of the development. In order to contribute to Norwegian technology development in this field, and to gain experience for, among other things, the development of regulations and further development of maritime safety services and maritime infrastructure for autonomous vessels, a test area for autonomous vessels has been established in the Trondheim Fjord.

Several shipping companies are currently considering the option of fully or partially unmanned vessels. Among other things, this is relevant for short distance passenger ferries. The Norwegian Maritime Authority is now considering which parts of the regulations are affected by automation and autonomous vessels. Suggestions from the industry on building and certifying vessels are being followed up with specific evaluations of how an equal level of safety and environment can be safeguarded in alternative ways. The Norwegian Maritime Authority, the Norwegian Coastal Administration, the Federation of Norwegian Industries, and

Autonomous vessel from Maritime Robotics in the Trondheim Fjord. Photo: NTNU.

MARINTEK initiated the establishment of the Norwegian Forum for Autonomous Ships (NFAS) in October 2016. This is a forum for Norwegian stakeholders in autonomous and unmanned vessels. The forum is an important initiative for knowledge exchange concerning technology which can provide new opportunities for the Norwegian maritime cluster, as well as ensure more environmentally friendly maritime transport. The forum works to make autonomous vessels safe to operate and secure against sabotage and hostile attacks, and to ensure that the interests of current and future employees are adequately safeguarded. The Government will facilitate the development and use of automation in vessels.

Test area for autonomous vessels in the Trondheim Fjord

The Norwegian Maritime Authority and Norwegian Coastal Administration signed a collaboration agreement with industry and research organizations for a test area for autonomous vessels in the Trondheim Fjord in 2016. This is the first test area for autonomous vessels in the world. NTNU, Kongsberg Seatex, Kongsberg Maritime, MARINTEK, and Maritime Robotics have taken the initiative to the test area in collaboration with Trondheim Harbour, the Norwegian Maritime Authority and the Norwegian Coastal Administration. The purpose of the agreement is to facilitate testing of fully or partially unmanned vessels and exchange experience and data for the development and use of such vessels. NTNU and Sintef will be using the area for testing.

Green shipping

Norway is among the world leaders in developing and using green maritime technology. The Government will strive to keep Norway at the forefront of the development of the world's most environmental shipping industry also in the future. Green shipping is among the Government's focus areas in the climate policy, and one of the main goals of the maritime strategy. The government-appointed committee of experts for green competitiveness submitted its recommendations and advice to the Government in autumn 2016. In the report, the expert committee presents proposals for a national strategy to reduce greenhouse gases while Norway maintains a high level of value creation and employment. The committee believes that a zero-emission maritime sector can give large cuts in emissions and considerable effects for the industry. It recommends that the authorities help engage the innovative power of the whole range of players in the maritime industry, in addition to involving both owners and the buyers of transport services. In connection with the committee's work, the maritime industry has launched proposals for solutions through a "chart for green coastal traffic".

Considerable resources are being used in the public support system and in the Norwegian Maritime Authority in order to support the environmental efforts of the Norwegian maritime industry. A long-term and strategic focus has made Norway a world leader in the use of liquid natural gas (LNG), and now also battery and hybrid systems in shipping. Collaboration between the public support system, the government and other public authorities and the business community has given good results. Norway has the world's largest fleet running on LNG, and is a preferred partner for the EU and several important countries, such as China, Japan, South Korea, and Singapore.

Electric ferry Ampere. Photo: Samferdselsfoto

Export of Norwegian solutions

The Norwegian Maritime Authority has promoted experiences and our national regulations for LNG and the IGF code "The International Code of Safety for Ships using Gases or other Low-flash-point Fuels".

The development of regulations for vessels using LNG as fuel, was put on the IMO's agenda following a proposal from Norway. Norway has had national regulations for vessels using LNG as fuel for a long time. Adoption of the IMO IGF code with associated training requirements provides an international framework which provides safety for passengers and crew on board this type of vessel.Both code and training requirements came into force on 1st January 2017. A number of Norwegian technology suppliers are involved in marketing in order to publicise Norwegian solutions.

The world's first battery powered ferry is Norwegian, and it is named Ampere. It covers the distance between Larvik and Oppedal on E39 in Sogn og Fjordane. The ferry was developed in Norway in close collaboration between the industry and public authorities. We are currently seeing an increasing interest in developing and using battery and hybrid solutions in shipping. The requirements of low- and zero-emission solutions in tendering processes have been an important incentive for this.

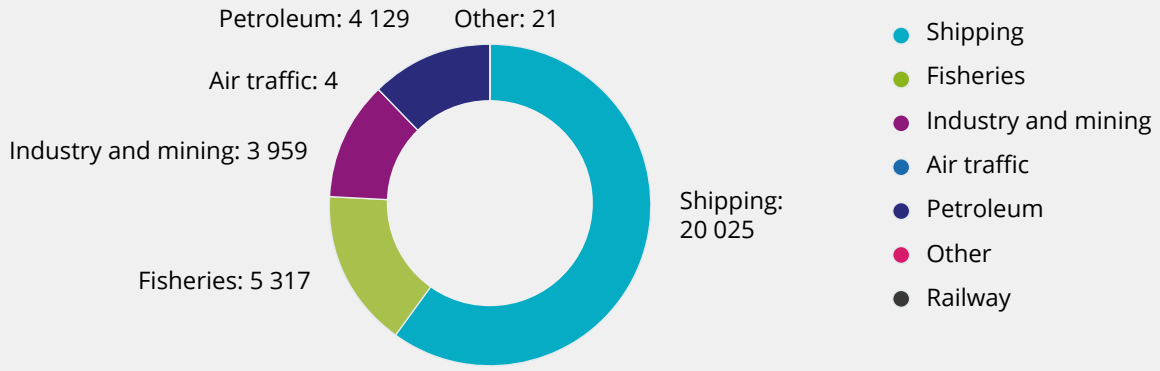
Low- and zero-emission solutions in shipping

In the revised 2016 national budget, the Government strengthened the focus on the development and implementation of low- and zero-emission solutions in domestic shipping with NOK 65 million. The funding is distributed through a grant scheme partly directed towards private players, such as shipping companies, shipyards and equipment suppliers (NOK 41 million, allocated by Innovation Norway), and partly towards county and municipal governments (NOK 20 million, allocated by the Ministry of Climate and Environment). The scheme is to contribute to the development of low- and zero-emission solutions in the shipping industry and help strengthen the county governments' environmental competence with regard to the procurement of ferry services. The purpose is to help reduce greenhouse gas emissions and contribute to development of green technology and green jobs along the coast.

There has been considerable interest in and commitment to the scheme on the part of the county governments. In the autumn of 2016, a total of NOK 20 million was granted on application to ten county and one municipal government wanting to put low- and zero-emission ferries in traffic along the Norwegian coast. The projects supported will give the county governments a solid basis for requiring low- and zero-emission solutions for ferry services in the future.

Constructive dialogue and collaboration between the industry and the authorities, is important. A good example of collaboration is the "Green coastal shipping programme" initiated by DNV GL. Both the authorities and the industry have signed a collaboration

The NOx fund´s verified NOx reductions 2008-2016 (Tonnes)



Source: The Business Sector´s NOx Fund

declaration with the purpose of helping realize projects to ensure more environmentally friendly coastal traffic. The Government will remain a partner in the "Green coastal shipping programme".

The business community's NOx fund is another important scheme to reduce emissions from industries such as shipping. The NOx environmental agreement on reduction of NOx emissions is signed between 15 business organizations and the Government represented by the Ministry of Climate and Environment. The fund's main responsibility is to finance specific NOx reducing measures. Businesses associated with the NOx fund are exempt from NOx tax. The NOx fund has accumulated emission reducing measures of a total of about 31,000 tonnes of NOx since the NOx agreement was signed in 2008. However, total taxable NOx emissions (including emissions exempt through the environmental agreement) have not declined significantly during the same period. There are ongoing negotiations between the Ministry of Climate and Environment and business organizations for a new NOx agreement effective after 2017. 941 businesses had joined the Environmental Agreement by the end of 2016. The total payment was NOK 5,809 million for the period 2008–2016. NOK 624 million of these were made in 2016. The fund has helped Norway comply with the Gothenburg Protocol's NOx emission obligations and been a long-term and strategic initiative which has made Norway a world leader in the use of LNG in shipping.

Together, the petroleum and shipping industries represent a total of 89 per cent of the fund's revenues. All the fund's revenues are returned to NOx reducing measures.

Measures implemented in shipping have the greatest overall effect on the emissions (about 60 per cent). The NOx fund has helped renew the offshore fleet, local shipping, and fishing industry through supporting measures. The Government will conclude negotiations with the business organizations for a new NOx agreement to be effective after 2017.

The Storting has asked the Government to initiate a process with affected business organizations for the establishment of an environmental agreement with an associated CO2 fund. The Storting assumes that the fund is secured revenue through an escalation of the carbon tax for affected industries, and that the funding is in place by 2020. The Storting has set the target for a carbon fund to help cut greenhouse emissions by 2 million tonnes of CO2 equivalents annually by 2030. The Government will return to the process, alignment and possible timeframe for establishing such

The building loan guarantee

GIEK offers guarantees for building loans in connection with building or reconstructing ships, vessels, and offshore installations through the guarantee scheme for building loans to ships, vessels and offshore installations (the building loan guarantee). The purpose of this guarantee scheme is to make sure that Norwegian shipyards, offshore workshops and other relevant businesses obtain building loans through risk protection for private banks, and thus help secure increased activity. The scheme will help make Norwegian shipyards more competitive by providing easier access to funding and increase the capacity of the Norwegian financial market. The scheme has seen increased demand in the past year. A fundamental cause of growth is that banks are now less willing to take maximum exposure on Norwegian shipyards. The

Danish seine fishing of cod. Photo: Jon Are Jacobsen/Nofima

Government is committed to a well-functioning guarantee scheme in order to strengthen shipyards' competitiveness, and will pay close attention to the development in the shipyard industry and the demand for building loan guarantees, and constantly consider whether it would be appropriate to increase the scope of the building loan guarantee.

4.7 Sustainable growth and value creation in the seafood industry

Increased global demand for food may in part be covered through increased production of seafood. A production environment that provides safe and healthy seafood must form the basis for further sustainable development in the fishing and aquaculture industries. The Government's expert committee for green competitiveness also underlined that marine industries have considerable potential for growth, and that the potential must be developed through sustainable growth where management, industry and technology are developed on biological terms.

Fisheries

It is a goal to manage wild marine resources so as to achieve the highest possible long-term yield. This forms the basis of employment, value creation, and export revenue. The Marine Resources Act regulates harvesting and other utilization of marine resources. The Participation Act regulates licences and conditions for commercial fishing. These acts help public administration regulate and control utilization of our marine resources and participation in fisheries. The Government continues to develop harvesting regulations that will contribute to a stable, high long-term yield from fisheries, within a sustainable framework in order to contribute to employment, value creation, and settlement along the coast.

The Government will also help develop more selective fisheries and fishing tools with lower energy consumption, better operational safety and a smaller carbon footprint. Our goal is to develop tools, catch methods and energy solutions that are as gentle on the environment as possible.

Centre for Research-based Innovation in Sustainable fish capture and Processing technology (CRISP).

Together with several partners and with partial funding from the Research Council of Norway, the Institute of Marine Research has established a centre for research-driven innovation (SFI), which is to develop smarter technology to meet future challenges for a sustainable and financially viable fishing industry. Trawling and seining are among our most important catching technologies. They can, however, present challenges in the form of unwanted bycatch and affect bottom organisms and habitats. The purpose of CRISP is to develop a form of collaboration where researchers, fishers and manufacturers of catching equipment and electronic instruments can work together in order to find better solutions to these challenges.

Optimal utilization of fish stocks

The potential harvest of the most commercially important stocks in the ocean is nearly fully utilized. However, stocks have traditionally been managed at a single-stock level, despite being harvested at various trophic levels, and despite of the many challenging biological relationships in the ecosystems. The exception is management of capelin and cod in the Barents Sea, where cod's feeding pressure on capelin is taken into account when determining capelin quotas. The Government will develop the management of fisheries in order to be able to treat the stocks as part of a larger context, that is, a higher degree of multiple stock management which in turn can contribute to increased value creation. Stock management must also safeguard access to food for other parts of the ecosystem, such as seabird populations. The Government will strengthen the knowledge base for implementing new monitoring technology for harvestable stocks.

There is financial, ethical and environmental gain in better utilization of marine resources. According to the Sintef report on leftover marine raw materials (2015), there were 890,000 tonnes of leftover raw materials from a raw materials base of 3.44 million tonnes of fish and shellfish in 2015. About 76 per cent is utilized and used as ingredients in feed and products for human consumption (seafood products, fish oil, extracts).[33] The Government will develop a strategy for use of leftover raw materials from the seafood industry where the overall goal is increased value creation. Relevant means and measures for reaching this goal will be presented in the strategy scheduled to be presented in the spring of 2017.

Smaller and more coastal stocks harvested commercially are not regulated by quotas. The Government will make sure that these stocks are managed so that the reproduction potential of the stocks is optimally utilized. There is probably a potential for commercial harvesting of species at lower trophic levels in the food chain, or other species which are currently little utilized, such as copepods and mesopelagic fish species, that is, species living in open waters at depths of between 200 and 1000 metres. Several mesopelagic species can have potential as feed for farmed fish or as foodstuffs. The Government will facilitate increased commercial utilization of wild living marine resources, including the evaluation of harvesting potential, and possibly facilitate commercial fishing of copepods and mesopelagic fishing. The Government will consider a licencing scheme for commercial utilization of mesopelagic species.

Harvesting of kelp for the production of alginate in Norway is an industry with an annual revenue of just under NOK 1 billion.[34] The management of seaweed and kelp resources lies with the Ministry of Trade and Industry and Fisheries, with the Norwegian Directorate of Fisheries as the executive body. In 1995 a "Regulation on harvesting of kelp and seaweed" was made. Then, in 2000, a "Management plan for kelp and seaweed" was presented. This serves as advice to the Ministry on management of kelp resources. The Norwegian Directorate of Fisheries determines regulations for harvesting at county level. The purpose of the regulations is to ensure prudent and long-term utilization of kelp and seaweed as part of comprehensive management of coastal resources and the natural environment. Kelp beds have a key function for many coastal species of fish, marine mammals and seabirds, which requires a firm knowledge base, and for the resources to be seen in context, before it may be opened for harvesting in new areas.

33) SINTEF (2015), "Analyse av marint restråstoff".

34) SINTEF (2014) "Norsk marin ingrediensindustri".

Hydrolysis trawler Molnes. Photo: Nordic Wildfish

100 per cent resource utilization with a hydrolysis factory on board

Norwegian waters are rich in resources, and our management is based on sustainability. However, the utilization of the resources for seafood production has not always been sustainable. On board trawler Molnes, Nordic Wildfish utilizes the entire fish. By use of hydrolysis, a process that splits leftover raw materials into marine proteins, fish oils and calcium, trimmings from the floating factory are transformed into feed and human food. With this type of technology, what used to be considered waste, could have more high-value applications in the future, for example in medicine and cosmetics.

Molnes, originally built at Brattvåg shipyard in 1998 and registered in New Zealand as "Aorere", was acquired by Nordic Wildfish in 2013. After extensive reconstruction at Vard Søviknes with support from the environmental technology scheme of Innovation Norway, the ocean-going vessel was ready for fishing in March 2016. The leftover raw material from the slaughter line on board freezer trawlers have traditionally represented about 40 per cent of the fish weight. Through quality improvement of the products, and a higher degree of utilization, it will now be possible to achieve higher value creation per kilo produced.

The quota system and the seafood industry

In the past 30 years, there has been a development from virtually open fisheries to a thoroughly regulated fishing industry. The quota system has been developed in parallel with the development in the fisheries. Technological development and an increasingly catch effective fishing fleet have made it necessary to close access to several fisheries and implement various efficiency schemes in order to adapt the fishing fleet to available resources. The Government therefore appointed a public committee to discuss how the quota system for the fishing fleet should be aligned in the future. The committee submitted its report in December 2016, and it may be relevant to propose how a provident quota system in fisheries should be structured, based on the report and contributions from public consultation.

White Paper 10 (2015–2016), "A Competitive Seafood Industry", expressed an intention to simplify and improve the system for firsthand trading of fish, which currently has to go through fish sales organizations and is regulated in the Act concerning firsthand trading of wild living marine resources (the Fish Sales Organization Act). An expert group appointed by the Ministry of Trade, Industry and Fisheries has submitted a report with proposals for the parties in first hand trading. These proposals are to involve simplifications and improvements of the firsthand fish-trading market mechanism, within the scope of the current fish sales organization act.

The Ministry of Trade, Industry and Fisheries is authorized to impose the fish sales organization to supervise the quality of the landed catch. A trial scheme was started for the three northernmost counties in 2015.

Photo: Johan Wildhagen/Norwegian Seafood Council

The scheme will be evaluated by Nofima in 2017 before it is decided whether the scheme is to be made permanent, and whether it is to apply to the entire country. This comes in addition to the Norwegian Food Safety Authority, which is responsible for supervising food safety and other considerations in accordance with the Food Act. Individual businesses are responsible for following food safety requirements.

Aquaculture

The Government will facilitate predictable growth in the fish farming industry. There is great demand for aquaculture permits for salmon and trout. The authorities therefore have a goal of controlled growth in the industry out of, among other factors, consideration for the environment. An important question is how Norway can increase value creation based on predictable, sustainable growth and better environmental adaptation in the aquaculture industry. When evaluating growth in the aquaculture industry, consideration of the environment will be what determines the scope of production allowed in various coastal areas in the future, cf. White Paper 16 (2014–2015) "Predictable and Environmentally Sustainable Growth in Norwegian Salmon and Trout Farming". In the report the foundation is laid for a new management system for further growth in Norwegian salmon and trout farming, and the Government will implement the new growth system. Elements in this system are that the coast is divided into production areas, and that the adjustment of production capacity in these areas is rule-based on environmental indicators (this time salmon lice a s an indicator). The principle is that growth should be allowed where the environmental footprint is acceptable. The Government decided on the new system on 17 January 2017, and the plan is that the first assessment of capacity adjustment will be made in the autumn of 2017. The Government is committed to achieve a growth in the fish farming industry that follows nature's lead. This is the only way we can maintain a future-oriented industry. This means that the impact of farming on wild salmon must be kept within acceptable limits. The Ministry emphasizes this both when working with the industry and towards the research communities.

Efforts against escape, salmon lice and other disease-related challenges in the industry must be strengthened through binding agreements with the industry itself. A letter of intent has therefore been signed with the organizations of the seafood industry, where they assume the obligation to, among other things, finance removal of escaped farmed fish. Municipalities that make areas available for the industry, should experience greater positive effects of the activity. In order to reward municipalities that make areas available to the industry, the Government has established an aquaculture fund where large portions of the compensation for awarding new licences, are accrued to affected municipalities.

Aquaculture can appear a complex industry to manage, with the need for several technical considerations and with several conflicting interests. However, it can still be possible to streamline the administrative process further. For example, in connection with Government work on the regional reform, there are ongoing efforts to evaluate how this process can be made more efficient. It is important that the administrative process for aquaculture is efficient and consolidated, and the Government will implement measures where needed.

Offshore aquaculture. Illustration: Ocean Farming

Aquaculture technology and offshore aquaculture

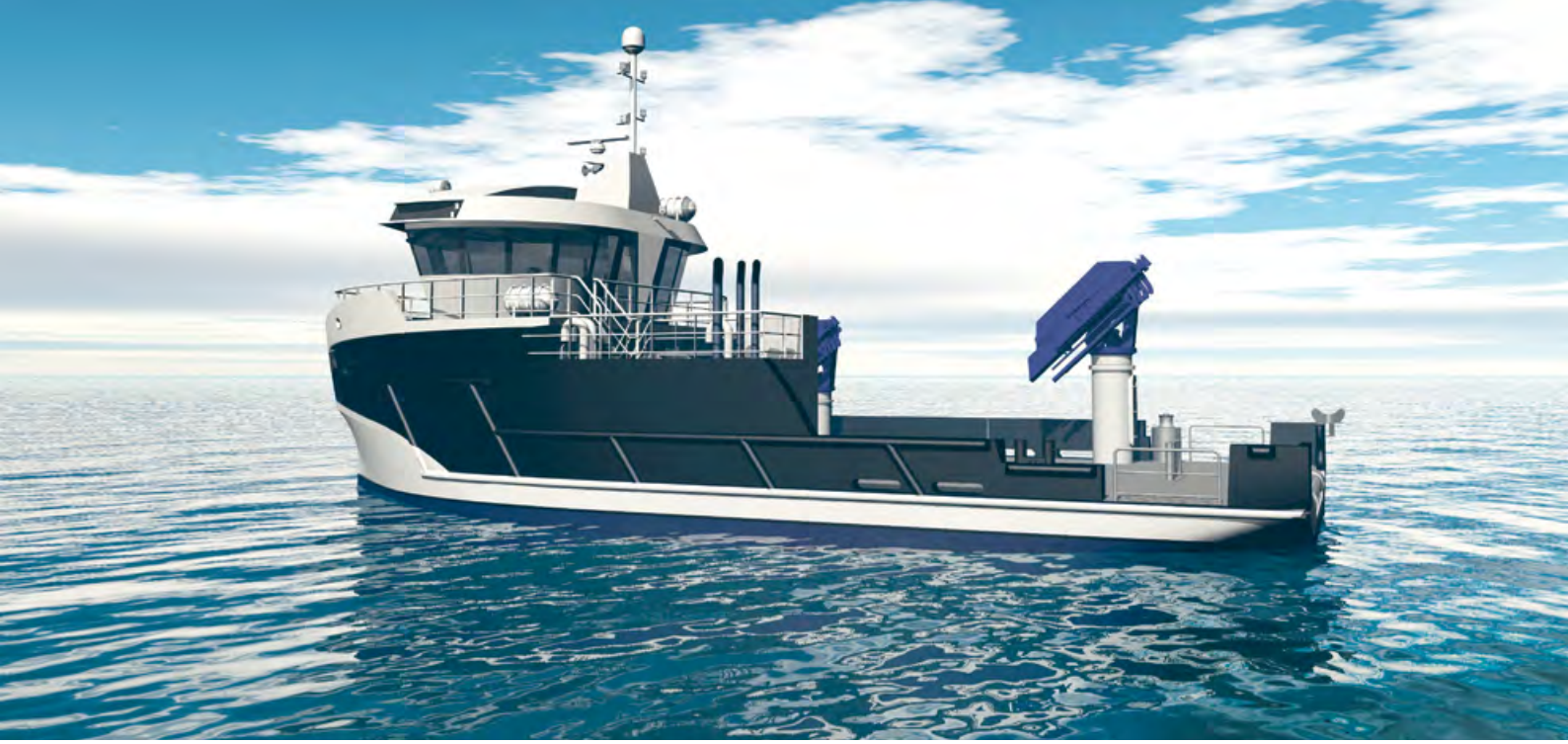
Technological development in the aquaculture industry is rapid. Development is fuelled both by research communities and the industry's need to solve environmental challenges such as escaping and salmon lice. The authorities have also used the licencing system to stimulate technological development; both through the licencing round in 2013 with "green licences" and through the development permit scheme that was in place in 2015. The latter may lead to considerable innovation in the aquaculture industry with things like development of facilities for fish farming in more exposed waters and open sea. Placing fish farms further offshore will make considerably larger areas for such production available. On the other hand, this may lead to other challenges associated with, for example, operations, fish welfare, and logistics.

Offshore aquaculture

In February 2016, the first development licences for an ocean based fish farming installation in history was awarded to Ocean Farming, a subsidiary of SalMar. The semisubmersible ocean net pen is designed using the same template as a floating rig, and it uses technology and experience from the offshore industry. The ocean net pen can be moved out into more open ocean areas in order to avoid problems associated with farming in the coastal area. The ocean net pen is scheduled for completion in the second half of 2017, and it will have a diameter of 110 metres and a height of 68 metres. It will be located in Frohavet/Trøndelag.

In order to facilitate the best possible development of the future aquaculture industry, while protecting safety, working conditions and the outer environment responsibly, it is important to review the existing regulations. Technological development in this field is so fast that prescriptive legislation can easily hamper development of new solutions. Accurate, but flexible, legislation must therefore be established, while avoiding oversizing and unnecessary costs.

The Government's development licencing scheme provides risk reduction for projects that involve considerable innovation and investments, and that have already helped realize concepts in ocean farming. The new fish farming installations in exposed waters will probably require higher investments than ordinary fish farming facilities closer to the shore. It could be a challenge that the construction itself cannot be registered in an asset register according to current legislation. The Government will evaluate the framework and legislation for aquaculture further offshore more thoroughly, so that the legislation does not hamper development and innovation in the industry.



Kelp farming vessel. Illustration: Møre Maritime

Cultivation of macroalgae

During the past three-four years, there has been great interest in aquaculture of macroalgae (seaweed and kelp), and several research communities consider the Norwegian coast to have a large commercial potential for kelp farming. The potential for growth in cultivation of macroalgae is considered significant, with applications such as food, feed, nutrients, chemicals, and energy. Unlike most aquacultural applications, where the county government coordinates and processes the applications, the Ministry of Trade, Industry and Fisheries is assigned this role here. Since 2014, the Ministry has granted such licences to about 25 different companies at about 35 locations. There is a need to increase knowledge of this type of aquaculture with regard to technology development, biology, environmental impact, food safety, and market. The Government will develop regulations and management regime for the cultivation and utilization of macroalgae further.

Technology for kelp farming

Sharing knowledge and collaboration across sectors is important in order to develop the equipment necessary to succeed with industrial kelp farming in Norway. In 2017, Møre Maritime AS, in collaboration with technology companies in fisheries, aquaculture, farming, and the offshore industry, starts working on developing vessels, technology and equipment for handling production, harvesting and storage of kelp at an industrial scale. The goal is to establish the world's first pure vessel concept for industrial kelp farming.

In the project "Development of a concept vessel with deck fittings and quality conserving technology for industrial kelp farming", Møre Maritime AS is working with the companies MacGregor Norway AS, Mustad Autoline AS, Orkel AS, Stranda Prolog SA, Abyss Aqua AS, and Polyform AS They are joined by research partners SINTEF Ocean and NTNU. The project is supported by the Research Council of Norway's ocean technology initiative.

Dolwin Beta at port in Haugesund. Photo: Øyvind Sætre/Aibel

4.8 Other emerging ocean industries

Offshore wind

The offshore renewable industry is associated with offshore wind, where there is potential for Norwegian companies to take more market shares for example through utilizing technology and competence from the petroleum industry.

The world's largest transformer installation for wind energy

Aibel has developed a new platform concept for utilizing offshore wind. The concept is based on proven technology, and it is a good example of how Aibel uses its competence and long experience from the oil and gas sector to create new solutions and step into the market for renewable energy.

Dolwin Beta is Aibel's first platform for renewable offshore energy. It is to service a large wind park cluster in the German sector of the North Sea. The platform hosts a transformer station: It receives alternating current (AC) from offshore wind parks and converts it to direct current (DC), which is sent ashore in underwater cables. The platform has a "self-installing" gravity-based jacket.

The Offshore Energy Act of 2010 states that renewable offshore energy production outside the sea boundary can as a general rule only take place when the authorities have opened specific geographic areas for licence applications. 15 areas in Norway are identified as areas suitable for offshore wind energy production. These represent a potential of between 18 and 44 TWh inn annual energy production. The fifteen areas have been reviewed in a strategic impact assessment, which was completed in 2012. Here the areas were rated, and five areas were nominated to be opened first. The Government intends to clarify which areas would be relevant to open for offshore wind licence applications.

Demonstration projects in Norwegian port areas will open up for Norwegian players to gain experience and contribute to innovation and development in offshore wind energy. Demonstration projects in Norway can apply for Enova support. The Offshore Energy Act allows licences to be granted to smaller demonstration projects for offshore wind energy or wind energy linked to offshore petroleum installations without areas being opened beforehand.

The extension of the tonnage tax regime to include windmill vessels was adopted in connection with the 2017 national budget, cf. Prop. 1 LS (2016– 2017). Previously, such vessels have only qualified for the tonnage tax scheme if they were considered to conducting transport operations. Small differences could determine whether such operations would be considered to fall outside or inside the scheme. The proposal therefore involves that the demarcation between such vessels inside and outside the scope of the tonnage tax scheme, is clarified. There is currently an ongoing notification process with the EFTA Surveillance Agency (ESA). The Government is working for the change to be effective within 2017.

Tone Aspevik tests enzymes that splice salmon proteins. Photo: Øyvind Ganesh Eknes/Nofima

Marine bioprospecting

The Nature Diversity and Marine Resources Acts allow regulation of outtakes for bioprospecting.[35]) It is important to enable research communities and the business community to take biological material from Norwegian nature in connection with bioprospecting, while making sure that this happens within sustainable limits and safeguarding the interests of the community. The Government will prepare a bioprospecting regulation that enables research communities and the business community to take biological material from Norwegian nature within sustainable limits while the interests of the community are safeguarded.

International maritime law discussions currently focus on the utilization of marine genetic resources. There are ongoing efforts in the UN to develop a new international regulatory framework for such utilization outside national jurisdiction. The work with the Norwegian national regulatory framework for utilization of such resources has come relatively far compared to other countries. Norway's national collection of genetic material and associated data (MARBANK in Tromsø) is far ahead in its activities, and is therefore the subject of international interest.

Mineral extraction on the seabed

Better mapping and development of new technology may make utilization of new seabed mineral deposits financially profitable. Possible commercial extraction of minerals on the Norwegian shelf is probably a thing of the distant future, however, mineral exploration may happen earlier. According to maritime law, Norway as a coastal state has the right to explore and extract natural resources on the continental shelf. The right to natural resources on the continental shelf lies with national authorities, and national authorities must grant permission if anyone wishes to explore or extract minerals.

The current regulations in exploration and extraction of other mineral resources on the Norwegian continental shelf is incomplete and not adapted to the current situation and future needs. It is therefore necessary to develop a more modern and complete regulatory framework.

The regulatory framework needs to safeguard various social considerations. Important social considerations are, among other things, ensuring good collaboration with Norwegian industries in Norwegian ocean areas. Increased knowledge of the consequences for the environment and for seafood production will be a central part of the exploration work before extraction may or may not begin.

The Government will facilitate extraction of mineral deposits, and in this context, it will prepare a proposal for new regulations for mineral activities on the Norwegian continental shelf. The proposal for new regulations for mineral activities on the Norwegian continental shelf is scheduled to be submitted for consultation in spring 2017.

35) Utilization of genes and biomolecules in organisms.

Photo: The Norwegian Maritime Authority

4.9 Comparative analysis of regulations for the ocean industries

The ocean industries are fundamentally different, and thus have different legal frameworks. Unlike maritime regulations, regulation of oil and gas operations has largely been based on framework requirements. And as previously demonstrated, new aquaculture constructions challenge the existing regulations.

The Government will conduct a comparative analysis of the legal framework conditions for the ocean industries in Norway. The purpose of such an analysis will be to better facilitate good frameworks that can contribute to further growth and development in the ocean industries, and to map the potential for simplifications. The analysis is to identify similarities and differences in frameworks and discuss them. This would give the authorities managing each industry important insights into how the other industries are managed, as well as ideas for making conditions more favourable for the industry for which they are responsible. It may also provide a basis for evaluating the regulatory framework for the ocean industries as a whole. A comparative analysis would reveal whether there are holes in the regulations, and whether there are differences that do not need to be there and hamper development. The purpose is not to give all industries the same framework – the differences are too great for that. However, there is a potential for removing unnecessary differences in the government created framework conditions. One must strive to secure technologically neutral regulations that help promote technological development.

4.10 Arenas and meeting points for dialogue

In this chapter, we have seen that the ocean industries work under many of the same assumptions, while facing different challenges and opportunities. The Government sees great value in good meeting places among the ocean industries, and also with other industries in order to discuss common challenges, but also various approaches to different and common challenges.

In the follow-up to the strategy, the Government will create an arena where the business community, administration, research and authorities can discuss common ocean related issues and solutions across the ocean industries. The goal will be to develop a natural common forum for discussing the issues that appear in the efforts to secure Norway's position as a world leading ocean economy.

The Government will:

- prepare good instructions and map utilities for coastal area planning, and facilitate active planning in counties and municipalities along the coast.
- prepare better tools for planning authorities to use for placement of aquaculture businesses, etc. in the coastal areas, including better current models and knowledge of the spread of infection and environmental effects.
- facilitate more maritime transport of cargo, and in 2017 a temporary, three-year pilot scheme will be established, with grants for transferring cargo from road to sea.
- facilitate the development of ecom infrastructure, cf. the Ecom Plan in White Paper 27 (2015–2016) .
- facilitate the use of new technology in monitoring and data collection associated with management of our ocean areas where practical.
- present a separate space strategy in 2017.
- conduct a concept study in order to assess the need and possibility for a satellite-based communications system in the Northern areas.
- discuss capital markets in Norway in the White Paper on Industry, and follow up on the Storting's request to perform an overall assessment of the access to venture capital in Norway, both public and private.
- pursue a high level of safety in Norwegian petroleum operations.
- facilitate development and implementation of intelligent transport systems in order to strengthen maritime safety.
- make sure that Norway continues to be at the forefront with regard to preparedness for emergency search and rescue in our ocean areas.
- accelerate construction of new, coastguard vessels that carry helicopters.
- develop the digital area tool for ocean areas further.
- present a proposal for a regulation that will liberalize the current classification regime for collecting and using detailed depth data.
- continue to facilitate more diversity in the petroleum sector, and continue to offer prequalification to ensure competition is also strengthened in years to come.
- maintain a high and predictable pace in allocating areas for petroleum activities in order to help maintain exploration and production on the Norwegian shelf.
- continue efforts that will influence more countries to ratify the change to the London Protocol.
- facilitate technology development and the use of automation in vessels.
- remain a partner in the "Green coastal shipping programme".

- conclude negotiations with the business organizations for a new NOx agreement to be effective after 2017.
- pay close attention to developments in the shipyard industry and the demand for building loan guarantees, and constantly consider whether it would be appropriate to increase the scope of the building loan guarantee.
- help develop more selective fisheries and fishing tools with lower energy consumption, better operational safety and a smaller carbon footprint.
- develop the management of fisheries so that one sees several stocks in context.
- strengthen the knowledge base for implementing new monitoring technology for harvestable stocks.
- develop a strategy for the use of leftover raw materials from the seafood industry.
- evaluate harvesting potential, and possibly facilitate commercial fishing of copepods and mesopelagic fishing, and consider a licencing scheme for mesopelagic fishing.
- implement the new growth system in aquaculture.
- evaluate the framework and legislation for aquaculture further offshore more thoroughly, so that the legislation does not hamper development and innovation in the industry.
- develop regulations and management regime for the cultivation and utilization of macroalgae further.
- aim to clarify which areas would be relevant to open for offshore wind licence applications.
- work towards the extension of the tonnage tax regime to include vessels conducting business in the form of mounting, repair, maintenance, and dismantling of offshore wind turbines to be effective for 2017.
- prepare a bioprospecting regulation that enables research communities and the business community to take biological material from Norwegian nature within sustainable limits while the interests of the community are safeguarded.
- prepare a proposal for new regulations for mineral activities on the Norwegian continental shelf.
- conduct a comparative analysis of legal frameworks for the ocean industries in Norway.
- create an arena where the business community, administration, research and authorities can discuss common ocean related issues and solutions across the ocean industries.

5

Knowledge and Competence

> The Government will facilitate development of knowledge and technology in the ocean industries through research and innovation, and education and competence.

Development of knowledge and technology is vital to releasing potential for value creation in the ocean industries, and to ensure sustainable growth.

The Government facilitates this through allocations to research and innovation, and through the education and competence system. The Government already has a considerable focus on the ocean industries, and the ocean is one of the focus areas in the Government White Paper 7 (2014–2015) "Long-term plan for research and higher education 2015–2024".

In order to achieve the goals of the Government's Ocean Strategy successfully, the Government will continue to strengthen the efforts through its research, innovation, and education policies. Emphasis will be on developing knowledge and competence through increased collaboration across industries, various disciplines, and across borders.

In order to attain the goal of The Ocean Strategy, the Government will do the following with regard to knowledge and competence.

- strengthen the basic knowledge of the ocean,
- further and strengthen the development and knowledge in current ocean industries,
- strengthen collaboration across industries and academic environments,
- facilitate new industries,
- strengthen international collaboration,
- ensure a good and relevant education system which helps cover the ocean industries' need for competence, as well as
- promote good recruitment for marine and maritime research, education and professions.

5.1 Fundamental knowledge of the ocean

Norwegian marine and maritime research covers coastal, fjord, and ocean environments from temperate waters in the south to glacial areas in polar regions in the north. There are great variations in the ecosystems, and knowledge of these is vital for releasing the potential for value creation in the ocean industries, and to ensure sustainable growth. Pure and rich ocean and coastal areas are necessary for safe and healthy food production.

Technological and knowledge development allow new business opportunities, and the commercial interests associated with using the ocean, are growing. At the same time, ocean environments are threatened by climate change, pollution and littering. Therefore, increased knowledge of various relationships in the ocean, biodiversity, and the function and resilience of the ecosystems, is a necessary foundation for future value creation and sustainable growth.

Marine ecosystems

Increased business activity in the ocean increases the need for more knowledge of how various industries affect each other, and the total effect on the ecosystems. Despite considerable knowledge in marine ecosystem research and management, there is still a lot we do not know about our ocean areas. The Government will therefore strengthen the knowledge regarding marine ecosystems, and changes in these as a result of human activities, climate change and pollution.

> Increased knowledge of the oceans is a necessary foundation for future value creation and sustainable growth.

Increased knowledge of ecosystems along the coast and the environmental effects of aquaculture, is necessary for further growth in the aquaculture industry. The Government will therefore strengthen knowledge of the ecosystems in coastal areas in order to facilitate aquaculture operations, farming of shells, seaweed and kelp, as well as new species, and to ensure a good foundation for long-term management.

Monitoring and data collection

Data collection and monitoring are necessary in ordernto strengthen the knowledge of ecosystems, for managing the ocean, and to facilitate sustainable growth.

Norway has a long tradition of marine and maritime research, and this has given Norway valuable data sets on the development in ocean areas. Through the seabed mapping programme MAREANO, bathymetry and data on the geology, sediments, biodiversity, biotopes, and pollution of the seabed are collected. The International Council for the Exploration of the Sea, ICES, points out that MAREANO is probably the largest and most extensive seabed mapping programme of its kind in the world.

There are many important marine data series among various research groups in Norway, but a good system for efficient exchange of marine data is lacking. Several institutes have joined forces to establish the Norwegian Marine Data Centre (NMD) at the Institute of Marine Research. Through this centre, a system is being developed for storing collected research data on the ocean in a common format to facilitate the exchange of data series between research institutions. Both historical data and new data are to be located on a common platform. The goal is better utilization of budgets as well as higher quality marine research.

Similarly, there are great gains to be made by better facilitation of data collected by private industry, and across borders, to be shared more easily between research communities, authorities, and the business sector. Therefore, Norway also participates in international collaboration on data collection and monitoring in order to make marine data more available to various user groups. Norway is working with other countries on data sharing through initiatives such as the European Marine Observation and Data Network (EMODNET), and now also the European Ocean Observing System (EOOS). The EOOS is a coordination platform designed to allow the total European ocean data to be seen more in context, while developing a common approach to data collection in order to be able to compare data collected by various countries more easily.

Knowledge of petroleum resources on the Norwegian shelf is vital to good resource management, and the Norwegian Petroleum Directorate has collecting geological information on the shelf as one of its core responsibilities. Only national authorities can conduct geological surveys in areas not opened for petroleum operations. In later years, the Norwegian Petroleum Directorate has had a particular focus on collecting geological data in northern ocean regions. There are still large areas of the Norwegian shelf where geology is not sufficiently surveyed. The Government will strengthen geological surveying, both mapping of petroleum resources and mineral deposits.

New technology changes marine and maritime research through new opportunities for increased access to data and more cost-effective collection methods. Satellite data is used operationally when monitoring sea-ice conditions, oil spills and maritime traffic. Improved metering technology and better access to high resolution ocean and environmental

K-lander. Photo: Kongsberg Gruppen.

data open new opportunities for monitoring ocean conditions. Digitization allows faster data transfer and data interpretation.

The Government will streamline data collection efforts through, among other things, use of new technology and national and international collaboration. Collected data will be made available to users faster

Ocean space observatory

Kongsberg Maritime has developed an ocean space observatory which can be placed on the seabed and equipped with a number of sensors for both research purposes and commercial operations. The "K-Lander" can operate, collect, and send data continuously over longer periods. The observatory has its own digital processing unit where data from various sensors can be processed, and the data are sent to the ocean surface using advanced acoustic technology through submarine cable. The K-Lander can be equipped with customized sensors which are supplied either by Kongsberg Maritime or by third party applications.

Within a short time, several clients, both in Norway and abroad, have started using the K-Lander. Centre for Arctic Gas Hydrate, Environment and Climate (CAGE) at the University of Tromsø is one of the K-Lander users. CAGE uses two ocean space observatories outside Svalbard to study natural emissions of greenhouse gases from the seabed.

Knowing the environmental status of the ocean

In many areas, the environmental situation in Norwegian ocean areas is currently good. However, we see several challenges that will have to be dealt with in the future. Pollutants may harm ecosystems, seafood production, and other biological products from the ocean. Increased presence of pollutants in the ocean also entails a risk that leftover raw materials from the seafood industry cannot be used or recycled for new, profitable products. The Government will therefore continue efforts to monitor the environmental situation in the oceans and consequences for, among other things, fish health and food safety. The Government will also prioritize increased knowledge of undesirable substances and nutrients in new species. Increased knowledge in these areas may strengthen new and alternative use of marine bioresources.

Marine waste, especially related to marine plastic littering, is a persistent and growing problem. Another example is the consequences of dumped munitions. This constitutes a risk both for the environment and maritime traffic.

In order to secure the environmental situation of the oceans, we must acquire more knowledge of the effects of pollution and littering on marine life and seafood, and we must ensure commercial activities do not add waste or pollutants to the oceans, and strive to stop the littering of the oceans. This is a considerable challenge that calls for international solutions. The Government will participate in international research collaboration to reduce ocean pollution, for example by striving to reduce amounts of plastic, and by increasing knowledge of consequences of dumped munitions.

"Kronprins Haakon" Photo: Øystein Mikelborg/Norwegian Polar Institute

The Government will continue planning an oil spill response and environmental centre in Lofoten/ Vesterålen. In 2015, the Ministry of Transport and Communications opened a temporary secretariat located at the Norwegian Coastal Administration in Kabelvåg. The Secretariat evaluates the concept of the centre, with proposals for location and responsibilities, organising and funding. The investigation is based on the purpose of the centre being the promotion of knowledge, technology, and methods for oil spill prevention and response, and the efforts against marine plastic littering and for a cleaner ocean environment. In the final budget for 2017, NOK 17 million has been granted for further planning of the centre.

Infrastructure and collaboration between specialist institutions

Research infrastructure is a very important part of the goal of having leading knowledge environments and a leading business community in ocean-related fields. At the same time, research infrastructure is a prerequisite for efficient technology development from research to commercialization. Research vessels and research infrastructure in the ocean are also an important part of ocean research both for data collection and for testing new equipment, etc. in natural environments.

The Nansen LEGACY

In the 2017 budget, the collaboration project "The Nansen LEGACY " is supported. The goal of the project is to create a more overall understanding of a changing arctic eco- and climate system.

In the project, the universities of Tromsø, Trondheim, Bergen, and Oslo, the University Centre of Svalbard, the Institute of Maritine Research, the Norwegian Polar Institute, and the Norwegian Meteorological Institute have joined forces to contribute to increased scientific understanding of the marine bio- and geosphere in central and northern parts of the Barents Sea. These are areas where we have previously not conducted this type of surveying, and the Nansen LEGACY will – through basic science – ensure:

- that Norway assumes responsibility and leadership for research and management in the Arctic,
- increased accuracy in meteorological forecasts and forecasts of ice conditions, waves and atmospheric icing, for safe navigation and operation in northern areas, and
- national collaboration and better utilization of knowledge, educational and research resources
- communication to the public and recruitment of a new generation of polar researchers.

Although an increasing proportion of marine data collection takes place using new methods and ordinary vessels, customized research vessels will still represent a considerable share of data collection also in the future. The new icebreaker research vessel "Kronprins Haakon" is to be completed in the autumn of 2017. With its scientific equipment, "Kronprins Haakon" will be one of the world's most advanced research vessels, and an efficient base in and of itself for research in polar areas, while at the same time acting as a platform for extensive use of modern autonomous systems (AUV, drones, etc.). The vessel makes it possible to do research and monitoring in both open and, at times, icy waters in a safe, environmentally friendly and predictable manner, and it also enables research and monitoring in perennially ice-covered areas in the Arctic and Antarctic, which until now have been practically inaccessible. The Government will strengthen knowledge of the role of marine ecosystems in global climate development through funding of the projects "The Nansen LEGACY" and "Kronprins Haakon". In the 2017 national budget, funds are also allocated for the procurement of a new, coastal research vessel. The Institute of Marine Research will own and operate the vessel, which will be suited for marine geological surveys, and which may be used by several users.

A strengthened knowledge base requires collaboration across institutions and academic environments. In order to improve interaction between strong marine research communities, a possible collocation of marine research institutions in Bergen is being considered. The Government has therefore initiated a concept study (KVU), submitted before Christmas 2016, and an external quality control (KS1) of this study. The Government will follow up on the external quality control (KS1) of the concept study for the collocation of marine research environments in Bergen.

Ocean Space Centre

The Ocean Space Centre in Trondheim is to be a knowledge centre for marine technology. The maritime technology centre at Tyholt has contributed to placing Norwegian industry at the forefront in ships, shipping, offshore oil and gas, fisheries and aquaculture. The Ocean Space Centre is to continue the legacy of the Marine Technology Centre and be an international knowledge centre for ocean space technology. The centre will be important for future recruitment to the ocean industries.

The Ocean Space Centre is a priority construction project in the Government's long-term plan for research and higher education. The Government will strive to find a solution for the Ocean Space Centre which meets the current and future needs of the business community, research, and education in the best possible way. A KVU has been conducted for the project, which was submitted in January 2017. It is now undergoing quality control (KS1). KS1 is scheduled to be available by the end of April. The quality control will then be processed, and the next step will be KS2. A proposal can then be submitted to the Storting.

Salmon fry. Photo: Johan Wildhagen/Norwegian Seafood Council

5.2 Knowledge and technology development in current ocean industries

The Government's goal of increased value creation in the ocean industries will necessitate that industries continue to develop and utilize knowledge that promotes innovation and facilitates necessary adaptations.

More research and innovation for value creation

The ability to develop and use new knowledge is among the most important competitive factors for Norwegian business and industry. The Government has therefore conducted a considerable strengthening of instruments for research and innovation for businesses. This will also benefit the ocean industries. Business related research and innovation, are supported through the instruments of Innovation Norway and the Research Council of Norway.

The instruments of Innovation Norway are mainly general and open for all industries. The intention is for the best projects to be supported regardless of geography or industry.

The three largest ocean industries, petroleum, maritime and the marine industry, get positive results from these schemes in Innovation Norway. Overall grants to ocean industries have increased from NOK 2,386 million in 2015 to NOK 2,935 million in 2016. This means that the ocean industries have increased their share of the overall grants in Innovation Norway from 34.6 per cent in 2015 to 47.1 per cent in 2016.

For the environmental technology scheme, total grants to the ocean industries (petroleum, maritime, and marine) amounted to NOK 216 million in 2016. This means that almost two out of every three kroner through the environmental technology scheme was allocated to these industries. In the R&D contract scheme (IFU/OFU)[36], projects in these industries receive a large portion of the support, with about half the funds. This suggests that broad instruments are relevant and work well for the ocean industries, and that Innovation Norway releases many good ocean related innovation projects.

Through the Research Council of Norway, ocean research is funded through separate programmes for the petroleum industry, the maritime industry, and the seafood industry, as well as through the general schemes.

36) Research and development contracts (R&D contracts) are grants for binding and targeted collaboration between two or more parties in the business community (IFU), or between the business community and public authorities (OFU).

Wireless battery charging. Illustration: Wärtsilä

Wireless battery charging in vessels

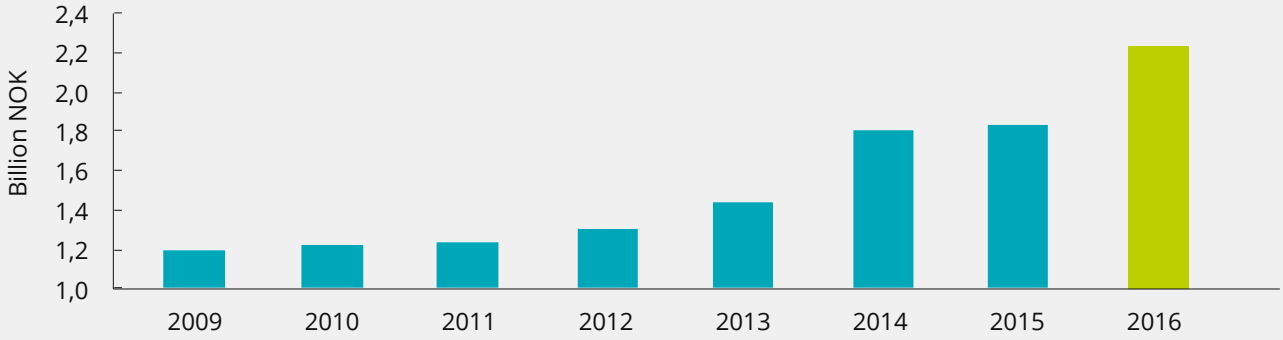
The use of battery solutions for zero-emission and plug-in-hybrid will reduce emissions from maritime transport considerably, and will be necessary in order to comply with national and international regulations, especially when used in coastal and emission sensitive areas. In order to meet the challenges and limitations of existing solutions, Wärtsilä has, with support from the Research Council of Norway's MAROFF programme and with support for piloting from Innovation Norway's environmental technology scheme, developed the necessary technology for high power battery charging on board vessels. Wärtsilä has tested a full-scale version of inductive charging, which will be installed in a commercial plug-in hybrid ferry in the spring of 2017. The project is a good example of seamless policy instruments contributing to the lowest possible technology risk and capital intensity.

The Research Council of Norway's sector-specific ocean related programmes

MAROFF is to help realize the Government's maritime strategy for promoting innovation and environmentally friendly value creation in the maritime industries. The programme shall contribute to maritime businesses and research communities developing their knowledge advantages further, and supports projects directed towards the research challenges necessary to realize the three central innovation areas: environment and environmental energy utilization, advanced transport and logistics, and demanding maritime operations.

Through knowledge and business development, PETROMAKS2 will contribute to increased value creation for society by developing Norwegian petroleum resources and utilizing them optimally within environmentally responsible limits. The programme will particularly facilitate research and technology development for increased extraction from fields in operation, exploration in immature areas, improving energy efficiency, and reducing greenhouse gas emissions as well as emissions to the ocean. The programme will help attain goals in the industry's own strategy for research and technology development; OG21 – Oil and gas in the 21st century, as well as research in order to reach priority goals for health, working environment and safety. The goal of DEMO2000 is to qualify new technology for use on the Norwegian shelf in order to improve utilization of Norwegian petroleum resources in a cost-effective and sustainable manner. New technological solutions will also strengthen the

Research funding to ocean industries through the Research Council of Norway 2013-2016



Source: The Research Council of Norway

Norwegian supply industry's international competitive power. The OG21 strategy is the governing document for prioritizing areas of technology in DEMO2000. In the programme, the supply industry works with oil companies to pilot and test new technology with the goal of preparing the technology for commercial use. DEMO2000 can fund up to 25 per cent of project costs, and a prerequisite for funding in that the project would not have been realized without this contribution.

The main goal of HAVBRUK2 is to deliver knowledge and solutions for socially, financially and environmentally sustainable growth in the Norwegian aquaculture industry. The knowledge will help secure and further develop Norway's position as the world's leading seafood nation. At the same time, the programme opens up for taking advantage of new opportunities. Among other things, it will increase research in order to develop marine production of new species lower in the food chain, strengthen the efforts in aquaculture technology, processing, and market, as well as increase the efforts to utilize the opportunities of biotechnological tools, nanotechnology, and ICT.

MARINFORSK is responsible for research associated with ocean and coastal areas. The goal is to provide a knowledge base for resource management, as well as contribute to increased marine value creation, with sustainability as the general principle. The main academic priorities of the programme are: marine ecosystems, pollution and other ecosystem impact, sustainable harvesting and value creation, processing and market.

The ocean is a priority area in research policy, and the funding of ocean-related research through the Research Council of Norway's schemes has increased from approx. NOK 1.1 billion in 2009 to NOK 1.8 billion in 2016.

In addition to the sector specific programmes, ocean research is funded through other schemes in the Norwegian Research Council. The technology programmes [37], the infrastructure programme, and the centre schemes in the Research Council of Norway are examples of schemes which are important for strengthening maritime research. The centre schemes include Norwegian Centres of Excellence (SFF), Centres for Research-based Innovation (SFI), and the Research Centres for Environmentally Friendly Energy (FME). The Research Council of Norway's funding scheme for infrastructure will contribute to giving Norwegian research communities access to relevant and updated infrastructure which supports high quality research and innovation.

Skattefunn is also an important instrument for the ocean industries. Skattefunn is a tax incentive scheme designed to stimulate research and development. All businesses and enterprises that are subject to taxation in Norway are eligible to apply for tax relief. Approved projects may receive a tax deduction of up to 20 per cent of the eligible costs related to R&D activity.

Strategies for research and technology development have been prepared in collaboration with the authorities, the industry, and research communities for all three ocean industries. The strategies provide input and guidance for the authorities' priorities in research efforts, and the authorities' follow-up of the strategies mainly takes place through the ministries' allocations to the Research Council of Norway.

37) Programmes for ICT, nanotechnology and biotechnology.

Salmon smolt. Photo: Marius Fiskum/Norwegian Seafood Council

Strategies for research and technology development

OG21 is Norway's national technology strategy for the petroleum industry. The strategy prioritises certain technology areas to help solve future challenges. The most important priorities are energy efficiency and environment; exploration and increased extraction; drilling, completion and intervention; and production, processing and transport.

Energi21 is a similar strategy for the energy field. Among the priority areas in Energi21, offshore wind power and CO2 capture are particularly relevant to ocean-based industries.

Maritim21 is the industry's proposal for a comprehensive strategy for research, development, and innovation for the maritime sector. A new Maritim21 strategy was presented to the authorities in the autumn of 2016.

The strategy recommends priority areas for research and development in the Norwegian maritime sector, as well as alignment and organizing of the research and development efforts. Among priority research areas are digitizing and enabling technologies, climate and environmentally friendly maritime activities, and offshore safety.

HAV21 is a proposal for a comprehensive research strategy for the entire biomarine field. Among the priorities are increased knowledge of marine ecosystems and focus on technology in the fisheries and aquaculture sectors making use of technology development in the maritime and offshore sectors, and which includes biotechnology, nano-material technology and information technology.

The Government will continue and strengthen industry oriented research and innovation policy, including research directed towards the ocean industries Collaboration between various instruments is necessary in order to promote cross-sectoral research and innovation, and contribute to structural adjustment. The instruments must be seen in an overall perspective, and they must be flexible with regard to joint calls for proposals or other forms of collaboration. The Government will consider possibilities to strengthen collaboration and dialogue between ocean industries with regard to dialogue and knowledge development, for example on the basis of the 21 processes.

Development and testing of technology projects

Demonstration and verification constitute a capital-intensive part of research and development for all ocean industries. In the 2017 budget, funds are allocated for new test centres for the business community. In so-called catapult centres, businesses and R&D players, also in the ocean industries, can test their ideas and solutions. In this phase technologies are tested full scale under authentic conditions, and projects in this phase therefore have a high-risk profile where risk reduction from public authorities plays a central part.

The demonstration programme for the petroleum industry, DEMO2000, has been vital for realizing several key technologies on the Norwegian shelf. In the maritime and marine sectors, funds for technology development are offered through the MAROFF and HAVBRUK programmes. There is a need for increased focus on demonstration and verification for the marine and maritime sectors. The Government will therefore prioritize further strengthening of the technology efforts in the marine and maritime fields on the model of DEMO2000.

Water injection technology. Illustration: Seabox

The Government will continue to keep petroleum research at a high level (DEMO2000 and PETROMAKS), and help transfer knowledge and competenc to other industries.

Seabox – From basic research to demonstration project

Injecting water into oil reservoirs is an important part of extraction in order to maintain pressure in the reservoir, so that oil production can be maintained. The development of a subsea water injection and processing facility, Seabox, has received funding from the Research Council of Norway through the programmes PETROMAKS and DEMO2000.

Current water injection solutions are placed on existing platforms, and installing them is often challenging and expensive due to limited space and weight capacity, as well as high costs associated with injection lines. Seabox has developed a solution that places equipment on the seabed, where sea water is processed and pumped directly into the injection well. This solution contributes to increased extraction, reduced costs, and reduced energy consumption.

Seabox is an example of cost and energy saving technology made possible through the overall composition of research programmes for the petroleum sector, from basic research to demonstration and qualification.

Knowledge development for green growth in the ocean

Environmental and climate change are important drivers for the development of ocean industries in the future. A knowledge based approach is essential in order to find solutions and input factors that secure sustainable growth and reduced emissions in ocean-based industries.

Development and use of technology in the business community plays an important part in reducing emissions of greenhouse gases. Enova, whose duty it is to create lasting changes in the supply and demand of efficient and renewable energy and climate solutions, allocated about NOK 2.6 billion in 2017. This is NOK 390 million more than in 2016. Enova has support programmes in a number of sectors, and is an important instrument in Government climate and energy efforts. Among other things, the increase is to be spent on strengthening green shipping.

The Government has also decided to establish a new investment company, which is to help reduce emissions of greenhouse gases (Fornybar AS). The investment company will mainly invest in new technology in transition from development to commercialization, and will give priority to low- and zero-emission solutions.

The business community plays a central part in the development of new solutions contributing to increased sustainability and reduced emissions of greenhouse gases. Through the research and innovation instruments, the Government will facilitate the industries' own efforts in developing climate and environmentally friendly solutions.

Counting bacteria colonies on agar plate. Jon-Are Berg-Jacobsen/Nofima

CO2 capture is an important technology area for reducing emission from both the industry sector andthe petroleum sector. The Government's strategy for the work on CO2 capture was submitted in the Ministry of Petroleum and Energy's Prop. 1 S (2014-2015). The strategy contains a number of measures from research and development to demonstration and realization of a full scale facility. Among other things, investigations of a full-scale CO2 capture chain in Norway has been initiated.

Idea studies and feasibility studies have been conducted, and these show that it is possible to perform CO2 capture at Norcem's cement factory in Brevik, at Yara's ammonia factory in Porsgrunn, and at Oslo Municipality's waste burning plant. CO2 can be transported by ship to a land facility on the West Coast, and from there in pipes to a storage facility under the seabed east of the Troll field. With the existing plans, an investment basis can be presented to the Storting in 2018, and the project can be in operation in 2022. The Government will therefore continue its efforts to explore a Norwegian CO2 capture chain with ship transport of CO2 and CO2 storage in geological formations under the seabed, and strive to disseminate experiences from the Norwegian CO2 capture efforts, so more projects can be realized.

5.3 Collaboration across industries and disciplines

Releasing the potential for increased value creation involves investing in specific knowledge needs, as well as developing the organization of knowledge acquisition and stimulating increased collaboration across ocean industries and between academic communities. This is important in order to strengthen both long-term basic knowledge and applied knowledge.

Strengthen collaboration between industries

Through the Research Council of Norway, there have been considerable investments in schemes to help the transfer of knowledge among ocean industries in 2016. For example, maritime knowledge is vital to the further development of marine industries, the petroleum sector, and for the development and application of ocean technology.

In total, approximately NOK 100 million were offered for technology development and knowledge transfer among ocean industries in 2016. Norway also participates in the European programme MarTERA[38] for knowledge and technology transfer across ocean industries. In the 2017 budget, measures to promote knowledge transfer and technology collaboration is further strengthened with NOK 25 million.

The ocean industries are part of the bioeconomy. The Research Council of Norway, Innovation Norway, and the Enterprise for Industrial Growth (SIVA) will

38) This is a new European research collaboration, ERA-NET Cofund MarTERA. A total of 30 million euro will be offered to international collaboration projects for developing new marine and maritime technology.

We are facing technology development which may change Norwegian ocean industries as we know them.

collaborate on an action plan associated with the Government's bioeconomy strategy. Among other things, the action plan will include proposals for better structuring and interaction between relevant instruments within and across funding agencies. The budget was strengthened with a total of NOK 100 million for bioeconomy in 2017 through the Research Council of Norway and Innovation Norway.

The Government will maintain and strengthen measures contributing to increased knowledge flow and learning across industries, and facilitate increased collaboration across sectors, industries, and disciplines. As part of this, the Government will consider establishing a new common superstructure above the current ocean programmes in order to better facilitate increased knowledge development across the ocean industries.

There are already strong and well established communities in Norway with considerable expertise with regard to ocean matters and the Northern areas. The Government believes that there is a potential for better coordination and profiling of these competence communities in the North, and will, in collaboration with the academic community, public administration, and the business community, evaluate how this potential can be released in the best possible way, including the establishment of a centre of excellence for ocean and arctic matters in Tromsø. This coordination and profiling must be based on existing pillars and structures for artic matters, where the ocean has become increasingly significant. In addition to coordination and profiling, a centre of excellence could help stimulate debate and shed light on national and global trends that affect Norwegian interests and scope of action as a maritime and coastal nation.

Knowledge transfer from human medicine to aquaculture

Norwegian salmon farming has challenges associated with loss of fish during the production cycle. It is mainly health problems with the fish that cause losses, and there is therefore a need for new technology to help reduce these. BIOVIVO TECHNOLOGIES (Bodø). has received funding for a project where two different methods for monitoring fish health at fish farms are being examined, and the goal is to extract information on the health status of the salmon quickly. The project combines experiences from human medicine and technology for miniaturized sensors. The first method involves the use of a probe which is sent through the fish's intestine to extract information. They will also look at blood as a base for analysing the health status of the fish. Both methods may have great potential for extracting important information from salmon at the facilities quickly. The project has been granted funds from the User-driven Research based Innovation (BIA), and came about through and idea lab.[39)]

The cluster programme

Competence and technology in leading clusters can contribute to structural adjustment, more innovation and increased productivity in other industries and businesses. The position and potential of the Norwegian clusters can be utilized for faster and more targeted renewal and restructuring of the Norwegian business community. Through collaboration, the clusters contribute to increased productivity, as well as innovation and digitization in businesses all over Norway.

39) The purpose of idea lab is to find radically new solutions to large societal challenges. 25–30 handpicked participants from various fields meet for an intensive work week. Project ideas are developed in concert with academically respected mentors. The best projects are granted funding through the Research Council of Norway upon conclusion of the idea lab.

The cluster programme Norwegian Innovation Clusters will help reinforce the innovation and renewal abilities of innovation communities all over the country through increased interaction and collaboration in the business community, and between the business community, knowledge communities, and public development players. The programme has three levels:

Arena contains clusters of newly established collaboration initiatives. Norwegian Centres of Expertise (NCE) contains clusters with an established organization with well-developed services, partners and achieved results from collaboration projects. Global Centres of Expertise (GCE) will contribute to increased value creation and give businesses a better position, and make them more attractive in global value chains.

Norway currently has 17 strong Norwegian Centres of Expertise clusters (NCE) of businesses proving themselves in their fields in the global market. Twelve of the clusters in the Norwegian Innovation Clusters programme have their core activities associated with the ocean. The Centres of Expertise clusters (GCE) Blue Maritime, Subsea and NODE are the most mature, largest and most prominent, but also NCE clusters such as Seafood Innovation Cluster, Maritime Clean-Tech, Aquatech and Aquaculture, as well as several of the Arena clusters, such as Blue Legasea, play an important part. These clusters have already assumed an active role in contributing to value creation for their partner businesses through technology and competence transfer, which provide new applications and synergies. The collaboration in the clusters also contributes to increased internationalization.

A number of projects are currently being implemented between clusters where the goal is to link known technology and competencee to new applications. For example, a number of the projects are about utilizing experience from oil and gas on remote operation, monitoring, HSE, and pump technology in offshore aquaculture and offshore wind. Another example is the collaboration between GCE Subsea and NCE Seafood Innovation in offshore aquaculture. For 2017 the cluster programme was strengthened with NOK 30 million. The Government will contribute to increased collaboration between the clusters.

New technology areas as a driving force for growth

We are facing technology development which may change Norwegian ocean industries as we know them. New materials are used, and processes are changed, automated and digitized. In part, it is about more efficient, more precise and more automated production, and in part about new products, new value chains, and new business models. Industry all over the world is affected by these technology changes, and the technology is spread quickly between countries.

Advanced materials, micro and nano electronics, photonics, industrial biotechnology, and information and communications technology are often described as enabling technologies, that is, technologies which are, or can become, so pervasive that they lead to great changes in society. Development in these technologies paves the way for new applications in advanced production processes, through the Internet of Things, robotics and automation, virtual or augmented reality, big data and layered production.

Exponential growth in available computing power, the possibility of storing large amounts of data, increasingly better infrastructure for data exchange and a rapid development in available software has helped digitize products, services and production processes.

Enabling technologies are a priority area in the Government's long-term plan for research and higher education.

Data highway for increased efficiency in oil and gas

Oil companies, operators and suppliers have joined forces in a project that could provide higher productivity, more service content in deliveries, and lower operating costs in the oil and gas industry. The concept is ground-breaking and has high transferability to many other industries.

The key to increased digitization and automation in the oil and gas sector is increased access to data in present time for suppliers who have developed and supplied equipment important to safety and good, cost-effective operation of drilling rigs, boats, and platforms. This is also an important basis for lower maintenance costs, since equipment can be replaced when needed, and not routinely at fixed intervals, which is often the case today. This is called condition-based operation and maintenance. We need to exchange data in a controlled and safe way between various systems so that we can achieve both cost and modernizing effects, which is enabled by more sensors and great computing power. It will enable a greater degree of remote controlling of more operations, increased automation, higher efficiency, increased safety, and lower operating costs.

This is a collaborative more than a technological project. The goal is to find safe ways of making each other perform well through a common platform for data exchange and secure access control, without interfering with the competitive situation. The Data Highway project is one of several initiatives in which GCE NODE participates within automation, digitizing, and robotics.

Sensors are increasingly integrated into products, and the devices connected to the Internet – a development often referred to as the Internet of Things. Among other things, sensors, automation and digital technology enable machines to communicate directly with each other. A machine can detect when it runs out of a component of production and order it from another machine without human involvement.

The technologies are different and affect productivity in different ways, and their utilization varies. We can expect the ocean industries to be fundamentally changed by products and solutions from enabling technologies. For example, researchers at Nofima have developed technology for use in seafood packaging to prolong the shelf life of a pack of fresh cod by up to four days. Collaboration and projects at the intersection between technology sciences and other disciplines is a prerequisite for finding ground-breaking solutions, and for contributing to the development of technology solutions to develop the ocean industries.

Enabling technologies is a priority area in the Government's long-term plan for research and higher education. The Government will continue its focus on enabling technologies and facilitate the ocean industries' use of new technologies.

Culture of Ballan wrasse as cleaner-fish. Jon-Are Berg-Jacobsen/Nofima

5.4 The knowledge base for new ocean industries

There is a gradual transition from further development of existing ocean industries to building up new industries. The Government still wishes to mention a few areas which may have great potential for future value creation and business development, and which will require special knowledge and technology development.

Research of sustainability and environmental impact will be vital to the development of new ocean industries. Development of new industries also require that the authorities develop knowledge based management and regulation of new industries. Commercial interests are best suited to evaluate which areas to focus on. However, individual businesses will not always have enough incentive to carry all the costs resulting from the development of new technology and knowledge. There are a number of government instruments directed towards investments in an early phase.

Utilizing new biological resources

Increased value creation from biological resources is about making use of new biological resources in the ocean, as well as using known biological resources in new ways. In line with the Government's bioeconomy strategy, it is a goal to ensure more efficient utilization of renewable biological resources, where for example waste and side streams from one value chain is used as a resource in another. Development of new possible applications takes place, among other things, through collaboration between offshore and onshore bioindustries.

Among new biological resources, mesopelagic fish represent a considerable reserve for marine protein and fat, which could be valuable as feed for farmed fish, and as a basis for human consumption in various forms. Previous attempts to utilize this resource have so far not resulted in profitable fisheries. However, by harvesting krill and copepods, the industry has gained experience and technology to harvest and process raw materials which must be harvested gently and processed quickly.

In order to realize these possibilities, increased knowledge of the resources, in addition to clarification of the regulatory framework and risk willing capital owners, is required. Among other things, extraction requires mapping of high concentration areas, knowledge of the ecosystem in which these species are included, and knowledge of the effects of the extraction on other species, especially other fish stocks. It is also necessary to know whether they are wholesome and safe for use in feed and as food, and methodology for volume measurement and management must be developed. Norway has productive waters, a large seafood industry and supply industry, and leading industrial and research competence. We therefore occupy a special position internationally for realizing the full potential of this resource. The Government will strengthen the knowledge base for harvesting mesopelagic species.

Sugar kelp. Photo: Sintef

Norwegian players currently harvest krill, a plankton present in cold waters surrounding the Antarctic continent. Assessment of the krill stock is based on an expedition in 2000, and the knowledge base for harvesting must be updated and improved if the potential of the industry is to be realized. In 2017, the Government will submit plans to the Storting for a research expedition to the Antarctic.

In aquaculture, farming of new species such as shellfish or seaweed and kelp, will require considerable investments associated with breeding and production, illnesses, regeneration, content of nutrients and unwanted substances, environmental impact, etc. Starting to farm new species is therefore expensive, and it is important to assess everything from market conditions to knowledge base for production conditions. In 2003, a report was prepared on "Planned initiation of new species in farming" where the market potential, Norwegian industry players' interest in various species, the biological knowledge base, environment, etc. are evaluated. The Government believes that it is now time for an updated knowledge base on initiation of new species in farming, and will initiate the assessment of this.

Renewable energy

Offshore wind technology has developed a lot in later years, and seabed turbines are built at greater depths than before. Due to great depths close to the coast in a number of countries, there is a need for developing floating turbines, an area where the Norwegian business community has been at the forefront. An important goal for technology development and R&D activity is to reduce costs throughout the lifetime of a wind park.

Research and development for wind power and other offshore renewable technologies, such as offshore tidal and wave power, is currently funded through the Research Council of Norway. The EU framework programme Horizon 2020 also has a lot of relevant funding announcements for offshore wind.

The Government will continue research and development in order to develop renewable offshore energy.

Increased revenue with improved wind data

The operators of wind parks are wholly dependent on accurate wind prognoses in order to get the most from wind resources. A wind park cannot control how winds blow, and must take into consideration how much power the network can receive.

In many countries, owners of wind parks must pay large amounts if the wind park delivers other amounts of power to the network than what they have announced. Power is usually sold on an hourly basis in the power markets. Owners of wind parks are therefore dependent on knowing as much as possible on how much wind there will be in the next few hours.

The Norwegian company WindSim has received funding from the Research Council of Norway to develop tools that give very accurate wind prognoses, based on public weather forecasts. The company uses 3D simulations combined with advanced computer systems, so-called neural networks. Through its technology, WindSim can train neural networks to provide better wind and production forecasts, both for each wind turbine and for the wind park as a whole.

> International research collaboration opens doors to new business development and new markets for Norwegian products and services, and is an important contribution to Norwegian technology becoming an international standard.

Mineral extraction

Å utvikle en fremtiDeveloping a future mineral industry in the deep ocean will require investments in surveying and further development of methods and technology. Exploration technology is largely in place, but it could be improved. Extraction technology is in the development stage, however full-scale machines for production at great depths are constructed and produced. Processing technology is better known, and will take place in surface vessels or onshore. Research communities and businesses in the fields of mining, subsea technology and production must collaborate in order to utilize the possibilities. A national strategy for geodata is to be prepared and be available in early 2017. It will also discuss geodata for coastal and ocean areas as the basis for planning, management, transport, and value creation. In 2017, the Government has asked the Institute of Marine Research to strengthen knowledge of the environmental effects of seabed mineral extraction.

There is a great and documented need for providing better knowledge of the coastal areas. The Geological Survey of Norway (NGU) is conducting marine geological surveys with the help of research vessel F/F Selma. The results of the survey are communicated through, among other things, marine base maps, which have become a much-requested tool for both industry and administration.

5.5 International research collaboration

Norwegian researchers and research communities participate in an extensive international research collaboration. Norwegian researchers and Norwegian research are world leaders in several fields. This is a fundamental prerequisite for developing Norway as an ocean economy.

Among other things, good international ocean research collaboration is important in order to contribute to high quality research, to secure a good, shared knowledge base for administering resources, and to secure the knowledge base for developing international guidelines for offshore business activity. International research collaboration is a door opener for new business development and new markets for Norwegian products and services, and an important contribution to Norwegian technology becoming the international standard.

As an ocean economy, Norway has a leading role internationally in efforts to develop knowledge of the ocean and to contribute to good international coordination of knowledge development. In the box on the next page, we show some of the arenas for collaboration where the ocean industries, research and authorities are active in order to secure as much knowledge of the ocean as possible.

There is increased international focus on the possibilities of blue growth.

Arenas for international research collaboration

UNESCOs oceanographic commission, IOC (The Intergovernmental Oceanographic Commission): The IOC is the UN's coordination unit for ocean observations, ocean research, exchange of ocean data, and ocean services. One of the IOC's core responsibilities is to enable decisions on the utilization of the ocean for food production, promotion of human health, and for marine transport, to happen on the basis of scientific knowledge. Through observation of the oceans, the IOC helps increase the knowledge base of the climate changes. Among other things, the IOC coordinates monitoring of the oceans through the Global Ocean Observing System (GOOS). The GOOS is the ocean component of the IPCC (Intergovernmental Panel on Climate Change). The IOC is also important in the efforts to fulfil UN Sustainability Goal 14a.

Horizon 2020 (2014–2020): The EU research and innovation programme Horizon 2020 is an important arena for funding of international collaboration. Renewable energy, maritime transport, and food are priority areas of the programme.

Several so-called border zone activities are funded in Horizon 2020 in order to strengthen research collaboration. Norway participates in several such collaborations in maritime areas.

Norway also participates in the SET plan – The European Strategic Energy Technology Plan. The SET plan will contribute to the development of low-emission solutions.

JPI Oceans: The goal of the Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is to contribute to healthy and productive oceans. This is done by developing joint strategies in order to facilitate sustainable growth, as well as to achieve better coordination of the research funding passing through the various countries for marine and maritime research. JPI Oceans has defined 10 strategic focus areas, and three transversals associated with policy development, competencies and infrastructure. Through JPI Oceans, several joint projects have been initiated, such as mapping ecological effects of microplastic, mineral extraction on the seabed, dumped munitions, more efficient utilization of infrastructure and ocean observations, and recently ocean technology in collaboration with Horizon 2020. JPI Oceans has established collaboration with two other JPIs with focus on food safety and health in order to include seafood in research and policy development in the field of food safety and nutrition. Norway is an active participant in all initiatives launched.

The main focus for JPI Oceans is to strengthen knowledge and policy development in order to achieve more integrated and coordinated ocean management. JPI Oceans therefore emphasizes increased collaboration on knowledge develop-

Delegation from Japan visiting Nofima. Photo: Magne Skodvin/Nofima

ment, development of common standards and observation systems, and collaboration on infrastructure.

ICES (The International Council for the Exploration of the Sea): The management of fish stocks and other living marine resources require close international collaboration on research and monitoring of ocean areas. The International Council for the Exploration of the Sea (ICES) is the most important forum for collaboration on marine research in the North Atlantic.

The Arctic Council: The Arctic Council is the only circumpolar political collaboration body at government level. Here, the eight Arctic states and representatives of indigenous people meet to discuss matters of common interest. The council's mandate is to contribute to sustainable development and protection of the environment in the Arctic. The professional work of the Arctic Council has been strengthened considerably through the years. The Arctic Council has presented reports on topics such as climate changes in the Arctic, which have given important contributions to the international climate efforts. The council's international influence and significance has increased considerably in later years. The Arctic Council was given its own administrative secretariat in 2013. The secretariat is located in Tromsø.

There is increased international focus on possibilities of blue growth. In addition to the EU countries, Russia, China, Japan, South Korea, North America, and Brazil are important partner countries for the development of knowledge of the ocean. Russia is particularly important for the marine sector and the petroleum industry, and for the latter, Brazil is another significant partner.

The Government will continue existing international research collaboration, and facilitate research collaboration with relevant emerging economies.

Increased production of food from the ocean could help solve the global challenges of of safety and nutrition. The Government will therefore raise awareness about the knowledge base for the significance of seafood for food safety and nutrition in international forums.

The EU research and innovation programme Horizon 2020 is an important arena for funding of international collaboration. Compared to Norwegian prioritization of maritime research, however, this field has relatively low priority in the EU. Norway was therefore a driving force in the establishment of JPI Oceans. Through Norway's central part in this work, we have, among other things, achieved a stronger prioritisation of the ocean in Horizon 2020. The Government will work for ocean-based research to have a more prominent place in EU research and innovation programmes, and strengthen collaboration on ocean-based research in Europe through JPI Oceans and others.

Minister of Petroleum and Energy Terje Søviknes in conversation with apprentice Marcus Johnsen at the Rosenberg WorleyParsons shipyard in Stavanger. Photo: The Ministry of Petroleum and Energy

5.6 Education and competence development

Ocean-based businesses need competent and innovative employees in order to use and develop new knowledge, and be able to compete both nationally and internationally. In the petroleum, maritime, and marine industries, practical experience from the sea, linked with research based knowledge, has been key to technology development and innovation throughout the value chain.

Education associated with ocean industries

Adequate and correct competence is vital for further economic growth and value creation in the ocean industries. Rapid innovation and the development of new, enabling technologies in the ocean industries in the years to come will also set increasingly higher standards for highly qualified experts for operating new and advanced technical equipment and systems.

MARKOM2020

The development project for maritime competence, MARKOM2020, has been established in order to raise the quality of maritime education to a higher and more specialized level. This collaboration includes four higher education institutions (NTNU in Ålesund, University College of Western Norway, University College of Southeast Norway, and the University of Tromsø – the Arctic University of Norway). Since 2013, the maritime vocational schools have been integrated in the project through the sub project MARFAG2020. Since 2017, a Ph.D. in nautical operations has been established through Markom 2020, across the four institutions for higher education in the project. The degree completes the course of maritime education from vocational school to Ph.D. In the 2016 national budget, the Government increased allocations for MARKOM2020 by NOK20 million, to NOK 38.5 million, a level which has been continued in the 2017 national budget.

The Government has big ambitions for Norway as a knowledge society, and the education system is the authorities' most important asset in order to strengthen competence in the workplace. High quality in all levels of the education system, from kindergarten and primary education, secondary education, including vocational training, vocational schools, higher education and research, gives competent workers and a good basis for innovation and value creation also in the ocean industries.

Adequate and correct competencies are vital for further economic growth and value creation in the ocean industries.

The ocean industries need more employees with science and technology competence. The Government has implemented several measures in order to strengthen scientific and technical disciplines. Among other things, the Government has presented a strategy for science studies, which is to help more students graduate from primary education with good knowledge and competence in science studies[40]. Through vocational qualification reform, the Government is facilitating more apprenticeships and more tailored courses of education. A full review of the supply structure of vocational training has also been initiated in order to ensure better relevance for the competence needed in the labour market. The proposal for a new supply structure is to be submitted for consultation in spring 2017.

Vocational schools are important to ocean industries. Maritime and technical subjects are large disciplines in terms of number of students. In the autumn of 2016, the Government presented a report to the Storting on vocational education, Government White Paper 9 (2016 -2017) "Professionals for the future". The Government wishes to strengthen quality and relevance in the vocational school sector in line with White Paper 9 (2016 -2017) "Professionals for the future". Vocational schools must be closely linked to work life in order to ensure that the education is relevant for the often-complex requirements of the labour market.

The university and college sector has developed varied study programmes adapted to the needs of the ocean industries. Several institutions have Bachelor's and Master's Degrees directed specifically at ocean industries.

From 2017, an inter-institutional doctoral programme in nautical operations has been developed for the maritime sector. The Government will continue to focus on research and education associated with the ocean in its work with the long-term plan for research and higher education.

Universities and colleges decide which study programmes they offer, as well as the academic content of the programmes. It is therefore important that educational institutions have good contacts with relevant stakeholders, so that academic content and dimensioning takes the needs of the labour market at all times, and that the candidates have high and relevant competence. At the same time, study programmes must be closely linked to high quality national and international research in their fields. The business community receives the largest contribution to research based knowledge and innovation through new graduates with competence based on updated research.

Norwegian working life is in constant change. In the coming years, technology development, climate challenges, internationalization, changes in industry structures, immigration, and an aging population will affect requirements for competence in all areas of work life. Since the competence requirements of the industries are changing rapidly, life-long learning will be increasingly important in the future. Continuing and further education will be important in order for businesses to develop their activities and in order to meet their needs for competence, and also for the individual's ability to remain employed.

40) "Tett på realfag. Nasjonal strategi for realfag i barnehagen og grunnopplæringen (2015–2019)".

The Government, social partners and other parties with an interest in competence policy have jointly prepared a national competence policy strategy. The goal of this strategy is to help society and the workforce obtain competence that enable Norway to meet restructuring requirements in the economy, make sure that as many as possible are employed, and that we also in the future will have a competitive business community and an efficient public sector. The national competence policy strategy will be an important basis for facilitating the long-term competence requirements of the business community. Here the regional elected level also plays an important part as community developer and regional planner. Regional competence strategies will meet the competence requirements in regional labour markets.

The Government has initiated a structural reform in the university and college sector, where one of the goals is to build stronger academic communities and coordinate resources. An important goal is to make sure that educational institutions are able to deliver high quality competence to the future labour market. Petroleum, maritime, and marine education are relatively small fields of education, and it is therefore important to collaborate on resources and build strong, profiled academic communities.

The Government has also presented a White Paper on quality in higher education. This report stresses that candidates from the university and college sector should have solid, research based knowledge that is relevant for a future labour market requiring change and continuous development. The interaction between universities, colleges and the business community will be important in order to strengthen the relevance of education.

Fisheries and Aquaculture Science in Practice at the University of Tromsø – the Arctic University of Norway (UiT)

The fisheries and aquaculture industry is constantly changing. It was necessary to achieve closer interaction between the Bachelor's programme in fisheries and aquaculture science and the industry parties. In collaboration with students and industry representatives, the UiT developed the subject Fisheries and Aquaculture Science in Practice. Placement businesses from the entire value chain are being recruited: from management and fishing boat owners to processing plants and export companies. The students have three-week placements. The feedback from the placement businesses is unerringly positive. Many point out that having placement students adds new competence and new perspectives. The students feel appreciated and many also report that they now understand better the relevance of the subjects they have studied during their Bachelor's degree, and that they are rewarded with opportunities with regard to work, thesis, etc. when working on businesses placements. Fisheries and Aquaculture Science in Practice started as a pilot projects with the first student admission in 2015, and it has continued in 2016 and 2017.

Apprentices at Kleven shipyard. Photo: Kleven

Promoting recruitment to research, education and professions

The number of students in seafood-oriented studies has increased. The number of admissions to maritime studies has stabilized in later years, while there was a marked decline in students seeking petroleum-specific education in 2016. Recruitment to petroleum-specific studies has a tendency to follow the cycle of the industry. In the years of high activity in petroleum businesses, the interest in such studies has been equally large. After the oil price drop, we see that the number of students also declines. Although the petroleum industry is cyclically sensitive, it is important to aim at a steady recruitment to the industry in order to maintain high competence.

Securing interest in, and recruitment to, ocean-related education is an important part of the Government's competence policy. "Sett Sjøbein" is a national collaboration initiative to secure recruitment and competence for the seafood industry. Among other things, "Sett Sjøbein" uses information campaigns on study programmes to recruit young people to professions associated with the seafood industry offshore, along the shore, and onshore.

The Ministry of Petroleum and Energy supports the Energy Schools in order to raise awareness of the opportunities in the petroleum and energy industries. The Energy Schools is a project run by the Norwegian Centre for Science Education at the University of Oslo. It gives upper secondary students education in topics related to petroleum and energy. Both teachers at the schools and businesses provide teaching. The Government will evaluate whether a programme such as the Energy Schools could be extended to include more ocean-based industries.

The focus on recruiting researchers in the form of doctoral degree programmes has been a priority in the Research Council of Norway's instruments for all parts of the ocean industries. This has had a positive effect on the competence level of Norwegian research institutions, and it has provided the industries and public administration with highly competent employees. In addition to leading to closer collaboration with research institutions, it contributes considerably to the industry's procurement skills and its ability to implement new, research based knowledge. The business community also has the opportunity to use the industry Ph.D. scheme or sponsor a professoriate in order to strengthen competence in an area. The Government will continue to stress that recruitment of researchers is prioritized through the Research Council of Norway's instruments.

The Government will:

- strengthen knowledge base of marine ecosystems, and how these are changed as a result of human activities, climate change, and pollution.
- strengthen knowledge of ecosystems in coastal areas in order to facilitate aquaculture.
- strengthen geological surveying, both mapping of petroleum resources and mineral deposits.
- streamline data collection efforts through, among other things, use of new technology and national and international collaboration.
- continue efforts to monitor the environmental situation in the ocean and the consequences for, among other things, food safety.
- prioritize increased knowledge of foreign substances and nutrients in new species, which may strengthen new and alternative use of marine bioresources.
- participate in international research collaboration in order to reduce pollution of the ocean, for example by reducing amounts of plastic, and by increasing knowledge of the consequences of dumped munitions.
- continue the planning of an oil spill response and environmental centre in Lofoten/Vesterålen.
- strengthen the knowledge base for the role of the marine ecosystems for global climate development through funding of the projects “The Nansen LEGACY” and the new icebreaker research vessel “Kronprins Haakon”.
- procure a new coastal research vessel in 2017.
- follow up on the external quality control (KS1) of the concept study (KVU) for the collocation of marine research environments in Bergen.
- strive to find a solution for the Ocean Space Centre which meets current and future needs of the business community, research, and education in the best possible way.
- continue and strengthen the industry oriented research and innovation policy, including research directed towards the ocean industries.
- consider possibilities to strengthen collaboration and dialogue across ocean industries on strategy and knowledge development, for example on the basis of the 21-processes.
- focus on further strengthening the technology initiative in the marine and maritime areas on the basis of Demo2000.
- continue to keep petroleum research at a high level (DEMO2000 and PETROMAKS), and contribute to the transfer of knowledge and competence to other industries.
- establish a new investment company to help reduce emissions of greenhouse gases (“Fornybar AS”).
- facilitate industries’ own efforts to develop climate and environmentally friendly solutions through research and innovation instruments.

- continue efforts to explore a Norwegian CO2 capture chain with ship transport of CO2 and CO2 storage in geological formations under the seabed, and strive to disseminate experiences from the Norwegian CO2 capture efforts, so that more projects can be realized.
- continue and strengthen measures contributing to increased knowledge flow and learning across industries, and facilitate increased collaboration across sectors, industries, and disciplines. As part of this, the Government will consider establishing a new, common superstructure above the current ocean programmes in order to better facilitate increased knowledge development across the ocean industries.
- contribute to increased collaboration between the clusters.
- continue to focus on enabling technologies and facilitate the ocean industries' use of new technologies.
- strengthen the knowledge base for harvesting mesopelagic species.
- submit plans to the Storting for a research expedition to the Antarctic in 2017.
- initiate evaluation of an updated knowledge base on the need for planned initiation of new species in farming.
- continue research and development in order to develop renewable offshore energy.
- continue existing international research collaboration, and facilitate research collaboration with relevant emerging economies.
- raise awareness about the knowledge base for the significance of seafood for food safety and nutrition in international forums.
- work for ocean-based research to have a more prominent place in the EU's research and innovation programmes, and strengthen collaboration on ocean-based research in Europe through JPI Oceans and others.
- strengthen quality and relevance in the vocational school sector in line with White Paper 9 (2016 -2017) Professionals for the future.
- continue to focus on research and education associated with the ocean in its work with the long-term plan for research and higher education.
- evaluate whether a programme such as the Energy Schools could be extended to include more ocean-based industries.

6

Market Access, Internationalization and Profiling

> The Government will strengthen the competitiveness of the Norwegian ocean industries by assisting efforts with market access, internationalization, and profiling of the industries.

The Norwegian ocean industries are highly export oriented, and operate in a global market where there is strong competition for market shares and contracts. The opportunities and success of the ocean industries internationally are of great importance to Norway's prosperity and growth. In this context, it is important that Norway plays an active part in international efforts to create a strong framework and more open market access.

In order to reach the goals of the ocean strategy, the Government will, when working with market access, internationalization, and profiling:

- strengthen efforts to ensure a global, predictable and competitive regulatory framework,
- help more companies step out into the world and succeed, and
- make sure Norway consolidates its leading global position as a hub for the development of ocean-based technology.

6.1 Internationalization and profiling of the Norwegian ocean industries

There is great potential in internationalization for the Norwegian ocean industries. Opportunities for growth in international markets are closely linked to the restructuring of the Norwegian economy as internationalization in itself is an important driving force for innovation and productivity. Norwegian ocean industries have a strong reputation internationally. Targeted profiling of the ocean industries is important in order to win new market shares. The Government wants to strengthen Norway's profile as a leading ocean economy.

The Foreign Service plays a central part, and is an important contributor in the efforts to assist in the internationalization and profiling of the Norwegian business community. This will be even more important in future in order to secure Norway's international competitive edge. Innovation Norway and foreign posts will work with clusters and maritime knowledge communities where relevant.

Through the public support system, the Government will strengthen international efforts with regard to ocean industries and reinforce the link between their international apparatus, Norwegian businesses, and reputable international players and communities in order to catch development trends, and to collaborate and exchange experiences.

Better and more targeted collaboration in Team Norway

Team Norway is a network-based collaboration between various public and private players working for Norwegian-based business internationally. The purpose of the collaboration is to contribute to increased value creation in the Norwegian economy through the exchange of information, coordination, coordinated efforts and initiatives.

In Norway, the Ministry of Trade, Industry and Fisheries coordinates collaboration in Team Norway together with the Ministry of Foreign Affairs, the Ministry of Education and Research, and the Ministry of Petroleum and Energy. Regular meetings are held with representatives of the Norwegian business community through a reference group, where information on upcoming plans and priorities is shared and discussed.

Team Norway networks are currently established under the direction of the Foreign Service missions in a number of countries. These consist of various players from different countries, jointly representing a wide diversity of different organizations. Examples of participants are Innovation Norway, Norwegian Energy Partners, The Norwegian Seafood Council and local Norwegian businesses. Team Norway groups are currently present in most countries where the Norwegian business community has a significant presence.

The petroleum industry, maritime industry, seafood industry and coastal-based tourism have a targeted focus on selected markets abroad. Several ocean industries are already a central part of the Team Norway efforts in many markets. The Government will, in collaboration with industry players and clusters, help Team Norway strengthen cross-collaboration in order to promote ocean industries collectively where this can give a stronger effect

Collaboration in foreign markets

In foreign markets, the Foreign Service and Innovation Norway coordinate their services in countries where both are represented. The Foreign Service is to prioritise outreach efforts, hold network meetings and ocean conferences at the foreign service missions where this is considered relevant. For example, the Consulate General in Rio de Janeiro is planning a seminar to bring Norwegian and Brazilian centres of expertise in management, ocean technology, and shipping together to discuss solutions of tomorrow and potential areas of collaboration. Assistance to individual businesses has high priority at all relevant foreign service missions.

Focus on ocean industries abroad through Innovation Norway

With 35 offices in 30 markets, and with district offices in all counties, Innovation Norway plays a key part in assisting Norwegian ocean industries with ambitions of international growth. Stimulating internationalization in Norwegian businesses is part of Innovation Norway's service offerings, which include loans, grants, industrial research and development programmes, and skills programmes.

Norwegian seafood. Photo: The Ministry of Trade, Industry and Fisheries.

Innovation Norway has established the programme Global Growth as part of the internationalization efforts. This programme is focused on closeness to, and knowledge of, relevant international markets and sectors. The goal of Global Growth is to encourage more small and medium-sized businesses to do business in international markets, stimulate the potential for growth in the businesses that go international, and contribute to the success of businesses with great ambitions for growth that go international. It is expected that Innovation Norway by means of this programme will be able to put more businesses in the ocean industries through an internationalization process, and contribute to further growth for those who have already taken the step.

The Government strives to strengthen Norway's profile abroad in order to support the Norwegian business community in creating more value. The Government wants Norway to be associated with our advantages in delivering attractive solutions to important global needs, also in the ocean industries. With the aid of three Global Centres of Expertise, GCE Blue Maritime, GCE Subsea, and GCE Node, Innovation Norway has initiated a process which includes nine ocean clusters. The process is to contribute to the efforts to promote Norway abroad, new efforts for increased export, and greater host attractiveness.

The Government will highlight Norwegian green solutions for increased export, for investments in research and development, and for new business activities in Norway. The purpose is to build a proactive, green profile that makes Norway attractive to international investors. The Government has therefore assigned Innovation Norway the task of establishing collaboration with the business community on promoting Norwegian, green technology solutions internationally. This collaboration will give Norway a proactive, green profile for international investors, and market Norway as the best country in which to establish and invest in private, green businesses.

Through the Invest in Norway function (IIN) of Innovation Norway, the Government will strive to draw more investments to Norway. The IIN is a point of contact and a coordinator ensuring good access to information on Norway as an investment country, access to networks, decision makers and authorities on a national and regional level, help with meeting agendas, etc. Its main purpose is to ensure proper handling, efficient use of resources, learning, and recycling of knowledge. The IIN focuses on areas where the function can be causative in the efforts to encourage value creating, foreign businesses to establish themselves in Norway. Among other things, the IIN works with opportunities in aquaculture and projects related to port capacity, and promotes Norway in maritime transport.

> Contributing to a larger degree of internationalization of Norwegian companies delivering goods and services to the petroleum and energy sector, is good economic policy.

The ocean and the coast make Norway an attractive destination

Parts of the Norwegian coast are in a good position to develop experience- and activity-based tourism at sea and on the ocean. Tourists come from all over the world to experience nature, wildlife, and activities along and outside the coast.

In the past 15–20 years there has been a considerable emergence of a tourism business enabling fishing tourism. The players facilitating recreational fishing are of varying sizes and offer different services. In one end of the scale, we find large fisherman's shack facilities offering everything from accommodation and dining to well-equipped fishing boats, equipment, and options for fish processing, training, and guided tours. At the other end of the scale, we find players who let their own houses, cottages and boats to tourists without additional facilitation. These contribute to increased activity and employment in a number of local communities. The Government has introduced a new scheme for fishing tourism that could safeguard value creation in the tourism industry and the fish resources in the sea in a sustainable way.

Internationalization through Norwegian Energy Partners

The Ministry of Petroleum and Energy (MPE) intends to strengthen the international competitive power of the two important industries petroleum and renewable energy, previously supported and promoted by two separate organizations: INTSOK for the oil and gas suppliers (established 1997) and INTPOW for the renewable companies (established 2009). In 2016 therefore, MPE took the initiative to unite the activities of these two in the new Norwegian Energy Partners.

From 1st January 2017, Norwegian Energy Partners has been promoting the internationalization of a united, Norwegian-based energy industry, and is the most important instrument of the authorities in this context. The global energy arena has become increasingly complex, and is expected to be more integrated in the future. Contributing to a larger degree of internationalization of Norwegian companies delivering goods and services to the petroleum and energy sector, is good economic policy.

Public funding has been increased considerably in the 2017 budget. This gives the Norway-based companies even better opportunities to utilize skills and technology across the entire energy arena. About half of INTSOK's members already had clients in the other ocean industries, and many supply companies consider entering new industries and markets such as offshore wind and aquaculture. INTSOK's presence in foreign markets will also serve the energy industry. Norwegian Energy Partners contributes to better utilization of skills and technology across the energy related supply industry.

Subsea installation from the Radøy Group and OneSubsea delivered to Shell at the world's deepest oilfield at 2900 metres in the Gulf of Mexico. Photo: Shell

International experience in the petroleum sector

The Norway-based petroleum oriented supply industry currently delivers in almost 100 countries, and its international revenue is approximately NOK 200 billion. Growth has been formidable since the 1990s, both in terms of number of markets and in terms of revenue. The introduction of a carbon tax-regime and stricter requirements regarding the environment and safety on the Norwegian shelf have forced supply companies to make great efforts in terms of innovation and technology development in order to be competitive. Their technology is in increasing demand internationally. Norwegian Energy Partners is making an important effort to promote the industry in foreign markets and for years there has been strong, close collaboration between the industry, the Norwegian Ministry of Petroleum and Energy, Innovation Norway, and the foreign service missions.

Through Team Norway and the new efforts of Innovation Norway, the ocean industries will be promoted even more. In this work, the 20 years of experience and work methods of INTSOK, and now continuing with Norwegian Energy Partners, will have great transfer value to other ocean industries with regard to targeted and efficient industry profiling internationally.

Promoting Norwegian seafood through the Norwegian Seafood Council

The Norwegian Seafood Council is a central instrument in increasing demand for Norwegian seafood. The Seafood Council promotes Norwegian seafood abroad, collects and shares market information, and contributes to safeguard the reputation of Norwegian seafood. The company is also a central adviser on matters pertaining to export, trade barriers, and market access. The Norwegian Seafood Council has offices in 13 countries, covering many regions. Their proximity to and knowledge of important markets for Norwegian seafood is an important resource for Norwegian seafood exporters. The Government will strive to provide the Seafood Council with the most predictable framework possible for its work. The level of funding for marketing will be better adapted to current needs by assessing the export fee more frequently. An model linking the fee to export volume rather than export value, will be assessed.

Stronger promotion of the supply industry to the seafood industry

There is much demand for Norwegian sustainable solutions directed towards value chains of aquaculture and fisheries internationally. This applies to both competence and technology. Norwegian know-how in management structures and sustainable development is highly sought after. The need to produce and harvest food from the ocean increases, and more and more countries set goals for developing sustainable food production from aquaculture and fisheries. This gives Norwegianknowledge and experience great value, and market opportunities are large. The Government will strengthen collaboration in order to promote internationally the supply industry to the aquaculture and fishing industries internationally.

Minister of Fisheries Per Sandberg in Iran. Photo: The Ministry of Trade, Industry and Fisheries

Clusters as partners for profiling ocean industries in foreign markets

The clusters in the Norwegian Innovation Clusters programme play a key part in contributing to increased interaction between the ocean industries. Collaboration in clusters also contributes to increased internationalization and exchange of experience between the various members. The Government will require the clusters, in collaboration with the public support system and Team Norway, to contribute to efforts to identify the most important markets, help create meeting points for experience exchange and support the work of the Invest in Norway function in the regions.

Collaboration on ocean economy through the EEA funding schemes

Through the EEA funds, Norway is to contribute about €2.7 billion to fifteen of the least affluent EU countries in the period 2014–2021. The funding will strengthen connections and collaborations between Norway and recipient countries. The EEA funds are relevant to industry policy with regard to safeguarding Norwegian business interests, and enabling more Norwegian businesses and collaboration partners to participate in the programmes. Striving to ensure a high level of participation by Norwegian businesses and relevant partners in programmes under the EEA funds is important, because in the long run, this can lay the foundation for further and deeper collaboration in business, research and innovation between Norway and recipient countries.

Thus, the EEA funds creates good opportunities for business, research and innovation collaboration, but also for collaboration in fields such as food, health, climate and environmental programmes. It would also be beneficial for Norway if the EEA funds help finance and develop European marine research infrastructure. Joint research through EEA funds is also important in order to develop research networks which, in turn, can produce joint applications for Horizon 2020. The EEA funds also represent an important source of funding in a time when many recipient countries cut down on research due to public budget cuts. The ocean industries are encouraged to take advantage of opportunities for EEA-funded project collaboration in recipient countries. The Government will promote collaboration on the ocean economy within the framework of the EEA funding scheme, and highlight possibilities inherent in the ocean economy to relevant recipient countries.

6.2 Export Financing

The Norwegian ocean industries, mainly the maritime and offshore industries, have been major users of public export financing schemes for years. In the past ten years, demand has been particularly great with regard to projects in the oil and gas segment. Stakeholders in public export financing now see a shift in demand towards projects in other ocean-based segments.

Competitive export financing could be important in the structural adjustment which the Norwegian business community is facing.

The Norwegian public system for long-term export financing

The Norwegian public system for long-term export financing consists of guarantees from the Norwegian Export Credit Guarantee Agency (GIEK) and loans from Export Credit Norway AS. This is to be supplementary to financing from commercial finance institutions, and will provide Norwegian exporters with the same competitive terms as other exporters from countries with similar schemes. Businesses selling fish or other goods with a need for short-time financing may contact the public corporation GIEK Kredittforsikring AS (GK), or other commercial insurance companies offering short-term credit insurance which can be bought on commercial terms.

Terms of officially supported export credits (such as minimum interest, premium rates and maximum repayment terms) are currently regulated by an OECD associated agreement, Arrangement on Officially Supported Export Credits (Arrangement).There are also ongoing negotiations for a new international agreement, where more countries than the current members, participate. The Government gives priority to the efforts to develop these international agreements. This is important because it helps ensure that competition between exporters is about the price and quality of the products and services, and not about the public financing offered, as well as limiting subsidy competition between countries.

Export financing and the ocean industries

2015 and 2106 saw an increase in applications to GIEK and Export Credit Norway from other industries than petroleum related industries. Also, among the applications from the maritime equipment industry was seen a shift from projects related to oil and gas, to new segments such as fishing boats, well boats, ferries and smaller cruisers, as well as equipment for aquaculture.

Competitive export financing could be important in the economic restructuring of the Norwegian economy. In this process it is vital that Norwegian businesses have the capacity to make their offers known and process new applications, while following up on loans and guarantees already granted.

Norwegian buyers of vessels and floating installations may currently receive export financing when these units make their profits from international traffic or offshore operations. Shipping companies could otherwise make themselves available for these schemes by registering abroad. The Government has made it clear that GIEK and Export Credit Norway can finance Norwegian companies' purchase of offshore aquaculture installations from Norwegian shipyards.

The Government also allows GIEK to give guarantees for loans for krill vessels to be built in Norway and sold to Norwegian buyers. Krill vessels are thus to be treated as fishing vessels, which can receive financing if they are to go in international traffic. GIEK will also be enabled to give guarantees for export of equipment to krill vessels built abroad for Norwegian buyers. The Government has submitted a similar proposal for Export Credit Norway for public consultation.

There is extensive collaboration between GIEK and Export Credit Norway, and in the past few years, these institutions have also worked more closely with Innovation Norway. The Government considers a well-coordinated public support system important. These three, together with GIEK Kredittforsikring, established a joint export team in the autumn of 2016. This team will visit businesses all over Norway, many of which having the ocean industries as their main markets. The purpose of the export team is to test whether a joint offer from the four organizations gives added value to Norwegian businesses .

In addition, GIEK and Export Credit Norway have also scheduled regular visits to Innovation Norway's foreign offices, and Export Credit Norway has strengthened its collaboration with Innovation Norway by having one of Innovation Norway's employees in Rio de Janeiro, Houston, and Singapore also serve as a resource for Export Credit Norway.

GIEK and Export Credit Norway also work with Enova and SIVA in individual cases.

The Government will perform an evaluation of GIEK and Export Credit Norway to look more closely at how the export financing system is working. This will sbe discussed in more detail in the Government's upcoming White Paper on Industry.

Export financing of subsea cables for offshore wind

The company Nobelwind – a joint venture between a Dutch, a Japanese, and a Belgian company – announced in 2016 that they would start building the fourth wind park in Belgian waters. GIEK has financed part of the wind park through Norwegian equipment delivered by Draka Norsk Kabel in Drammen and DeepOcean in Haugesund. A cable of almost 14 km already delivered from Nexans Norway, and installed in connection with the building of Northwind Offshore wind park, is also included. The lender warranty from GIEK covers a 20 million Euro loan from BNP Paribas Fortis in Belgium.

6.3 International judicial collaboration

As a small open economy, Norway benefits from an increasing degree of joint regulations or regulatory collaboration. This also applies to value chains in the Norwegian ocean industries, since they benefit from more uniform and well-functioning trade and labour markets.

The framework for the ocean industries is largely determined internationally, and Norwegian authorities are active advocates for uniform global requirements. These efforts pertain both to ensure free trade through open markets, and to making strict requirements to safety, environment, and social standards.

The International Maritime Organization. Photo: The Norwegian Maritime Authority

Norwegian regulations for the ocean industries are largely based on internationally negotiated regulations, and are in compliance with international regulations. At the same time, it is important to preserve the option of implementing necessary regulations within the framework of our international legal obligations, in order to attain legitimate, national goals.

The Government will ensure that the interests of the Norwegian ocean industries are safeguarded through active participation in the development of international regulations and standards. The focus is directed towards international forums such as the UN and the International Maritime Organization (IMO). Collaboration with the EU through the EEA agreement is also important in order ensure uniform regulations.

The UN Convention on the Law of the Sea (UNCLOS)

The UN Convention on the Law of the Sea constitutes the legislative framework for all activities at sea. The convention establishes rights, obligations and responsibilities for coastal states, port states, and flag states with regard to resource management, safety and protection of the environment of the ocean and the continental shelf. The UN Convention on the Law of the Sea establishes which states own which resources, and which national regulations apply where, and when.

This provides predictability and safety for investments and financial activity. The Government will continue efforts to implement and strengthen maritime law, and further develop standards and regulations in fields important to Norwegian resource utilization and business activities.

International discussions on maritime law are currently giving sustainable use and protection high priority There are ongoing efforts in the UN to develop a new international regulatory framework for the protection and sustainable use of marine biodiversity outside national jurisdiction, including rules for establishing marine protected areas in international waters. This may provide guidelines for future Norwegian business activities. The Government will continue to advocate for the UNCLOS balance between use and protection to be respected, and clarified in new rules and new collaboration.

International regulatory framework for shipping in the UN International Maritime Organization, IMO

The maritime industry is a global industry, and the frameworks are largely determined internationally. Here, Norwegian authorities are an active driving force to secure the greatest possible degree of uniform, global requirements to the industry, open markets, free trade, and strict requirements to maritime safety, environment, and social standards. The UN International Maritime Organization IMO is the global developer of regulations for vessels and crew. Norway is actively facilitating a stable and predictable IMO regulatory framework. Collaboration with the maritime industry and other relevant stakeholders is important in order to identify good proposals for an international regulatory framework to be submitted in the IMO. The Government will work for the IMO regulatory framework to be sufficiently adapted to current challenges associated with the development of new technology, trade barriers, and sustainable development.

The framework for the ocean industries is largely determined internationally, and Norwegian authorities are active advocates for uniform global requirements.

In later years, the international regulatory framework has implemented stricter and more extensive environmental requirements. The IMO regulatory framework is global. However, there are a number of options for establishing stricter requirements for regions where this is needed. In several areas, the International Convention for the Prevention of Pollution from Ships (MARPOL) has particularly strict requirements which may be implemented in areas where they are needed. In Norwegian waters, the North Sea is covered by particularly strict environmental requirements regarding oil spills, waste, littering and sulphur pollution, and the IMO has also approved that the North Sea is to be covered by the IMO's strictest requirements to NOx emissions. In the Arctic, there are additional requirements to safety and environment through the IMO polar code. The IMO maritime safety committee sets requirements for construction, equipment, and operation for vessels, crew skills, handling of various types of cargo, etc.

Norway is active in the IMO Marine Environment Protection Committee (MEPC) in order to promote environmentally and climate friendly shipping. In 2016, the IMO made three important decisions to reduce the emissions of greenhouse gases from international shipping. The first decision regards reporting emission data. The shipping industry must report fuel consumption and other relevant information, such as distance sailed. Information on emissions and activities is to form the basis of new requirements for the reduction of greenhouse gas emissions. The second decision provides a mandate for negotiating stricter energy efficiency requirements for new builds. Several vessel types can be built with even stricter energy efficiency requirements than the current minimum requirements. In the third decision the IMO member countries agreed on a road map for lower greenhouse gas emissions from vessels. The strategy is to define an ambition and provide proposals for various policy measures. The Government will continue its targeted work in the IMO to further develop a climate and environmentally friendly international regulatory framework.

Regulatory development in the EU through the EEA agreement.

The EEA agreement currently covers the 28 EU member countries (27 when the United Kingdom leaves the EU) and the three EEA-EFTA countries Norway, Iceland, and Liechtenstein. Norway is part of the EU's inner market through the EEA agreement, including the EU's inner energy market. Norway is an active participant in the EU's regulatory development in several areas.

Norway does not have free trade terms for fish in the EU. Nor does the EEA agreement's Protocol 9, which regulates trade with fish and fish products, nor the 1973 Free Trade Agreement, grant the seafood industry zero tariffs in the EU market. Just like agricultural products, trade with fish is exempt from the provisions of the EEA agreement, both with regard to free flow of goods and general provisions for competition and subsidy rules. Negotiations for market access take place in connection with renegotiation of Norwegian EEA contributions. The last round of negotiations for market access for seafood was concluded in July 2015. A considerable improvement in market access was obtained for Norwegian seafood in the EU in the current agreement term, i.e. 2014–2021, where product composition is adapted to the needs of the industry. The new quotas became effective on 1st September 2016.

Sheringham Shoal wind park outside England. Photo: Alan O Neill/Statoil

The veterinary field, however, is harmonized with the EU, and thus also part of the EU's internal market for fish and fish products. The veterinary provisions apply to regulations for the entire seafood production, including feed and intermediate goods, fish health and fish welfare, by-products and seafood safety. Among other things, this involves free movement for all fish products and live fish within the EEA area, that is, without veterinary border control between Norway and the EU.

In the maritime area, Norway is represented on the board of the European Maritime Safety Agency (EMSA). Norway has a broad range of contact with the EU Commission and the EU member states in order to contribute to the EU's regulatory processes. In this context, the Norwegian maritime cluster is an important collaborative arena for developing constructive and sustainable proposals for regulatory development.

6.4 Trade Agreements and Bilateral Collaboration agreements

According to the Sundvollen political platform and White Paper 29 (2014–2015) "Globalization and trade", the Government will work for freer trade and maintain an aggressive trade policy emphasizing Norway's interests. The framework for the ocean industries is largely determined internationally, and Norwegian authorities are active advocates for uniform global requirements. Both foreign policy and trade policy play important parts in securing equal and fair rules within the framework of an open global economy.

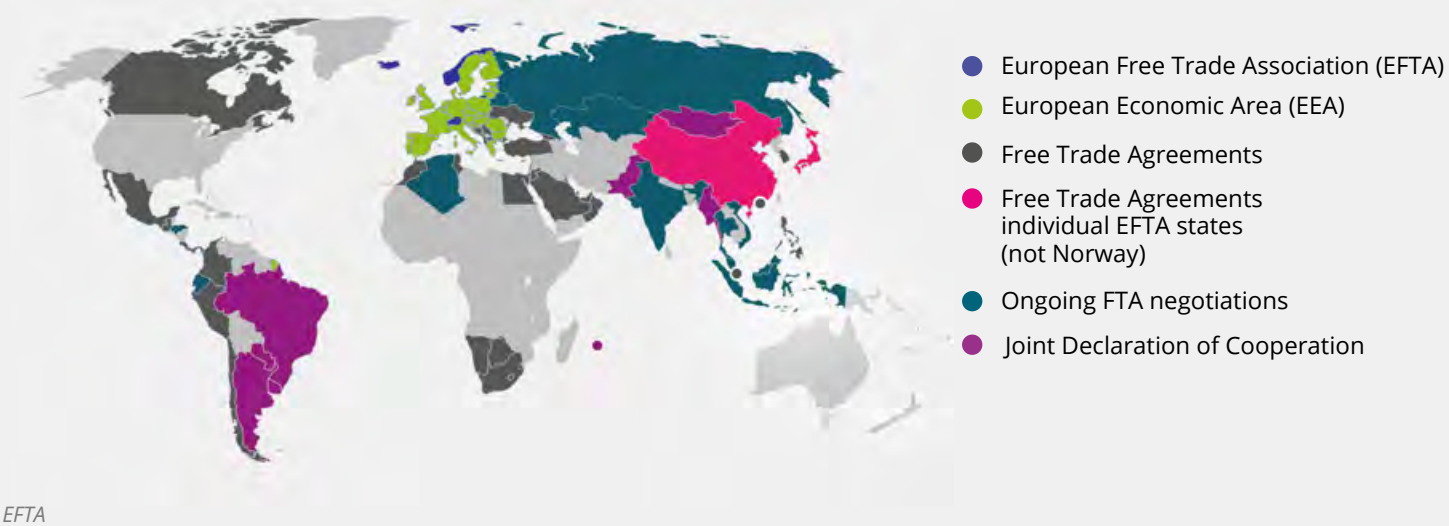
Additionally, Norway's foreign trade is regulated by a number of agreements and regulations, the WTO agreement, and a number of free trade agreements negotiated through EFTA.

Through the World Trade Organization (WTO), a multilateral, legislation based trade regime has been created, which is vital to small, open economies such as the Norwegian economy. The WTO has provided the opportunity for a considerable increase in global trade and value creation through rules that have given predictability as well as easier and more cost efficient trade across borders. The Government will follow up on ongoing WTO processes, and strive to further reduce trade barriers for seafood and other Norwegian interests associated with the ocean industries.

In March 2013, about 50 WTO countries initiated multinational negotiations for an international service agreement, the "Trade in Services Agreement" – TISA. Norway has assumed a leading role in the work with maritime transport services and energy related services in the negotiations in order to secure the most ambitious result possible for these industries. Also, it is particularly important to remedy the situation of negative special treatment of maritime transport services in regulatory frameworks and obligations in the WTO.The Government will follow up on the TISA negotiations in order to improve market access for maritime- and offshore-related services.

Negotiations toward a WTO Environmental Goods Agreement in the WTO, which consists of 44 member countries – including large players like the USA, China, and the EU – aim to achieve tariff exemption for goods that can help improve the environment and mitigate climate change. An agreement will make important

Norway and the EFTA free trade agreements



Source: EFTA

environmental technology more easily accessible at a lower price, and have a potential to support global value chains in clean technology. The agreement may have both direct and indirect positive effects on the ocean. The negotiations also concern Norwegian goods, for example ballast water cleaners and oil spill equipment.

The negotiations on fishery subsidies in the WTO started in 2001. The work has gained new momentum with the UN sustainability goal 14, target 6 (SDG 14, 6), which states that certain fishery subsidies are to be prohibited by 2020. It is estimated that $35 billion USD is granted in fishery subsidies every year, whereof $20 billion USD is used to increase the capacity of the fishing fleets. As an addition to the multilateral negotiations, there is parallel work on an agreement including the WTO members with the highest ambitions in this area. In order for the regulatory framework to be effective, all countries must be included. The Government will work actively to fulfil the UN sustainability goal 14, target 6, through a multilateral agreement in the WTO outlawing certain forms of fishery subsidies by 2020.

Norway signs free trade agreements in order to secure market access and better predictability for Norwegian businesses, especially in emerging economies outside the EEA area. A central principle is to ensure that framework conditions for the Norwegian trade and industry in foreign markets are at least as good as for competitors in other countries, especially in the EU.

EFTA free trade agreements with countries outside the EEA area are an important industrial policy instrument. The agreements have gained increasing importance for the Norwegian business community as a result of trade becoming more globalised. The Government gives priority to free trade agreements with countries where an agreement can make the greatest contribution to more overall trade and value creation. When prioritizing countries, importance is also placed on foreign policy and development policy considerations. Norway is currently negotiating EFTA free trade agreements with a number of countries, including India, Indonesia, Vietnam, Malaysia, and Ecuador. The ocean industries are among Norway's main interests in ongoing free trade agreements negotiations. The Government will consider the interests and needs of the Norwegian ocean industries when selecting new countries for future trade agreements.

Bilateral dialogues with authorities

Norwegian authorities conduct active and regular dialogues with authorities of several countries where the Norwegian ocean industries have considerable interests and investments. Norway currently has bilateral commissions with a number of countries, including important ocean economies such as Brazil, China, South Korea, Russia, Germany, and the US.

There are ongoing efforts to establish a commission with India. Norway also negotiates bilateral shipping agreements with countries where we have specific interests to protect.

Everything from regulatory collaboration to market access issues are discussed through bilateral dialogues. The collaboration helps strengthen trade and solve specific problems that Norwegian companies are facing abroad. The Government will develop existing dialogues with authorities further, and involve the business community in identifying new partner countries for closer collaboration on the regulatory framework of the ocean industries.

Skandi Angra in Brazil. Photo: DOF ASA

The BN21 agreement

There have been regular political visits to Brazil through the years in order to promote Norwegian-based supply industry and strengthen research collaboration. In November 2013, the Ministry of Oil and Energy signed a collaboration agreement on research, skills and technology development in oil and gas with the Brazilian Ministry of Research, Technology and Innovation (MCTI). The agreement is called BN21, which stands for "Brazil-Norway in the 21st Century". The initiative came from Brazil.

The purpose of the collaboration is to help utilize the resources on both countries' shelves through the development of technical solutions for the petroleum industry. From Norway, Statoil, the academic community, research institutes, and the supply industry are involved. This collaboration is a good platform for promoting the skills of the Norwegian-based supply industry, and for meeting relevant decision makers in Brazil.

The Research Council of Norway has also signed an agreement with its Brazilian counterparts NINEP (corresponding to Innovation Norway) in November last year, and with CNPq (the "Research Council of Brazil") in August 2014. The agreements open the door to closer collaboration between both countries' public support systems, and will help implement joint calls for applications for research funding for offshore oil and gas. The final decision on which projects are ultimately to receive funding will be made in consultation with NINEP. A joint call for application was made in 2016, directed towards the supply industry. There is ongoing work on another joint call for applications, this time for the academic community and the institute sector.

Other relevant trade policy processes

There are currently several large, ongoing trade policy processes in which Norway does not participate, but may have direct or indirect impact on Norwegian economy and the Norwegian ocean industries.

Great Britain's impending withdrawal from the EU will also have consequences for Norwegian interests. The Government will closely monitor development in ongoing and new trade policy processes in which Norway is not involved and will consider measures on an ongoing basis to protect Norwegian interests.

6.5 International ocean policymaking

For Norway and other coastal nations, ocean-based resources represent enormous possibilities for future economic growth, employment and development of knowledge and technology. The UN's 2030 agenda for sustainable development identified protection and sustainable utilization of ocean-based resources as one of 17 sustainability goals. The Government will ensure national implementation of UN Sustainability Goal 14 to preserve and use oceans and marine resources in a way that promotes sustainable development.

Ocean policy is becoming a priority matter in many countries. This is the result of the acknowledgement that global challenges such as climate change, poverty, and food safety must be met and handled through sustainable and efficient management of ocean resources.

Norway must manage the ocean and ensure sustainable development in the oceans in collaboration with other countries. Norway has the ambition to take on a leading role internationally in important ocean matters. This will be tied to Norway's strong interest in ensuring healthy and productive world oceans. In the spring of 2017, the Government will present a White Paper on oceans which will clarify how foreign and development policy can support Norwegian ocean interests and help attain the UN sustainability goals.

Although only a few countries have, or are planning for, their own comprehensive ocean strategies, most coastal states have various policy documents and strategies based on ocean-related matters and industries. More countries are expected to develop their own ocean strategies in step with increased attention on the range of opportunities in the ocean economy. The Government will monitor policy development in central ocean economies closely, and contribute to greater international collaboration on the opportunities inherent in the ocean economy. This could be done through existing or new bilateral frameworks, and by signing collaboration agreements related to the ocean.

The efforts are directed towards select countries which have positioned themselves as pioneering countries in ocean matters and ocean industries, such as Canada, Japan, China, Great Britain, Singapore, South Korea, Germany, and the US. Collaboration is to be based on the exchange of knowledge as well as collaboration on business development. The Foreign Service and Innovation Norway's foreign offices, through Team Norway, will play an important part in facilitating contact and the establishment of new meeting points with foreign authorities, research communities, and the business community.

The Government will also contribute to greater collaboration and coordination regarding the ocean in new and existing multilateral and regional collaborations structures. Collaboration with the EU on blue growth and ocean matters is becoming relevant in light of the EU Commission presenting its report on international ocean management in 2016. The EU emphasizes safe, clean and sustainable oceans as the overall goal of its strategy. In 2014, the EU launched its strategy for blue growth. This strategy is to support sustainable growth in the marine and maritime sectors. The ocean is regarded as a driving force in the European economy, and is considered to have great potential for value creation and innovation. Norway's collaboration with the EU is extensive in several areas covered by the ocean strategy. This concerns anything from collaboration on climate changes, overutilization of resources, as well as illegal, unreported and unregulated fishing (IUU-fishing).

> Through the Oil for Development programme (OfD), Norway assists twelve partner countries in Africa, Asia, the Middle East, and Latin America in managing oil and gas resources based on Norwegian experience.

The Asia-Europe Meeting (ASEM) represents a useful and efficient arena for political contact, especially with Asian, but also European political leaders. Since Norway became a member in 2012, we have been using ASEM as a platform for dialogue, and as an observational post to monitor development in Asia and in the EU's Asia policy.The Government will strengthen its involvement in ASEM and strengthen the economic pillar in the collaboration by focusing on opportunities in the ocean economy.

Norway plays a central part in many developing countries with regard to the development of management regulations and procedures in the ocean industries. Through the Oil for Development programme (OfD), Norway assists twelve partner countries in Africa, Asia, the Middle East, and Latin America in managing oil and gas resources based on Norwegian experience. Norway's new development programme Fish for Development (FfD) contributes correspondingly with combating poverty through food security, sustainable management, and profitable business activities. The Government will use development programmes such as FfD and OfD to promote Norwegian views and experience with regard to ocean management in collaboration with developing countries.

For Norway, which has distinctive natural advantages to achieve sustainable growth in the ocean economy, it is important to emphasize the need and potential for business development in the ocean. Norway is also a pioneering country for knowledge-based and sustainable management. Together with representatives from the ocean industries, the Government will consider possible ways of promoting sustainable business development in the ocean internationally. Such collaboration will have a comprehensive scope and be rooted in all the central ocean industries. The "Global Ocean Initiative" is a contribution from the Norwegian business community seeking to emphasize Norwegian experience in uniting the need for protection with sustainable growth. The initiative will be a tool for promoting Norwegian views and skills, and thus help strengthen Norway's role as an active advocate for sustainable business development in the ocean.

The Government will:

- strengthen Norway's profile as a leading ocean economy.
- strengthen international efforts with regard to ocean industries and reinforce the link between their international apparatus, Norwegian businesses, and reputable international players and communities in order to catch development trends, and to exchange experiences and collaborate.
- in collaboration with industry players and clusters, help Team Norway strengthen collaboration in order to promote ocean industries collectively where this can give a stronger effect.
- highlight Norwegian green solutions for increased export, for investments in research and development, and for new business activities in Norway.
- through the Invest in Norway function (IIN) of Innovation Norway, strive to draw more investors to Norway.
- strive to provide the Seafood Council with the most predictable framework possible for its work, while the level of funding of marketing will be better adapted to the need by assessing the tax level more often than before.
- strengthen collaboration in order to promote the supply industry of the aquaculture and fishing industries internationally.
- demand that clusters, together with the public support system and Team Norway, contribute to the efforts to identify the most important markets, help create good meeting points to exchange experiences, and support the work of the Invest in Norway function in the regions.
- promote collaboration on the ocean economy within the framework of the EEA funding scheme, and highlight possibilities inherent in the ocean economy towards relevant recipient countries.
- conduct an evaluation of GIEK and Export Credit Norway to examine more closely how the export financing system works.
- ensure that the interests of the Norwegian ocean industries are safeguarded through active participation in the development of international regulations and standards.
- continue efforts to implement and strengthen maritime law, and further develop standards and regulations also in areas important to Norwegian resource utilization and business activities.
- continue to advocate for the UNCLOS balance between use and protection to be respected and clarified in new rules and new collaboration.
- work for the IMO regulatory framework to be sufficiently adapted to current challenges associated with development of new technology, trade barriers, and sustainable development

- continue its targeted work in the IMO to further develop a climate and environmentally friendly international regulatory framework.
- follow up on ongoing WTO processes, and strive to further reduce trade barriers for seafood and other Norwegian offensive interests associated with the ocean industries.
- follow up on the TISA negotiations in order to improve market access for maritime and offshore-related services.
- work actively to fulfil UN Sustainability Goal 14, target 6, through a multilateral agreement in the WTO prohibiting certain forms of fishery subsidies by 2020.
- consider the interests and needs of the Norwegian ocean industries when selecting new countries for future trade agreements.
- develop existing dialogues with authorities further, and involve the business community in identifying new partner countries for closer collaboration on the regulatory framework of the ocean industries.
- closely monitor development of ongoing and new trade policy processes where Norway is not involved, and consider measures on an ongoing basis to protect Norwegian interests.
- ensure national implementation of UN Sustainability Goal 14 to preserve and use oceans and marine resources in a way that promotes sustainable development.
- present a White Paper on oceans in foreign and development policy.
- monitor policy development in central ocean economies closely, and contribute to greater international collaboration on the opportunities inherent in the ocean economy.
- contribute to greater collaboration and coordination on the ocean in new and existing multilateral and regional collaborations structures.
- strengthen its involvement in ASEM and lift the economic pillar in the collaboration by focusing on the opportunities in the ocean economy.
- use development programmes such as FfD and OfD to promote Norwegian views and experience with regard to ocean management in collaboration with developing countries.
- together with representatives from the ocean industries, consider possible ways of promoting sustainable business development in the ocean internationally.

Published by:
The Ministry of Trade, Industry and Fisheries
and Ministry of Petroleum and Energy
Public institutions may order additional copies from:
Norwegian Government Security and Service Organisation
Email: publikasjonsbestilling@dss.dep.no
Internet: www.publikasjoner.dep.no
Telephone: + 47 222 40 000
Publication code: W-0018 E
Design: Anagram Design as
Cover photo: Eco Leader. Photo: Awilco. Offshore Aquaculture
Illustration: Ocean Farming. Ekofisk. Photo: ConocoPhillips.
Lofoten fishery. Photo: Mittet & Co
Print: Norwegian Government Security and Service Organisation
04/2017 – Impression 100