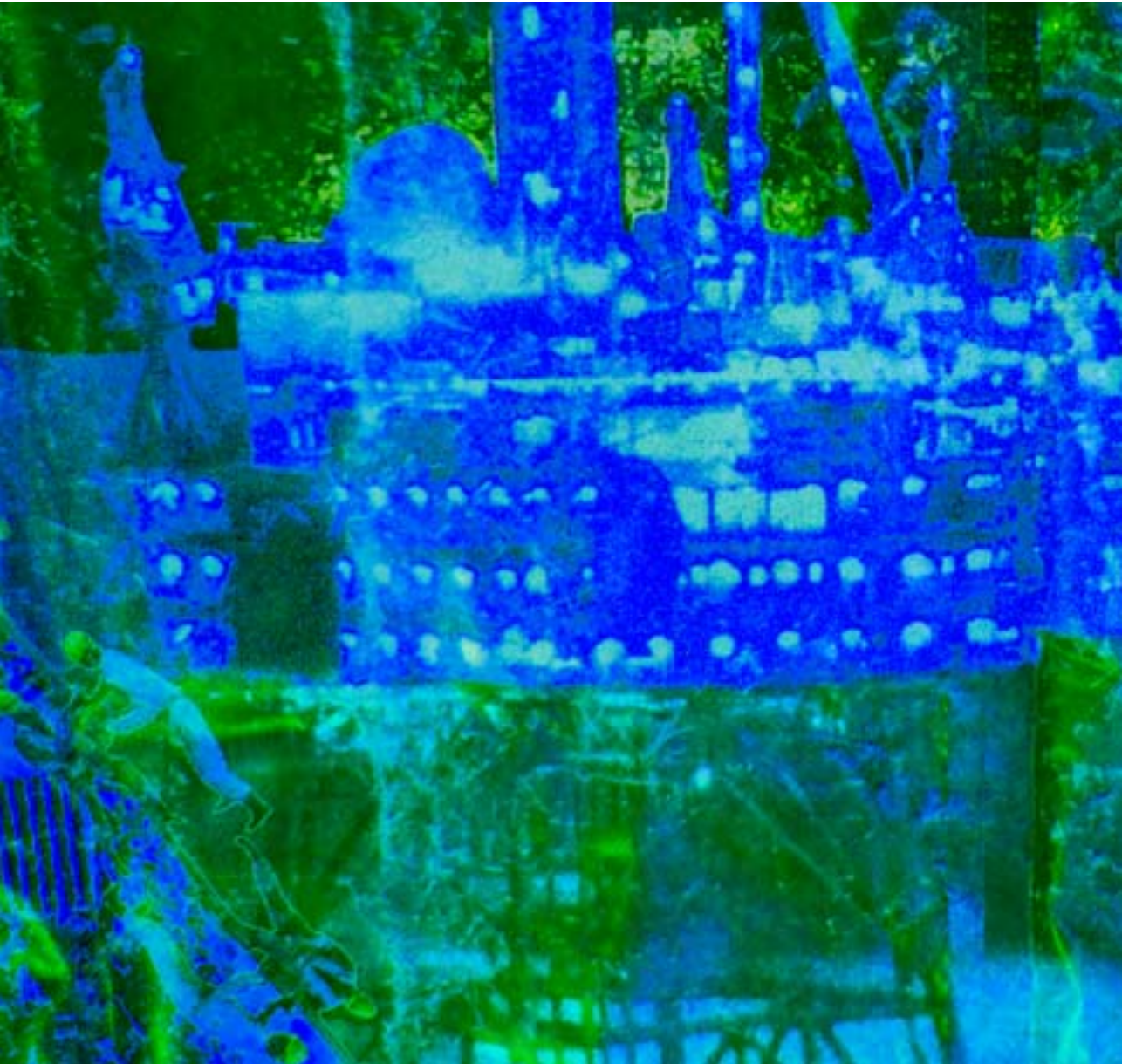


8

Research, technology and industrial development



Norwegian petroleum industry

Building up Norwegian and Norwegian-based petroleum expertise has been an important element in Norwegian petroleum policy. In the beginning, much of this knowledge was obtained from foreign oil companies and supplier firms. Today, however, Norway has a highly developed and internationally competitive petroleum industry. This applies both to oil companies, the supplier industry and research institutions. The sector also provides valuable input to innovation and technological development in other sectors of Norwegian business and industry.

Supplier firms in Norway are represented in most steps of the value chain, from exploration and development to production and disposal. Norwegian suppliers are among the best in the world in fields such as seismic surveys, drilling

equipment, subsea facilities and floating production solutions. These supplier firms are located in every county in Norway and the local and regional ripple effects of the petroleum activities are evident even in parts of the country that would not normally be expected to have a link to this industry. A study¹ conducted by Menon Business Economics shows that the industry generates more than just tax revenues for the state. It creates jobs and stimulates local and regional business development. Increased internationalisation manifests itself as more local employment and value creation. Approximately 100,000 people are employed in the supplier industry in Norway.

Investments by oil companies in development, operation and maintenance on the Norwegian

¹ KonKraft Report 4 Internationalisation

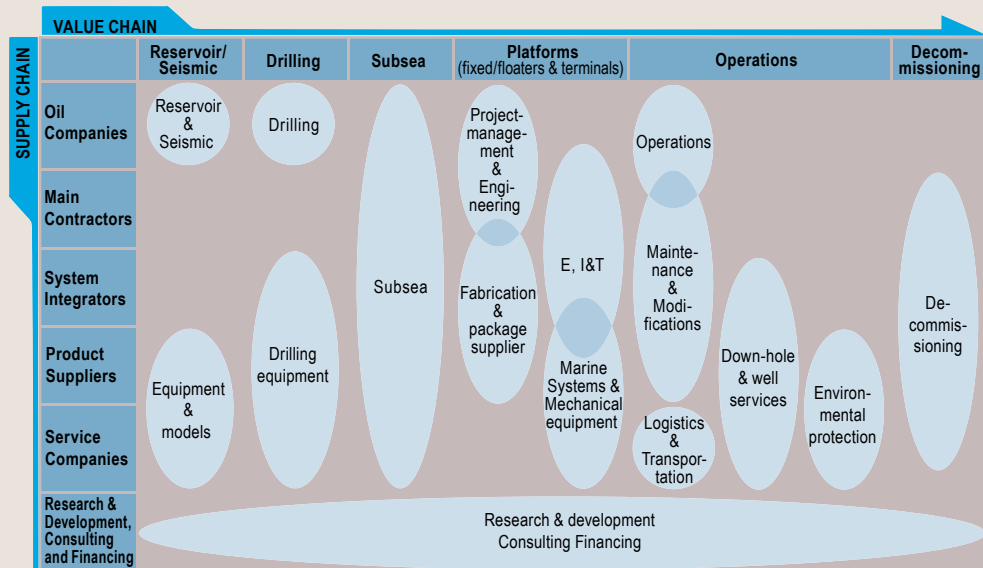


Figure 8.1 Interactive map of Norwegian oil and gas clusters
(Source: www.Intsok.com)

continental shelf generate a considerable demand for products and services from the supplier industry in Norway and abroad. In order to stimulate the continuation of this growth, the supplier firms must ensure that they continue their expansion into the international arena. International experience and participation in international development projects are extremely important for the further development of the supplier industry. This international experience could also help reduce the cost level on the Norwegian continental shelf.

Industry and industrial cooperation linked to the petroleum industry

There are a number of arenas and meeting places which promote coordination in the petroleum industry and improve the players' wider understanding of the range of challenges that the industry faces today – be they organisational, technological or commercial. The Ministry of Petroleum and Energy considers it important to support and participate actively in these arenas.

INTSOK

In order to promote the internationalisation of Norwegian petroleum-related industry, the authorities established INTSOK – Norwegian Oil and Gas Partners – in 1997, in partnership with the Norwegian petroleum industry. INTSOK is regarded by the Norwegian authorities as an important partner. About 180 companies are members of the foundation. Figures from Menon Business Economics assume that, in 2007, Norwegian petroleum-related companies had international sales of NOK 95 billion; six times as much as in 1995. The goal is to increase annual sales abroad to about NOK 120 billion in 2012.

Petrad

As part of its international activities, the Ministry of Petroleum and Energy also supports the Petrad foundation. Petrad is a Norwegian assistance agency which offers various types of knowledge transfer programs to the management of national oil companies and petroleum authorities in developing countries.

Oil for development

The Ministry of Petroleum and Energy cooperates with the Ministry of Foreign Affairs, the Ministry of Finance and the Ministry of the Environment on a joint commitment to assist developing countries when it comes to petroleum administration and good management. This program includes:

- reinforcing Norwegian bilateral assistance to countries requesting Norwegian petroleum expertise
- emphasis on sound governance and insight in petroleum management

Oil for development is a broad-based program, encompassing issues such as resource management, revenue management, the environment and industrial development. Norwegian experts on technical disciplines and petroleum resource management are involved in this work, including the Norwegian Petroleum Directorate, Petrad and INTSOK. Norad is responsible for coordinating these efforts.

EITI

The Extractive Industries Transparency Initiative is an international initiative whose purpose is to strengthen good governance in resource-rich countries through the publication of revenues from oil, gas and mining companies to the state. Publication of revenue streams may contribute to

greater accountability on the part of the authorities to the populace. Norway has supported the initiative since 2003.

An overriding principle in the Norwegian authorities' petroleum management, as in all parts of the administration, is that it should meet the highest standards with regard to accountability. It is an important principle in Norwegian petroleum management that there should be transparency regarding tax payments to the state, and tax figures are available to the public. The revenue streams are independently audited through the work of the Office of the Auditor General in Norway.

Norway is well-positioned to demonstrate international leadership regarding the issue of transparency of revenue streams from the petroleum industry, and this is also reinforced in the Oil for Development program. Both EITI and the Norwegian system are set up to secure transparency around payments. While EITI is intended for less

mature and transparent systems than we have here, Norway nonetheless decided in the fall of 2007 to implement the EITI in Norway. This means that, even though the revenue streams are already transparent, we have undertaken the responsibility to go through a process stipulated by the EITI principles. The purpose is to make information about the revenue streams from this sector more readily available. While Norway already meets the intentions of the EITI, the purpose of Norway's undertaking to implement the EITI is to further the initiative internationally. In the winter of 2008/2009, a group was established to take responsibility for the implementation in Norway. This group included representatives from the civilian population, the industry and the authorities. Norway also applied for status as an EITI candidate.

The member companies in OLF, the Norwegian Oil Industry Association, share the government's ambition of greater revenue transparency in the extractive industries. On behalf of its members, the association has accepted that tax payments to the Norwegian state from oil companies present on the Norwegian continental shelf may be made public.

Norway also hosts the International Secretariat of the EITI. More information on the EITI may be found at www.eitransparency.org.

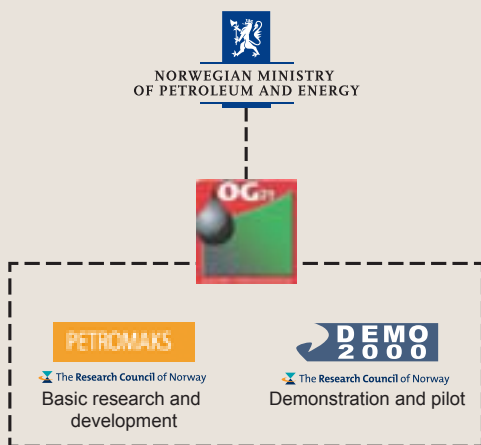


Figure 8.2 The Ministry of Petroleum and Energy's involvement in petroleum research
(Source: Ministry of Petroleum and Energy)

Research and technological development in the oil and gas sector

Development of new technology and increased competence in the oil and gas industry are important to ensure that the sector will continue to contribute to economic growth and general welfare in Norway. Several of the solutions currently used by the oil and gas industry are the result of significant investments in research and technology development in the 1970s, 1980s and 1990s. In the years to come, however, value creation on the Norwegian continental shelf will be

more technologically demanding and knowledge-intensive than is the case today. For this reason, continuing efforts in research and technology development are important to ensure a competitive Norwegian oil and gas industry. Figure 8.2 illustrates the organisation of petroleum research in Norway.

In order to meet the challenges associated with efficient and prudent petroleum activities, OG21 – oil and gas in the 21st century - was established on the initiative of the Ministry of Petroleum and Energy in 2001. OG21 is organised in a board, whose composition is determined by the Ministry of Petroleum and Energy, and a secretariat.

OG21 has managed to encourage oil companies, universities, research institutes, the supplier industry and the authorities to join forces and support a common national technology strategy for oil and gas. In the International Energy Association's evaluation of Norwegian energy policy in 2005, the OG21 collaboration was recognised as being unique in a global perspective.

An important objective for OG21 is to increase state funding of research and development in the petroleum-related area to NOK 600 million per year. OG21 maintains that such a public research effort

would be required to sufficiently meet the main technological challenges in the sector.

The authorities' contribution to petroleum research is largely organised in the PETROMAKS and DEMO 2000 research programs. These programs are intended to contribute to attaining the goals identified in the OG21 strategy. The funds from the authorities are channelled through the Research Council of Norway, which coordinates the programs.

The OG21 strategy was revised in 2005 to better adjust to today's challenges. The revised strategy has identified eight core technology areas which will be vital for the future development of the Norwegian petroleum activity:

- 1 Environmental technology for the future
- 2 Exploration technology and reservoir characterisation
- 3 Enhanced recovery
- 4 Cost-effective drilling and intervention
- 5 Integrated operations and real time reservoir management
- 6 Subsea processing and transportation
- 7 Deep water and subsea production technology
- 8 Gas technologies

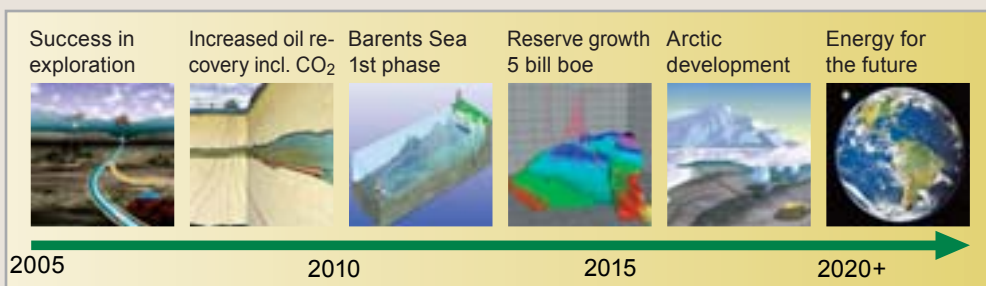


Figure 8.3 OG21's technology roadmap for value creation on the Norwegian continental shelf
(Source: OG21)

The new OG21 board was appointed in October 2007 and is chaired by StatoilHydro.

PETROMAKS

PETROMAKS (maximum exploitation of the petroleum reserves) is a petroleum research program covering strategic fundamental research and development of expertise, user-related research and technology. The program's target groups are Norwegian companies and research communities that wish to promote the build-up of knowledge and expertise in Norway. The national technology strategy, OG21, serves to guide PETROMAKS' priorities.

The objective of PETROMAKS is to contribute to better exploitation of fields in production and increased access to new reserves. The activities in the program are largely aimed at discovering more oil and gas, improving recovery from existing fields, streamlining transport of wellstreams over large distances and efficient transport of gas to the markets. The program also seeks to prepare a basis for development in HSE issues and the external environment, reducing the cost level on the Norwegian continental shelf and strengthening petroleum-related industrial development, in Norway and internationally. Another important objective of PETROMAKS is to contribute to an increased level of competence in the petroleum sector as well as to improve recruitment to the industry.

The Research Council does not have dedicated programs for the northern areas. Instead, northern area research is integrated throughout all of the Research Council's activities, including the PETROMAKS program. In this context, PETROMAKS finances research on special arctic-related issues such as extreme climate, less developed infrastructure, development and production in ice-affected areas, handling of ice and transport over very long distances.

DEMO 2000

An important initiative in the promotion of new technological solutions within the petroleum industry is the DEMO 2000 program. New technology is often associated with high costs and high risk, and it can be particularly challenging to get solutions out onto the market. The objective of DEMO 2000 is to contribute to reduced costs and risk for the industry and commercialisation of new technology by supporting pilot and demonstration projects. The program is based on the national technology strategy, OG21.

The pilot projects entail close cooperation with supplier firms, research institutions and oil companies; a collaboration which, in itself, helps to develop a progressive, market-oriented expertise network.

The DEMO 2000 program has supported demonstration of new petroleum technology since 1999. Some of the technologies developed through the program are already available on a commercial basis, and have resulted in significant cost savings for the industry. DEMO 2000 believes there is a great potential within technical disciplines such as seabed processing, gas compression on the seabed, efficient drilling and integrated operations (remote control). Innovations within these areas carry a substantial potential for increased value creation. The DEMO 2000 program, like PETROMAKS, emphasises developing and testing petroleum technology with particular relevance for arctic conditions.

PETROSAM

PETROSAM is a social-scientific petroleum research program. The aim of the program is to provide insight and competence regarding social conditions relevant to strategic and policy-making decisions of the government and the petroleum sector. PETROSAM will also focus on international

relations, in particular the Middle East and Russia. PETROSAM was established in 2006 and will continue until 2012.

PROOF

The research program PROOF examines long-term effects of discharges to sea from petroleum activities, and constitutes a part of the larger program, “The Sea and the Coast”, which is planned for the period 2006–2015.

CLIMIT

CLIMIT is a cooperative program between Gassnova and the Research Council of Norway, and relates to research, development and demonstration of technology associated with environmentally friendly power generation. The program is financed partly by the Gas Technology Fund’s returns, which are managed by Gassnova, and partly by funds channelled through the Research Council.

CLIMIT’s objective is to contribute to profitable power generation with CO₂ capture. The program will cover financial support to the entire development chain, from long-term research for competence building to projects demonstrating CO₂ capture technologies. The project portfolio will mainly focus on technology solutions for cost-effective CO₂ capture. In addition, CLIMIT will prioritise development of knowledge and solutions for safe and reliable capture of CO₂ in geological formations.