Forskningsrådet

Work programme for the DEMO 2000 Programme 2018–2022

DEMO 2000

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1 Summary

The DEMO 2000 programme seeks to ensure long-term competitiveness in the oil and gas industry and continued profitable and sustainable recovery of petroleum resources on the Norwegian continental shelf.

The aim of the DEMO 2000 programme is to demonstrate and qualify innovative products and systems in close collaboration between the supplier industry, petroleum companies and research institutes. Demonstration and qualification activities are to be carried out under realistic conditions offshore or in suitable facilities on land.

The DEMO 2000 programme will through pilot testing and demonstration promote:

- increased recovery and more discoveries
- reduction of greenhouse gas emissions and environmental impacts
- cost-effective and energy-efficient solutions
- improvements to health, safety and the environment
- stronger petroleum-related industrial development, more rapid-paced innovation and enhanced competitiveness
- maintenance and development of necessary expertise and employment for the industry

The DEMO 2000 programme provides funding for upstream oil and gas activities, and focuses on four thematic priority areas:

- Reducing greenhouse gas emissions, energy efficiency and the environment
- Exploration and increased recovery
- Drilling, completion and intervention
- Production, processing and transport

The programme has three cross-cutting priorities that can be addressed across all four thematic priority areas:

- reducing greenhouse gas emissions and energy efficiency
- digitalisation
- the Arctic areas

The programme is targeted towards Norwegian supplier companies and subcontractors that, together with petroleum companies and/or other end-users, have a need for pilot testing and demonstration of new technology for use on the Norwegian continental shelf or to sell in international markets. It is presumed that a major part of the activity relating to the technology will be carried out in Norway and will provide or safeguard Norwegian jobs. Pilot testing activities themselves may be conducted abroad.

Funding under the DEMO 2000 programme may comprise maximum 25 per cent of overall approved project costs. The remaining 75 per cent of the project costs must be covered by the applicant and partner institutions/end-users.

2 Background and challenges

Underlying framework for the DEMO 2000 programme

The Norwegian Government's Long-term plan for research and higher education 2015–2024[1] states that Norway is to maintain its position as a world leader in technology development for offshore production of oil and gas. The plan states that continued cost-effective and sustainable exploitation of the petroleum resources on the Norwegian continental shelf requires further investment in research, development and expertise. The petroleum sector needs more basic knowledge about the seabed and the subsurface, as well as knowledge for testing new technology under realistic conditions. The industry also needs new know-how to maintain high health, safety and environmental standards in connection with petroleum activities in more vulnerable areas.

Deploying new solutions often entails major costs and a high risk. The DEMO 2000 programme was established by the Government with the goal of reducing costs and risks for the industry and promoting the commercialisation of new technology by providing support to pilot projects and demonstration.[2] Additionally, the programme is to encourage the application of new technology for the recovery of oil and gas on the Norwegian continental shelf.

Opportunities and societal and industry-related challenges and needs that form the basis for the programme

Norway's petroleum resources belong to the Norwegian people and must be managed in a manner that benefits Norwegian society as a whole. This is the principle underlying the management of the country's petroleum resources. There are still large oil and gas resources on the Norwegian continental shelf, in both mature and immature areas, with the potential for major value creation and revenues for Norway. A large share of the undiscovered resources lie to the north (in the Barents Sea and Norwegian Sea). This offers new opportunities for industrial development in North Norway. The High North is also one of Norway's foreign policy priorities, and key focus is placed on petroleum resources in the Government white paper on the High North.[3]

Climate change is a major global problem. In 2016 Norway ratified the Paris Agreement on climate change, under which it is committed to achieving a minimum 40 per cent reduction in greenhouse gas emissions compared with 1990 levels by 2030.[4] Norway is aiming to work alongside the EU to achieve the 2030 climate targets. The development of new technology that enables Norway to fulfil its international climate obligations is crucial for ensuring the continued exploitation of Norway's oil and gas resources far into the future.

Oil and gas resources will continue to represent a keystone of the Norwegian economy and provide a significant contribution to national and international welfare for the foreseeable future. The DEMO 2000 programme is designed to help the Norwegian continental shelf and Norwegian supplier industry to remain competitive. The focus is on increasing cost-efficiency in all segments of the

[1] Meld. St. 7 (2014–2015) Long-term plan for research and higher education 2015–2024, white paper from the Ministry of Education and Research

[2] Meld. St. 28 (2010–2011) Report to the Storting (white paper): An industry for the future – Norway´s petroleum activities.

[3] Meld. St. 7 (2011–2012) The High North – Visions and strategies, white paper from the Ministry of Foreign Affairs.

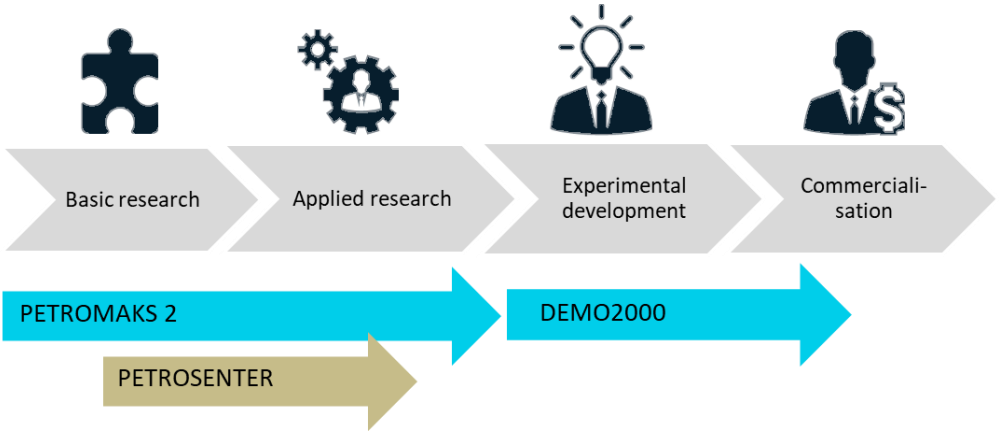
[4] https://www.regjeringen.no/no/aktuelt/norge-vil-raskt-ratifisere-klimaavtalen-fra-paris/id2482881/

industry. New technology, industrialisation, digitalisation, new solutions and forms of cooperation are all important elements for increasing productivity and competitiveness.

Current state-of-the-art for research/knowledge underlying the programme's priorities
The OG21[5] strategic forum is an advisory body that brings together oil companies, universities, research institutions, suppliers and public bodies to develop a national petroleum technology strategy for Norway.

The OG21 reviews the most important knowledge and technology needs for the Norwegian continental shelf and provides clear recommendations on the areas which need improvement. The most important priorities are incorporated in this work programme.

The 2015 report on Research Council activities related to petroleum research[6] provides a detailed overview of how the Research Council initiatives as a whole are aligned with activities in trade and industry to address key challenges on the Norwegian continental shelf. The three research programmes, PETROMAKS 2, PETROSENTER and DEMO 2000, together comprise a set of instruments designed to achieve this. The DEMO 2000 programme is targeted towards the interface between technological development and commercialisation. The programme is linked to earlier phases of petroleum-oriented research in that a number of research and development projects carried out under other research programmes, with private or public funding, are pilot tested and qualified under the DEMO 2000 programme.



A key perspective underlying public funding of petroleum research is that Norwegian petroleum resources must be sustainably managed and exploited in line with the UN's Sustainable Development Goals. The societal mission and socio-economic significance of the Research Council's petroleum-targeted research initiatives are therefore critical. Public investment is expected to lead to:

- long-term knowledge and technology development that combined leads to optimal utilisation of Norway's resources;

[5] https://www.forskningsradet.no/servlet/web/prognett-og21/Home_page/1253962785326
[6] Petroleumsforskningen i 2015 – Forskningsrådets innsats [Petroleum research in 2015 – activities at the Research Council]. 978-82-12-03539-3.

- industrial development that promotes the transition to a low-emission society and gives greater consideration to climate and environmental challenges;
- openness about research-based knowledge;
- competence development and researcher training within research groups;
- structuring effects, particularly in terms of establishing collaboration that would not otherwise have been initiated;
- targeted international cooperation, where Research Council efforts help to activate research groups and trade and industry;
- launch of research and innovation activities that would not have taken place without public funding.

3 Objectives for the programme

Primary objective:

The DEMO 2000 programme seeks to ensure long-term competitiveness in the oil and gas industry and continued profitable and sustainable recovery of petroleum resources on the Norwegian continental shelf.

The aim of the DEMO 2000 programme is to demonstrate and qualify innovative products and systems in close collaboration between the supplier industry, petroleum companies and research institutes, Demonstration and qualification activities are to be carried out under realistic conditions offshore or in suitable facilities on land.

Secondary objectives:

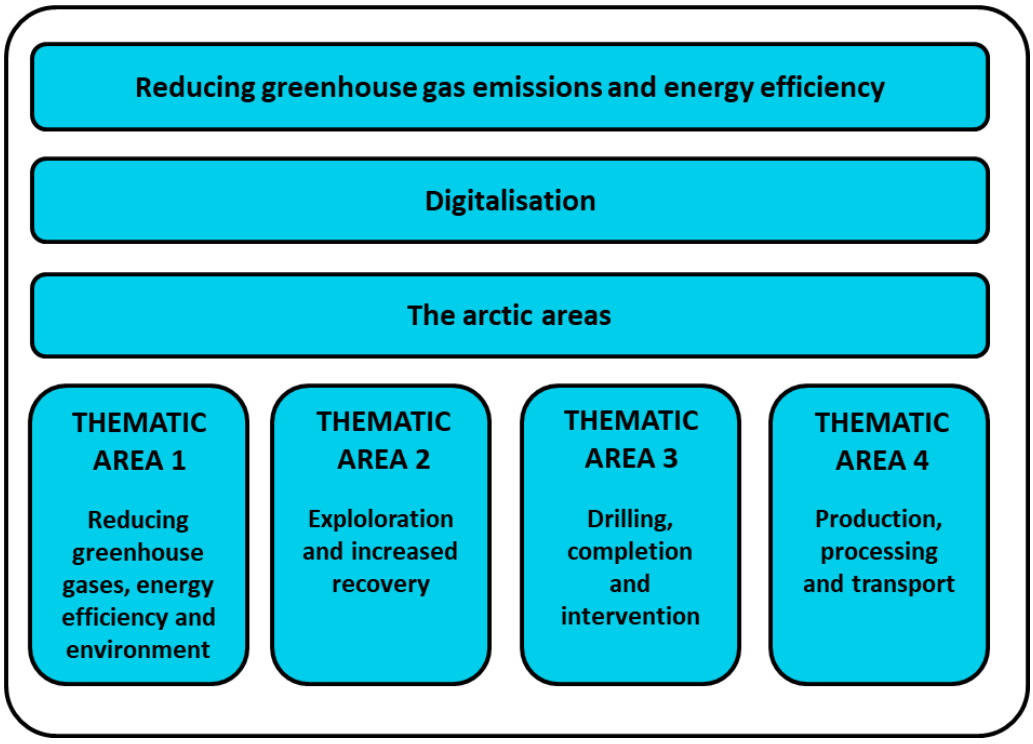
Funding from the DEMO 2000 programme is intended to help reinforce the industry's own efforts to develop innovative technology and to encourage projects that carry high socio-economic benefits. The DEMO 2000 programme will through pilot testing and demonstration promote:

- increased recovery and more discoveries;
- reduction of greenhouse gas emissions and environmental impacts;
- cost-effective and energy-efficient solutions;
- improvements to health, safety and the environment;
- stronger petroleum-related industrial development, more rapid-paced innovation and enhanced competitiveness;
- maintenance and development of necessary expertise and employment for the industry.

4 Scientific priority areas

The DEMO 2000 work programme sets out four thematic areas. In adition there are three cross-cutting priorities that are to be addressed across all the thematic priority areas.

Applicants seeking to address the cross-cutting priorities must direct their grant proposal towards one or more of the four thematic priority areas set out in this work programme and explain how the cross-cutting priority will be integrated.



4.1 Cross-cutting priority areas

4.1.1 Reducing greenhouse gas emissions and energy efficiency

Petroleum activities on the Norwegian continental shelf accounted for approximately one-fourth of Norway's total emissions (CO_2 equivalents) in 2015.[7] Most of the emissions from this sector, roughly 81 per cent, are linked to power production.

For this reason, technology that reduces energy needs and helps to decrease greenhouse gas emissions is one of the cross-cutting priority areas set out in the work programme.

4.1.2 Digitalisation

The oil and gas industry is undergoing restructuring and technological transformation. Competence and technologies are needed across all the thematic priority areas that are based on automation, autonomy and ICT.

Technology and expertise are needed from the component level to the system level and in the following areas:

- data management and data quality;
- data integration, optimal information processing, model-based control, decision support and autonomous systems;
- robotisation and remote operations;
- virtual reality – simulation;
- data security and digital vulnerability.

[7] www.norskpetroleum.no

4.1.3 The Arctic areas

Roughly 65 percent of Norway's undiscovered petroleum resources lie in the Barents Sea.[8] The aim of this cross-cutting priority is to develop knowledge and technology to solve particular challenges in the currently opened areas of the Norwegian parts of the Barents Sea, including cold weather, shallow reservoirs, carbonates, long distances and logistics, and emissions to the external environment.

Creating new activity in Arctic areas is an overarching objective of the programme.

4.2 Thematic priority areas

4.2.1 Thematic priority area 1: Reducing greenhouse gases, energy efficiency and the environment

This thematic priority area encompasses development and demonstration of technology and expertise that supports exploration, development and production which will lead to reduced greenhouse gas emissions, improved energy efficiency and a smaller environmental footprint.

Technology needs:

- improved efficiency of and reduced greenhouse gas emissions from power and heat production;
- low-emission solutions;
- electrification;
- methane emissions and flaring;
- cleaning produced water, including EOR chemicals;
- cost-effective subsea safety barriers;
- integrated environmental monitoring and modelling systems;
- oil spill preparedness;
- technical safety barriers for the Arctic areas;
- improved weather forecasting and communications for the Arctic areas.

4.2.2 Thematic priority area 2: Exploration and increased recovery

Exploration encompasses expertise and technology related to the development of exploration technology relevant for the Norwegian continental shelf.

Increased recovery is limited to expertise and technology for the development and production of the reservoir in order to achieve a higher degree of utilisation.

Technology needs:

- improved methods for identification of oil and gas prospects;
- improved exploration technologies;
- Improved reservoir understanding and management;
- water diversion and radical new EOR methods;
- CO_2 for EOR and storage.

[8] Norwegian Petroleum Directorate (2017): Resource Report 2017. http://ressursrapport2017.npd.no/

4.2.3 Thematic priority area 3: Drilling, completion and intervention

This thematic priority area encompasses expertise and technology related to offshore drilling, well intervention and completion for recovery of petroleum resources. It also encompasses more climate- and environment-friendly, cost-effective drilling, completion and intervention, as well as plugging and abandonment of wells.

Technology needs:

- drilling and completion technologies for challenging reservoirs;
- drilling automation and autonomy;
- smart well solutions and well productivity;
- solutions for improved well bore positioning and navigation in the Arctic areas;
- reduced intervention costs and increased reservoir exposure from existing subsea wells;
- downhole instrumentation and power supply;
- plugging and abandonment of wells.

Research questions related exclusively to geothermal energy are covered under the Large-scale Programme for Energy Research (ENERGIX).

4.2.4 Thematic priority area 4: Production, processing and transport

This thematic priority area encompasses the technology and expertise necessary for safe, effective transport of the well stream from the well head to a platform, onshore facility or subsea facility. It also encompasses processing technology, marine operations, risers and platform technology.

Technology needs:

- life extension of infrastructure;
- improved utilisation of host platform by subsea developments;
- flexible and lean field development concepts;
- energy management, including power and heat production;
- produced water handling;
- integrated monitoring;
- process simulation and optimisation;
- unmanned operations, autonomous systems and decision support;
- efficient marine operations;
- multiphase transport, particularly for the Arctic areas;
- subsea technology, including all-electric subsea wells;
- solutions for tackling challenges related to ice and icing of installations and equipment
- pipeline technology;
- CO_2 capture from well stream and storage.

Downstream gas and oil processing, gas conversion and refining are viewed as an integral part of the downstream area and are outside the scope of this work programme.

5 Guidelines and requirements

5.1 Cooperation and user participation

5.1.1 Who can apply for funding?

Only companies that have been officially issued a Norwegian enterprise number under the Register of Business Enterprises may apply for funding under the DEMO 2000 programme. Grant applications must be submitted by a Norwegian supplier company or subcontractor. The project must be carried out in collaboration with an end-user, preferably a petroleum company, shipowner or other end-user of the technology.

Support granted by the DEMO 2000 programme must play a critical role in facilitating the implementation of the project or lead to changes in how the project is designed or implemented. The support is a means of reducing the level of risk or a catalyst to attract other industry financing and users. It is important that the projects clearly reflect the applicant institution's strategic priorities. For companies lacking sufficient resources or competence, the DEMO 2000 programme will attach importance to the ability of companies to obtain the necessary competence through cooperation with others, both from the business sector and from research institutions.

Oil companies on the Norwegian continental shelf are primarily to act as partners and contribute co-financing, piloting facilities and user involvement to the projects.

5.1.2 User participation

User participation and the participation of an end-user are mandatory requirements under the programme's calls for proposals. Such cooperation enhances the relevance and benefit of the project for development of the Norwegian continental shelf. Cooperation with research groups in areas where companies lack sufficient expertise or capacity is also encouraged.

By giving priority to a collaboration model in which petroleum companies participate as users, the DEMO 2000 programme can help to steer private financing towards key national objectives and promote national cooperation.

5.1.3 Interdisciplinary cooperation

The programme will work to mobilize new consortiums and will be open to collaboration across disciplines to address prioritised knowledge and technology needs within all of the programme's thematic areas. In special cases the programme may decide to issue targeted funding announcements requiring projects to incorporate multidisciplinary cooperation and interdisciplinary integration.

5.1.4 International cooperation

The DEMO 2000 programme is primarily focused on qualifying technology for use on the Norwegian continental shelf. In addition, the technology developed will help to safeguard Norwegian jobs by keeping the Norwegian oil and gas industry competitive. If foreign petroleum companies show an interest in Norwegian-developed technology and wish to try it out and qualify it on their respective oil fields, then these activities will be given equal status to tests carried out on the Norwegian continental shelf. The objective is to keep the ownership of the technology in Norway, thereby improving Norwegian competitiveness.

5.2 Type of support

The DEMO 2000 programme use the application type “Other support”, and will announce funding on a regular basis (1–2 times yearly) to support the industry’s needs. State aid awarded in the form of funding for ”Other support” is covered by *Article 25 of the General Block Exemption Regulation for state aid: Aid for research and development projects*.[9] Project activities are to primarily fall within the R&D category “experimental development” defined in Article 25 of the state aid rules. Funding under the DEMO 2000 programme may comprise maximum 25 per cent of overall approved project costs. This means that the remaining 75 per cent of the project costs must be covered by the applicant and partner institutions/end-users.

5.3 Competence-building and jobs

The petroleum deposits on the Norwegian continental shelf have created the foundation for a highly competent supplier industry that is internationally competitive. The industry provides advanced services and products both to the Norwegian continental shelf and abroad. In 2015, the petroleum sector accounted for 15 per cent[10] of Norway’s overall value creation and 40 per cent of national export revenues. This represents a significant contribution to the nation’s economy and welfare.

The oil and gas industry is present throughout Norway, with activities primarily concentrated along the coast from the Swedish border to Trøndelag. As petroleum activities are now moving northwards and into the Barents Sea, there is widespread interest in developing local competency of relevance to the industry.

Although certain segments of the supplier industry tend to have foreign owners, the industry stays in Norway because the country has world-leading clusters with relevant expertise and a willingness to innovate. It is critical for the DEMO 2000 programme to ensure that knowledge centres are established, expanded and that they remain in the country. In addition, the oil and gas industry has established very close working ties with the supplier industry, petroleum companies and the research sector that has given, and will continue to give, Norway a unique position in an industry with high value-creation and profitability.

The programme will work to establish new groups and safeguard employment in the existing community. The DEMO programme will give priority to projects that enhance national competence development and reflect national strategic priorities, and to projects where intellectual property rights (IPR) and jobs are retained in Norway.

5.4 Gender balance

In accordance with the Research Council’s gender policy, the DEMO 2000 programme will apply moderate gender quotas in the distribution of funding. The following sentence will be included in all funding announcements: “Assuming that all factors relating to scientific merit and relevance are essentially equal, priority will be given to projects led by women project managers.”

The programme will also recruit more women to sit on referee panels and expand the number of women giving presentations at the programme's meeting places.

[9] https://www.forskningsradet.no/en/State_aid_rules/1253979455092
[10] Proposition to the Storting, prop. 1 (2016-2017).

5.5 Dissemination of results

The projects themselves are responsible for disseminating individual results. The Research Council will help to give the results a wider profile. All projects awarded funding must actively disseminate their own technological developments via relevant channels.

Dissemination of results and knowledge is important for demonstrating the benefit to society of the programme and for compiling a fact base for use by the public authorities and decision-makers. The programme will give priority to disseminating results and facts at an aggregated level.

Dissemination activities will be targeted towards providing guidance to applicants and to increasing participation of new applicant groups. The programme will give priority to taking part in important meeting places and organising project workshops, applicant seminars and start-up meetings, as well as to providing advice and guidance to companies.

6 Anticipated results, impacts and societal outcomes

The DEMO 2000 programme will employ the Research Council's general quantifying mechanisms and programme-specific performance indicators to measure and assess whether the programme is on course in achieving its objectives. Certain indicators are related to the volume of grant proposals received, while others are related to the research results from the project portfolio. The programme will conduct regular analysis of the portfolio of concluded and ongoing projects as well as prepare an annual report as a basis for action plans and funding announcements.

In order to assess the programme's impacts and societal outcomes, the programme administration or programme board may initiate or conduct its own analyses and studies.

External evaluations will be required to obtain a comprehensive assessment of the programme's impacts and societal outcomes in terms of reputation, governance and organisation, additionality and achievement of objectives. External evaluations are resource-intensive and should be carried out when the programme is facing a major crossroads or when there are changes in framework conditions, and not as part of the ongoing administration of the programme. The decision to carry out an evaluation will be taken by the division research board.

An evaluation of the DEMO 2000 programme carried out in 2017 by Menon-Economics AS shows that the programme delivers considerable benefits.[11] The authors of the evaluation conclude that the DEMO 2000 programme has played a crucial role in implementing many new technologies on the Norwegian continental shelf.

7 Resources and budget

The programme has been in operation since 1999 and is primarily financed through annual allocations from the Ministry of Petroleum and Energy. Funding for the programme is linked to the political priorities that are current at any given time, and the level of support has varied.

[11] https://www.forskningsradet.no/prognett-demo2000/Nyheter/DEMO2000_nokkelen_til_innforing_av_ny_teknologi_pa_sokkelen (in Norwegian)

Aside from the guidelines given in the allocation letters from the funding ministries, the programme will not be specifying budget use for the individual thematic priority areas. The programme will work across all of the objectives in parallel to ensure that the funding announcements will have an optimal effect.

8 Governance and organisation

The programme board of the DEMO 2000 programme is appointed by and reports to the Research Board of the Division for Energy, Resources and the Environment. The activities of the programme board must comply with the framework documents approved by the division research board, including the work programme, action plan, long-term budget and schedule for funding announcements. The programme board's activities must also be in compliance with the Research Council's overall principles and guidelines for the operation of research programmes.

The Research Council administration is responsible for the programme's day-to-day operation and for ensuring that this complies with the framework documents, plans and guidelines for the programme. The Research Council administration will serve as the secretariat for the programme board and is responsible for ensuring that the programme board can carry out its tasks.

The selection of projects recommended for funding consideration is carried out by the programme administration in collaboration with the Technical Forum, which is appointed by the Norwegian Oil and Gas Association. Referee panels are appointed by the Technical Forum and the programme administration to assess the grant applications.

The valid guidelines from the Ministry of Petroleum and Energy set out the roles of the programme administration and programme board in the operation of the programme.

9 Other related instruments

The DEMO 2000 programme shares an interface with several related programmes at the Research Council, including the PETROMAKS 2, MAROFF, ENERGIX, MARINFORSK, CLIMIT, NORRUSS, POLARPROG, IKTPLUSS, NANO2021 and BIA programmes. All these programmes primarily support the R&D category "industrial development" as defined in the state aid rules, whereas the DEMO 2000 programme supports the category "experimental development" under the priority areas described in Chapter 4.

The SkatteFUNN scheme is a tax incentive scheme under which companies may deduct costs associated with research and development. It is a rights-based scheme that places no restrictions regarding number of employees, revenue or research topic on companies.

The Large-scale Programme for Petroleum Research (PETROMAKS 2): www.forskningsradet.no/petromaks2
The Innovation Programme for Maritime Activities and Offshore Operations (MAROFF): www.forskningsradet.no/maroff
The Large-Scale Programme for Energy Research (ENERGIX): www.forskningsradet.no/energix
The Research Programme on Marine Resources and the Environment (MARINFORSK): www.forskningsradet.no/marinforsk
The Norwegian RD&D CCS Programme (CLIMIT): www.forskningsradet.no/climit

The Research Programme on Russia and the High North/Arctic (NORRUSS): www.forskningsradet.no/norruss
The Polar Research Programme (POLARPROG): www.forskningsradet.no/polarprog
The Initiative for ICT and digital innovation (IKTPLUSS): www.forskningsradet.no/iktpluss
The Research Programme on Nanotechnology and Advanced Materials (NANO2021): www.forskningsradet.no/nano2021
The Programme for User-driven Research-based Innovation (BIA): www.forskningsradet.no/bia
The SkatteFUNN R&D Tax Incentive Scheme (SKATTEFUNN): www.skattefunn.no