norway exports™

research & development

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The **NORWAY EXPORTS** series provides timely, in-depth information on a selection of Norwegian companies, products and services in over 15 industrial sectors.

NORWAY EXPORTS is distributed free of charge through the Innovation Norway offices and Norwegian foreign service missions (see inside back cover), selected trade publications and at major conferences and trade fairs around the world.

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All **NORWAY EXPORTS** publications can be downloaded at **www.nortrade.com**

facts:

Norway in Brief
Size: 385,155 sq. km
(including the islands of Svalbard and Jan Mayen)

Population	4.7 million

Main Cities	**Population** (incl. suburbs)
Oslo	811,688
Bergen	213,585
Stavanger/Sandnes	173,132
Trondheim	147,139

GDP 2006	USD $261.7 billion

Exchange Rate:
NOK/USD 6.42 (average 2006)
NOK/EUR 8.05 (average 2006)

Exports and Imports 2006

	NOK bill.	USD bill.	Amount of GDP
Total Exports	1,002	156	46.6%
Total Imports	610	95	28.3%

Main Export Commodities
Oil & gas, metals, machinery, chemical products, fish & fish products, pulp & paper and ferro alloys

Main Import Commodities
Transport equipment, machinery, chemicals, textiles and metal products

Distribution

Norway Exports – Research & Development is distributed through the following channels:
- Innovation Norway’s offices and Norwegian embassies and consulates abroad
- The Norwegian Ministry of Foreign Affairs’ offices abroad
- The Norwegian Ministry of Trade and Industry
- The Research Council of Norway’s contacts and networks
- The Association of Norwegian Students Abroad’s (ANSA) contacts and networks
- The Confederation of Norwegian Enterprise’s (NHO) contacts and network
- Norwegian Chambers of Commerce worldwide
- Official state delegations in Norway and abroad
- The following trade fairs:
  - CIEPEC+EPTEE, Shanghai, April, 2008
  - OTC, Houston, May, 2008
  - BIO 2008, San Diego, June, 2008
  - NEFTEGAZ, Moscow, June, 2008
  - EUROSATORY Paris, June, 2008
  - ONS, Stavanger, August 26-29, 2008
  - NOR-FISHING, Trondheim, August, 2008
  - SMM, Hamburg, September, 2008

Recipients of Norway Exports – Research & Development will include:
- Relevant industry contacts in both the public and private sectors in Norway and abroad
- Relevant departments, politicians, and county and township offices in Norway
- Attendees of international events, meetings and trade shows where Innovation Norway or Norwegian embassies are represented

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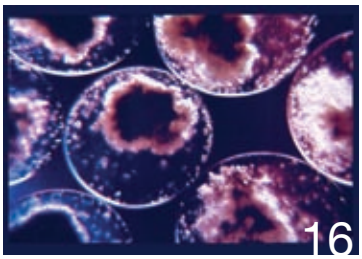

The biotechnology industry in Norway is playing an increasingly significant role in the search for solutions to global health problems. Ever since biotechnology was identified as a core focus area over two decades ago, public authorities and private enterprises have worked towards a bright common future.

The oil and gas industry is not only the largest in Norway; it is also a power on the world stage. With this strength comes an environmental responsibility, taken seriously by the Norwegian Government, research organizations and companies here in this country.

In January 2008, the Norwegian Government pledged to make the country carbon-neutral by 2030, fully 20 years earlier than had been previously planned. This promise rocketed Norway into a leadership role with the most ambitious climate policy target on the planet.

SPECIAL THANKS TO:

Arild Aspøy (Research Council of Norway), Kjetil Svorkmo Bergmann (Innovation Norway), Kim Davis (Research Council of Norway), Arvid Hallén (Research Council of Norway)

alphabetical listing

NORWAY EXPORTS – Research & Development

northern advantages

Norway is among the most productive countries in the OECD area. In the 2007 report “Going for Growth”, the OECD ranked Norway second when it comes to worker productivity. Norway is also among the highest ranking countries regarding publicly funded Research and development.

Research-based innovation is one of the strongest drivers of economic development. Globalization affects not only products and services, but also knowledge and research. The competitiveness of industry depends more and more on the ability to attract investments internationally. Norway has a good starting point to include foreign research and development activities in this equation. We educate excellent workers and have a creative atmosphere in the open, flat organizational structure that characterizes Norwegian industry. The cooperation between industry and scientific knowledge-based organizations is also excellent. These advantages are reflected in the increased foreign investment in Norwegian research and development. From 1995 to 2005 foreign investment in Norwegian R&D increased by 300%.

Norway focuses outward in fostering knowledge and promoting the exchange of ideas. Our challenge is to advance national research internationally, both in cooperation with other countries and with scientists from other countries. The emphasis is on knowledge and expertise in selected areas, such as top-notch petroleum research environments. In addition, special attention is being paid to energy and the environment, health, oceans and food, as well as to three technology areas – new materials and nanotechnology, biotechnology, and information and communications technology. Naturally, cooperation with the EU is a focal point for Norwegian R&D and the trigger for closer integration in the European Research Area (ERA). The Norwegian success rate in the EU is high when it comes to research. The EU approved of 35% of all research projects that had Norwegian involvement in the 6th framework programme. This is well above the average of approximately 20% approval rate for European countries. Furthermore, bilateral cooperation with North America and Asia is being strengthened.

We want to wish our R&D colleagues from abroad a warm welcome to Norway as partners in research. We’ll be happy to help you find partnership opportunities within Norwegian research activities.

In this magazine you will find examples of how we work within several of the most important research areas in Norway. Please enjoy reading this publication and welcome to Norway, an exciting R&D nation.

arvid hallén

Director General of the Research Council of Norway

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NORWAY EXPORTS – Research & Development

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– We give local ideas global opportunities

Innovation Norway offers products and services to increase innovation in industry throughout Norway, to help develop the regions and promote Norwegian industry and internationalization, and to promote Norway as a tourist destination.

With offices in more than 30 countries worldwide and in all Norwegian counties, Innovation Norway is easy to reach. Its staff has knowledge of local and international factors that will help turn its customers' ideas into business successes.

Products Tailor-Made to Customers' Requirements

Innovation Norway assists the entirety of Norwegian industry, but has particular responsibility for aiding entrepreneurs and assisting small and medium-sized companies with an ambition and potential for growth.

Innovation Norway offers:

- Funding provided as loans, guarantees and equity capital programmes
- Advisory and expertise development measures
- National and international network building and technology transfer
- Marketing of Norwegian industry and Norway as a tourist destination

With these measures as a point of departure, Innovation Norway customizes its products and services according to the needs of each individual client. Through its offices in Norway and abroad, Innovation Norway's clients also gain access to services from other public agencies – such as the Research Council of Norway, the Norwegian Design Council and the Industrial Development Corporation of Norway (SIVA).

Dynamic & Result-Oriented

Innovation Norway supports the profitable development of industry in both individual companies and in society at large:

- Innovation Norway contributes to the creation and securing of 9,000 jobs annually
- Customer surveys show that 90% of Innovation Norway's funds have been allocated to projects viewed as important to companies' survival and profit growth

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Innovation Norway took over the tasks of the Norwegian Trade Council, the Norwegian Industrial and Regional Development Fund, the Govt. Consultative Office for Inventors and the Norwegian Tourist Board on January 1, 2004.

northern alliance –

funding r&d projects in norway

Norway has a technologically advanced society, with a positive interplay between business, research and government funding. Norway has the 3rd biggest budget for publicly financed research and development in the OECD. Add to this that the general level of education in Norway is very high, and you have the perfect foundation on which to build alliances and partnerships.

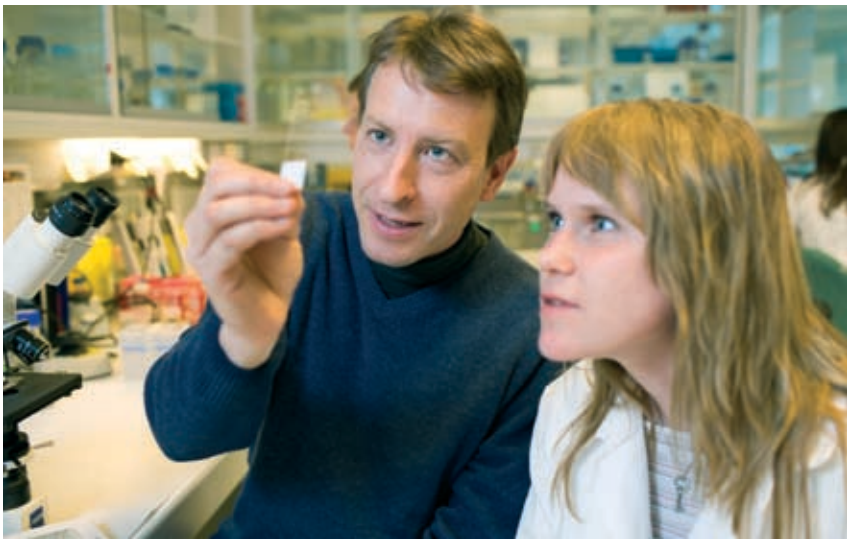
The Research Council of Norway (RCN) is a national strategic body and funding agency for research activities. The Council collaborates with research institutions as well as the private and public sector to create new patterns of planning and cooperation that facilitate the realization of common goals.

A Central Role in Norwegian Research

Companies that invest in R&D in Norway are also offered RCN guidance and project funding. In addition to RCN's own research programmes, which offer a range of opportunities for project funding, the Council also assists companies in forming strategic alliances internationally and obtaining international financial support for research.

RCN responsibilities include the administration of SkatteFUNN, a tax incentive scheme that grants an 18 or 20% tax deduction for R&D activities up to NOK 8 million (EUR 1 million).

In addition, RCN cooperates closely with Innovation Norway and the Industrial Development Corporation of Norway (SIVA) to ensure optimal growth conditions for business.



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The Centres for Research-based Innovation (CRIs) aim at enhancing the capabilities of the business sector to innovate by focusing on long-term research based on forging close alliances between research-intensive enterprises and prominent research groups.

Finding Partners in Norway

The Research Council of Norway can help you find partnership opportunities within Norwegian research activities. Visit www.rcn.no/industry to learn about the possibilities for information and financial support for R&D activities in Norway.

RCN helps companies go further – to use research and innovation to expand frontiers, grow and become more profitable. Visit the Council at www.rcn.no/industry

The Research Council of Norway

The Research Council of Norway

pioneering micro- and nanotechnology will help diabetes patients:

big ambitions for a tiny implant

A technology developed by the Norwegian company Lifecare AS can help millions of diabetics worldwide, and contribute to industrial development in Norway in the process.

By employing completely new, groundbreaking micro- and nanotechnology, the small start-up company is seeking to revolutionize diabetes treatment – while making the lives of diabetes patients simpler and safer.

Diabetics check their blood sugar levels several times each day by pricking a finger and squeezing a drop of blood onto a glucose meter. Their monitoring kit has to accompany them wherever they go.

In 2006, Lifecare sought funding under the Research Council's programme for user-driven innovation (BIA) to develop a device that could be implanted in the body to continuously monitor blood sugar levels. The finalized version of the device will be unimaginably tiny, but will nevertheless contain a sensor, membrane, radio transmitter and power supply unit. The device will fit on the tip of a syringe for surgery-free implantation.

Completely New Knowledge

"We didn't base this project on existing knowledge – we devised something completely new based on osmotic pressure," states researcher and Project Manager Erik Johannessen enthusiastically. He expects the project to deliver significant findings in the spring of 2008.

"The most difficult part is constructing the membrane," he explains. "The membrane is the barrier between the sensor and the body. It has to be porous, and making pores at the molecular level is very challenging. But we believe we will succeed in the course of the spring. Another major challenge is how to get the human body to accept the sensor and not reject it or encapsulate it."

Lifecare is collaborating with eminent international research groups at the Swiss Center for Electronics and Microtechnology, Inc. (CSEM) and the University of Glasgow, which are providing assistance in creating the membrane. Finland's leading technological research institute, VTT Electronics, as well as 3M of the USA and MicroTEC of Germany are also providing expertise.

The goal is to market a prototype in 2010.

Vast Potential

Diabetes is a growing problem in many parts of the world, and the costs to society of treating this disease are rising. Diabetes is the seventh most common cause of death in the USA. According to statistics from the *International Journal of Fertility and Menopausal Studies*, diabetes causes more deaths among women than breast cancer, so improved treatment methods are of potential economic importance.

From a business standpoint, the potential is just as great. "Our product will compete directly with existing glucose meters on the market. A global market share of 2.5% would yield an annual turnover of over NOK 1.5 billion," Dr Johannessen figures.

Photo: Tore B. Jørgensen, Atlantia

Erik Johannessen shows Lifecare's blood sugar monitoring implant, scheduled for market in 2010.

ansa

(association of norwegian students abroad)

ANSA – the Association of Norwegian Students Abroad – is a non-profit, independent organization voicing the interests of Norwegian students who study abroad. Currently 22,000 Norwegian students are studying abroad in over 60 countries at over 1,200 educational institutions worldwide.

ANSA was founded by Norwegian students in 1956, and through the years ANSA has worked to improve and change the rules and regulations governing grants and loans for students abroad. ANSA believes that all students should have the right to study any subject in any country they wish.

ANSA provides a broad range of services to students before, during, and after their studies abroad:

Before Studies

ANSA is the national Information Centre for higher education abroad. The Information Centre is funded by the Ministry of Education and Research and gives unbiased advice on higher education abroad. Its five full-time educational advisers visit schools and student recruitment fairs, give individual counselling, and publish information both in print and on the Internet.

During Studies

As the welfare organization of Norwegian students abroad, ANSA offers services and funds social events for its members during their studies. Members are organized locally in 21 groups spread all over the world, and more than 500 volunteers arrange various events and represent ANSA where they study.

Members also run professional committees in a variety of subjects. These committees arrange meetings for professional development and networking, often in close collaboration with Norwegian organizations such as Tekna (science and engineering), *Siviløkonomene* (business administration) and *Den norske lægeforening* (medicine).

In cases of international crises, ANSA cooperates closely with the Ministry of Foreign Affairs to secure the safety of Norwegian students abroad. ANSA also works with the Norwegian Church Abroad (*Sjømannskirken*) and the Student Health Services at the University of Oslo in giving individual aid to students in difficulty.

In cooperation with Norwegian service providers, ANSA offers high-quality and cost-effective banking and insurance solutions tailored to the needs of students abroad.

On the political front, ANSA acts as an advocate for students and studying abroad through its relations with the Ministry of Education and Research, the Norwegian State Educational Loan Fund (*Lånekassen*) and other players in the field of higher education. Six hundred yearly quotations in the media make ANSA's views known both to politicians and the general public.

After Studies

ANSA Alumni is a career network set up to help former students gain access to the Norwegian job market. ANSA Alumni arranges seminars, cooperates with ANSA's professional committees and offers an extensive network for job recruitment.

ANSA also maintains close connections with both public and private Norwegian employers, and with the Confederation of Norwegian Enterprise (NHO). Employers regularly advertise for candidates in ANSA's magazine *ANSAnytt* and through ANSA's mailing list. Every year ANSA organizes a Symposium where employers and students meet to discuss job opportunities.

ANSA
Association of Norwegian Students Abroad

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Website: www.ansa.no

ANSA attends to the professional, economic, social, and cultural interests of Norwegian students abroad, and strives to strengthen the appreciation of the resources these students represent because of their international experience and qualifications.

Search for jobs and career opportunities in Norway

www.careerinnorway.no

The Norwegian economy has never been in better shape.
While this is obviously good news, it's also a problem:
Norwegian companies don't have enough qualified personnel to handle high-tech applications and advanced Norwegian technology in order to keep pace with market growth. Therefore, Norwegian businesses are eager to recruit skilled labour from all around the world.

At **www.careerinnorway.no** job seekers can search for different vacancies by keywords, job title, categories or company name. This is the first service providing information and available positions for foreign employees looking for a career in Norway. The website also contains articles and other relevant information about working and living in Norway.

For more information send an email to *post@careerinnorway.no*

www.careerinnorway.no

norway exports™ nortrade.com™

farming the sea

By Nancy Bazilchuk

Norwegians have long been seafaring folk, with their livelihoods and well being reliant on the ocean's bounty. More than 1,000 years ago, Norsemen set out on the North Atlantic, exploring and briefly colonizing Iceland, Greenland and North America, with at least five expeditions to North America between 985 and 1011. Those expeditions were only possible because of Norwegian fish, caught from their spawning grounds off the Lofoten Islands, where literally millions of cod come dependably each winter. Norwegian fish fed the Vikings, brought wealth in the Middle Ages to the Hanseatic League, and in the centuries afterwards, provided a good livelihood for thousands of Norwegian fishermen.

These days, Norway's economic well-being is first and foremost dependent on a different North Sea product, petroleum. And the fisherman's world has changed as well. While fishing remains important to Norway's economy and culture, it is aquaculture, particularly the farming of Atlantic salmon and trout, that provides the fisheries industry its real economic powerhouse, with Norway ranking among the top ten aquaculture nations on the planet.

A Record-Breaking Year

In 2006, the latest year for which figures are available, Norwegian fish farmers sold a record NOK 17 billion worth of farmed fish, up 26% from 2005 and the highest value ever recorded. In contrast, Norwegian fishermen in the same year sold NOK 12 billion worth of wild fish. In fact, the United Nations Food and Agriculture Organization (FAO) reports that aquaculture worldwide continues to grow more rapidly than all other animal food-producing sectors, at an average rate of 8.8% per year since 1970, compared with only 1.2% for capture fisheries and 2.8% for terrestrial farmed meat production.

"Aquaculture is a significant industry in Norway, but it is also the most rapidly growing source of animal production in the world," says Trond Storebakken, Director of the Aquaculture Protein Centre, a collaborative of the Norwegian School of Veterinary Science (NVH), the Norwegian University of Life Sciences (UMB) and the former AKVAFORSK, the Institute of Aquaculture Research, which is now part of a new industry-oriented research group that includes the Norwegian Institute of Fisheries and Aquaculture Research, Matforsk and Norconserv. "Seafood is the highest quality food, and world demand is increasing at a tremendous rate, while wild catch is declining ... sustainable development in fish farming worldwide can make a significant contribution to world food production."

There's no question that Norway's deep, clean fjords and abundant wild fish stocks provided the country the foundation for its leading position in the aquaculture world today. But the real secret behind Norway's success has been the country's focused investments in aquaculture research and development. From 2000 to 2005, for example, the Research Council of Norway (RCN) invested NOK 460 million in aquaculture research, an amount more than matched by industry expenditures.

Beginning in the early 1970s, Norway was a pioneer in salmon farming. Since those early days, researchers have explored

© Marine Harvest

Norway has pioneered nearly every aspect of salmon farming, from genetic research to development of ocean-based fish cages.

every aspect of fish cultivation, from improving genetic stocks, to developing new types of feed and feeding technology, to learning more about fish behaviour, health and well-being. They're also working on developing and expanding the aquaculture market for cod, halibut, and a range of other marine species, along with tropical freshwater fish, such as tilipia, for farming in developing countries.

Feeding Fish, Feeding the World

One of the big challenges facing modern-day aquaculture is fish feed itself. In an ideal world, salmon, trout and other carnivorous fish need fish fats and proteins to grow and thrive, but the ability of the marine catch to feed both people and serve as a basis for fish feed is limited. If current trends continue, "we are going to need 80 million tonnes of fish feed by 2025," says Storebakken, the APC's director. Aquaculture researchers across the globe are scrambling to find ways to produce healthy fish feed using alternative protein sources. The importance of this problem is one reason the APC was recognized in 2002 as one of Norway's first Centres of Excellence, a designation awarded by the Research Council.

It's possible to boost the amount of plant proteins in fish feed, but that has to be done carefully, Storebakken says. "Carnivorous fish have not been good about eating their vegetables over evolutionary time," he jokes. APC scientists are looking at the complex reactions that different species of fish may have to plants used as a component for fish feed.

Another avenue being explored at the APC and at the Institute for Marine Research (IMR) in Bergen is the use of plankton or krill as a basis for fish feed and food for humans. While it's estimated that just one or two percent of the plankton in the seas would be sufficient for the global aquaculture industry's feed ingredients needs, Norwegian researchers are also studying plankton populations to make sure that using plankton for feed won't disturb marine ecosystems. This research is being conducted at the IMR, and is funded by a Research Council programme called HAVKYST – Oceans and Coastal Areas, which focuses on marine ecosystem research and has a budget of roughly NOK 81 million for 2008.

At the APC, researchers are working jointly with Krill Seaproducts AS of Ålesund to evaluate the use of Antarctic krill in fish feed. The Norwegian Directorate of Fisheries recently granted three Norwegian companies the right to harvest 400,000 tonnes of krill annually, as approved by CCAMLR, the Commission for the Conservation of Antarctic Marine Living Resources. Storebakken says one of the challenges of using krill for fish feed is that the shells contain high levels of fluoride.

Good nutrition is also critical for healthy fish growth, as researchers at Nofima's Akvaforsk Sunndalsøra branch can attest. Led by Grete Bæverfjord, researchers at the Sunndalsøra facility are studying skeletal malformations in farmed salmon and cod, as one of numerous projects funded under the RCN's HAVBRUK, one of the council's major research programmes extending from 2006-2015. HAVBRUK had an annual budget of approximately NOK 116 million in 2007; in 2008, 25 new research projects funded at NOK 29 million were added to the programme's roster.

Bæverfjord's research cooperative involves scientists from other branches of Nofima, as well as NIFES, the Norwegian Institute

Land-based facilities are used to produce juvenile fish for aquaculture.

for Nutrition and Fisheries Research, IMR, the University of Bergen, and the company Marine Harvest. The researchers are also working with aquaculture scientists in Sweden, the Netherlands, Belgium, Canada and Portugal. “There’s less attention paid to skeletal deformations in other countries, but these researchers have different approaches that are important to consider in our analyses,” Bæverfjord says in the RCN’s Forskning magazine.

A Place to Study Fish

Top-notch research needs top-notch research facilities, which helps explain the successes achieved by Norwegian aquaculture researchers over the decades. At the University of Life Science in Ås, for example, NOK 4 million has been invested in expanding the university’s fish laboratory, where researchers can work on physiology, behaviour, feed and broodstock, along with the possibility of using radioactive tracers in various ways. NTNU SeaLab in Trondheim also offers specialized facilities for farming juveniles and the study of live feed, along with chemistry and processing laboratories.

A multifaceted consortium funded by the Research Council, called CREATE, the Centre for Research-based Innovation in Aquaculture Technology, is being hosted by SINTEF Fisheries and Aquaculture. CREATE is a specially designated Centre for Research-based Innovation, with a budget of NOK 160 million over eight years and a range of partners, including NTNU, the Institute of Marine Research in Bergen, the Nofima group, AKVA group, Helgeland Plast, Egersund Net and Erling Haug.

CREATE has an ambitious 10-part research agenda: the reduction of escapes and nutrient pollution; fish welfare; monitoring and control of water quality; sea loads; reduction and control of fouling; handling net cages; feeding systems; sorting and handling live fish; control and optimizing of production; and traceability. “For the most part we’re focusing on those aspects of aquaculture that take place in the sea,” says Arne Fredheim, research centre director.

In the Genes

From the very first days of Norwegian aquaculture, researchers have used conventional breeding techniques to improve fish stocks. Now, Norwegian farmed salmon are among the most efficient converters of feed on the planet, and selective breeding has contributed to this. Selective breeding research continues at Nofima and a number of private companies have breeding programmes, such as Marine Breed for Atlantic cod, and Salmobreed and Aqua Gen for Atlantic salmon.

These days, however, researchers work on using molecular genetics tools for the genetic improvement of stocks. Anna Sonesson, a Nofima senior researcher, says high density molecular genetic information from the whole genome can be used to select for traits such as disease resistance that are particularly difficult to select for by using conventional breeding. “We are working with Aqua Gen to develop and implement these techniques in their breeding programme for Atlantic salmon,” she says.

A five-year-long NOK 65 million marine genomics resource, competence and service platform called GenoFisk was established by the RCN in 2006. Norwegian researchers have already been busily working with an international collaborative to sequence the salmon and cod genomes, and GenoFisk will help coordinate that work, along with sponsoring the study of specific functional genes in farmed fish. Researchers at the Norwegian School of Veterinary Science are also exploring disease-related genes in Atlantic salmon, while scientists at the Norwegian College of Fishery Science in Tromsø are looking at the salmon’s first line immune defences against viruses.

Halibut farming has proved to be more challenging than salmon farming, but companies like Marine Harvest have worked to try to make the endeavour profitable.

© Marine Harvest

Norwegian-based companies such as Akvaforsk Genetics Center AS, GenoMar and AquaGen are also using genetic tools to improve aquaculture fish stocks. AquaGen works with developing broodstock for salmon and rainbow trout, whereas GenoMar in Oslo has commercialized a tilipia broodstock and is now working on GenTrack, a patented DNA fingerprinting technique. Akvaforsk Genetics Center AS works with a range of species, including salmon, trout and cod, but also sea bass, sea bream, halibut and carp.

Beyond Salmon: Cod and Halibut

In 1866, the legendary Norwegian marine biologist G.O. Sars was the first to artificially hatch cod, followed by the establishment in 1882 of a Norwegian cod hatchery by G.M. Dannevig. The hatchery produced 35.5 million cod fry in 1886, and a whopping 327 million fry in 1896, which were released to the ocean an unsuccessful attempt to increase cod populations. In spite of this early start, however, salmon, not cod, has dominated Norway's aquaculture landscape.

Targeted research and development efforts, along with willing entrepreneurs, have led to explosive growth in the cod farming industry, with production increasing from just 946 tonnes in 2003 to more than 10 000 tonnes in 2006. In 2002, the Norwegian Cod Breeding Programme was established in Tromsø, in an effort that expands on earlier efforts at the former AKVAFORSK, now Nofima, and at the IMR in Bergen. In late 2007, researchers at the Tromsø Cod Breeding Programme announced they had established 190 cod "families" with which to work. Private companies are also busily breeding cod; one such firm is Marine Breed AS, a subsidiary of the Akvaforsk Genetics Center AS.

Researchers are hoping similar success can be had with halibut farming, which has proved challenging to develop on a commercial basis. Researchers at the IMR recently made a major breakthrough in their studies of juvenile halibut development when they found that periods of dark and times without access to feed helped improve two key halibut development milestones. Roughly 1,500 tonnes of halibut were farmed in Norway in 2006, half of which was sold for export.

At Bodø University College's Department of Fisheries and Natural Sciences, researchers are looking at ways to produce all female stocks of halibut. The studies could lead to more profitable halibut farming, because female halibut are larger than males, says Oddvar Ottesen, a researcher at the university college. He says it's important for aquaculture to improve its ability to help feed the world in the future. "Aquaculture products will be increasingly important as a food resource globally, and for the food supply of the globe," he says.

Every aspect of Norway's aquaculture industry has been carefully developed to provide optimal conditions for fish health, welfare and growth.

AQUACULTURE

Aquaculture is one of the Research Council of Norway's large-scale programmes. The programme finances projects that form a basis for a value-added aquaculture industry based on market focus and sustainable production.
For more information on the Aquaculture programme, visit **www.rcn.no/havbruk.**

© Marine Harvest/Steinar Johansen

the spirit
of growth

By David John Smith

The biotechnology industry in Norway is playing an increasingly significant role in the search for solutions to global health problems. Ever since biotechnology was identified as a core focus area over two decades ago, the Norwegian Government, the Research Council of Norway, biotech companies, the university environment, as well as independent research institutions have all worked towards a bright common future.

There are now more than 100 Norwegian biotechnology companies and research institutions doing a thriving business within areas that include diagnostics, therapeutic and vaccine healthcare, agri- and marine biotech, environment, and bioprocessing. Together with this expansion, an increasingly active international cooperative network is resulting in a positive impact being felt far beyond Norway's borders.

Ole Jørgen Marvik, Coordinator of Life Sciences for Innovation Norway, reflects upon the spirit of growth here in this country; "Over the last 10 years Norway has seen a tremendous growth in the entrepreneurial spirit, giving rise to more than 80 new companies focusing on biotechnology. While human and veterinary medicine has dominated this first generation, we will most certainly during the next decade see how biotechnology will expand into the agricultural and renewable energy industries and provide sustainable solutions to environmental problems in the form of waste management and cleaner industry processes. Correspondingly, Innovation Norway supports the biotech industry through several of its different industry programs aiming to maximise technological synergies."

Bringing it All Together

Founded in 2001, the Norwegian Bioindustry Association (NBA) is the member organization for biotechnology companies. Members, all mainly within the medical or pharmaceutical field, include start-up companies and SMEs as well as larger established corporations with international clientele. NBA members typically are involved in the development of new products and technology.

The NBA strives to facilitate successful communication between the biotech industry and politicians, authorities and the general public. This in turn creates synergies for bridge-building between industry and research institution – in addition to improving the possibilities for entrepreneurial and start-up support. One area showing particularly notable growth is the number of companies doing business within marine biotechnology.

© NBA

Thor Amlie, CEO of the Norwegian Bioindustry Association.

An important role for the NBA is to profile the high standard that Norwegian biotech companies bring to the marketplace. The global environment welcomes this consistent quality, as witnessed by the fact that international pharmaceutical companies are becoming increasingly involved in developmental projects and clinical trials here in this country. At the same time, a wide range of smaller companies also enjoy success.

The majority of the Norwegian biotech companies can be characterized as small, but growing. There are also numerous companies listed on the Oslo Stock Exchange, including Algeta, Biotec Pharmacon, Clavis Pharma, DiaGenic and NutriPharma to name a few. As its success and international stature grows, the Norwegian biotechnology industry is experiencing wide optimism – just as the global environment is becoming more aware of this positive momentum.

Reaching Out

Continued internationalization is a top priority in the Norwegian Government report "Commitment to Research". This report guides governmental activities as

well as the Research Council of Norway's overall strategy related to biotechnology, enhancing scientific merit and in turn promoting innovation and the development of knowledge-based industries in Norway. Recent developments in this direction include the easing of restrictive regulations related to stem-cell research and pre-implantation Genetic Diagnosis (PGD) in Norway. In addition, the Norwegian Parliament has also adopted a governmental proposal that Norway became a member of the European Patent Organisation effective in 2008.

The Research Council of Norway is central in the R&D process, administrating and distributing public funding through a wide range of projects that include large-scale biotechnology research programmes; FUGE, a functional genomics project; PROSBIO, research within bioprocessing; and MABIT, marine biotechnology. See the separate article profiling the Research Council of Norway.

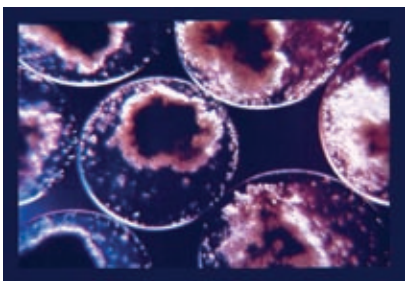
The Largest in Scandinavia

Another important support and knowledge leader in Norway is the SINTEF Group, Scandinavia's largest research organization. Extremely active within various areas of biotechnology and bioprospecting, SINTEF also has broad focus that encompasses numerous other areas of expertise. A multi-disciplinary research institution with employees from 50 countries, SINTEF provides research-based knowledge and related services based on deep insight into technology, natural science, medicine and the social sciences.

The education research environment includes the Protein Engineering and Proteomics (PEP) group at the Norwegian University of Life Sciences, involved in several research projects mainly related to protein science. These projects range from fundamental structure-function studies on the folding, stability and functionality of individual proteins to applied studies in enzyme technology for biomass processing. Very active in protein engineering, PEP also focuses on protein and proteomics oriented research in the field of lactic acid bacteria.

Taking it to the World

One strength of Norwegian biotechnology is the ability to research and develop a product – and then translate that to business success. The list of successful companies in Norway is a long one, including Pharmexa; a company that has built a strong pipeline in a broad range of therapeutic fields. Other excellent examples include Axis-Shield, a global company with an ongoing mission to improve healthcare through development and sales of in-vitro diagnostics products; ClavisPharma, developing pharmaceuticals using Lipid Vector Technology (LVT); and Nova Matrix, one of the world's leading producers and suppliers of ultra pure, well-characterized and documented biopolymers and biomaterials for use in pharmaceutical, biotechnology and biomedical applications.



© Nova Matrix

Nova Matrix has developed a unique selfgelling/injectable alginate system that is bio compatible and gives a controlled biodegradability.

Nova Matrix technologies are used to develop novel drug delivery therapies, with an ongoing dedication to R&D is central to company success. Recent breakthroughs include work being done with alginate foams that offer a wide range of possibilities for overcoming biomedical challenges within areas such as tissue engineering, medical implants and wound management. Nova Matrix has also developed a unique self-gelling/injectable alginate system, bio-compatible and providing controlled biodegradability.

Early Detection Saves Lives

R&D has translated into success on an international scale for NorDiag ASA. Starting with one product, the DNA-based faecal test GeneFec – used for the early detection of clorectal cancer - NorDiag's product portfolio expanded with the acquisition of Genpoint AS in 2007. The

company offers automated solutions, including instruments, software and kits, for sample preparation for sexually transmitted diseases, tuberculosis, MRSA and other pathogens. In addition, the company's instrument platform will support future applications in the cancer segment as well.

Specifically, NorDiag develops automated sample preparation for isolating DNA/RNA from bacteria, viruses and cells from clinical samples such as urine, swabs, sputum, and stool. Automated systems and tests assist in the detection of colorectal cancer at a precancerous or early stage, and mutation tests that are designed to predict a patient's response to specific drug therapy. As Mårten Wigstøl, CEO, indicates; "NorDiag's core competence is automated systems for isolation of DNA/RNA from difficult clinical samples, where the end user value proposition is increased workflow, reduced labor cost, and reproducible results."

Innovative Success

The Oslo Innovation Centre (see separate article) is a place of innovative R&D creativity for over 140 companies, many working within the biotechnology field, including Diatec Monoclonals, an accredited supplier of monoclonal antibodies to some of the largest companies in the diagnostics industry. Production of monoclonal antibodies, custom conjugations to enzymes and fluorochromes and other related activities require the highest level of quality assurance, and the company's long list of satisfied customers show that they are succeeding.

Loyal customers that literally span the breadth of the biotechnology industry and include Affitech, Axis-Shield Diagnostics, Invitrogen Dynal, and a host of others. Ongoing development with an emphasis on the collaborative approach with clients is important to the company, as indicated by Lill Aarseth, Contract Production Manager; "Diatec Monoclonals is dedicated to becoming a leading supplier to the industrial market for diagnostic applications. Key to our success is cooperation with customers to upgrade their production of monoclonal antibodies as well as testing new serum-free media for more documented processes and final products used in diagnostics."

Working with the Best

The list of successful biotechnology companies affiliated with Radium Hospital/Rikshospitalet (see separate article) is impressive, including Affitech, a privately held Oslo-based biotechnology company that has developed a comprehensive package of innovative technologies for the generation and use of human antibodies. Cooperative R&D activities translate into success for the company, most recently when partner Peregrine Pharmaceuticals announced that its anti-VEGF antibody R84, an antibody identified by Affitech, selectively blocks the interaction of vascular endothelial growth factor (VEGF) to VEGF receptor 2 (VEGFR2); and is as effective as Avastin® (bevacizumab) in inhibiting growth of established tumors in a preclinical breast cancer model.

Affitech CEO Martin Welschof, Ph.D commented; "We are delighted with the in vivo results and Peregrine's decision to evaluate R84 as a candidate for further preclinical studies and potential clinical development." Established in 1997, the company's mission is to become a leader in the discovery and development of proprietary antibody-based therapeutic products, addressing significant medical needs. Affitech has received worldwide attention for its proprietary technologies, including its dominant worldwide patent position on phagemid-display of antibodies.

Looking to the Sea

With nearly 22,000 kilometres of coastline, Norwegians naturally look to the sea to unlock biotech secrets. The Trondheim-based Norwegian University of Science & Technology (NTNU) is in the thick of this

© NorDiag

NorDiag Bullet, an automated sample prep instrument for difficult clinical samples.

bioprospecting activity. NTNU is also the site of the newly established Centre for Marine Bioactives and Drug Discovery (MabCent), working to discover the unique yields that the sea has to offer. With approximately 20 marine biotech companies operating in the Trondheim-region, MabCent is at the core of this promising area of discovery. Close collaboration is essential, and MabCent works with marine biotech companies such as Lytix Biopharma, Biotec Pharmacon, Probio Nutraceutical and Pronova Biopharma to unlock the health secrets of the ocean.

The Trondheim-based company Aqua Gen's focus on renewal, effectiveness and quality improvement has again paid off as it was awarded the Innovation Prize 2007 for the development of a machine for the high quality grading of fertilized Samonid and Trout eggs. The result of a three-year project, this technological innovation improves markedly improves product quality, reduces costs, and increases the welfare factor.

Aqua Gen has decades of biological and technological experience focused on the further development of aquaculture in a profitable, sustainable and environmentally friendly way, and the Innovation Prize only confirms that the company is continuing to move in the right direction. Another company enjoying international success is Akvaforsk, specializing in applied genetic research in aquaculture. With more than 30 years of success, the company ranks among the world research leaders in its field. Working side by side with the aquaculture industry is important to Akvaforsk's successful activities, including research and applied work on genetic improvement on selective breeding covering 11 species worldwide.

Tales of the Sponge

Professor Sergey B. Zotchev of the NTNU biotechnology department, together with fellow professor Geir Johnsen, knows that secondary metabolites produced by microbes have wide ranges of individual characteristics and may hold keys that can unlock doors to important drug discoveries. The attention of Zotchev and Johnsen has been drawn to sea sponges, simple sea creatures that are in an ongoing battle against the billons of micro-organisms that are found in every single litre of salt water.

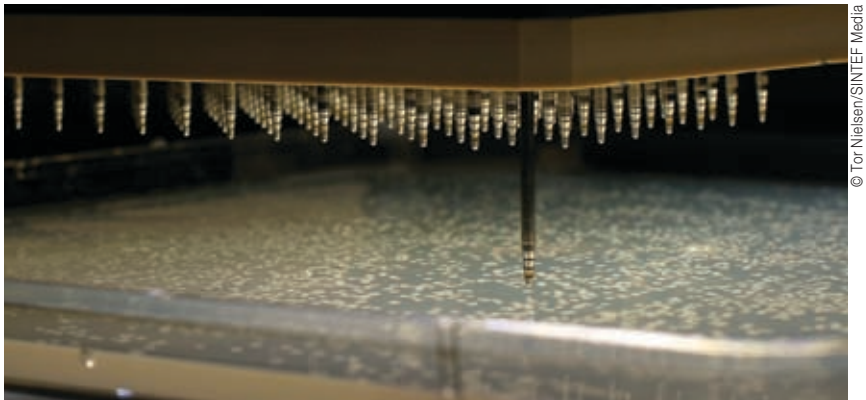
This epic struggle of the sea sponge is powered by chemical weapons produced by bacteria living inside the sponges, and it might be possible to utilize such compounds to fight human diseases. Bacteria isolated by Zotchev's research team from sponge samples are then thoroughly screened to see if secondary metabolites produced by them may be of medical or commercial value, this screening taking place using robotic systems shared by NTNU and SINTEF. The study is ongoing, and the prognosis for finding a healthy ally in the simple sea sponge is positive.

Dedicated to Improving Life

The Norwegian biotechnology industry is thriving for a number of reasons, not in the least as a result of the support and understanding it enjoys in this country. A clear majority of business leaders and the general public understand that Norwegian biotechnology's is important in changing lives – as well as the excellent effect that it is having on the life quality – not only in their native country, but far beyond Norwegian borders as well.

FUGE

FUGE (Functional Genomics in Norway) is one of the Research Council of Norway's large-scale programmes. The programme finances projects that create new understanding in the field of biological processes and those that give a basis to new products and production processes.
For more information on the FUGE programme, visit **www.rcn.no/fuge**.



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Sponge screening is conducted with robotic systems shared by NTNU and SINTEF seeking medical or other commercial applications.

milestones in studying
the earth's environment

By Nancy Bazilchuk

In November 2007, a team of Norwegian and American scientists with four tracked vehicles set out on the first leg of a 5,500 kilometre journey across the most unknown piece of real estate on the planet – the East Antarctic ice sheet, the most massive continental ice sheet in the world. Their NOK 75 million research project, funded jointly by the Research Council of Norway and the US National Science Foundation, is an important part of the International Polar Year (IPY), an effort involving thousands of scientists from over 60 nations examining a wide range of physical, biological and social research topics.

With roughly NOK 330 million invested in 26 IPY projects, Norway is a leading nation in helping scientists to understand the role that the poles play in shaping the Earth's climate and environment. This is part of a larger commitment that the country has to the study and development of ideas and technologies that will help protect the planet while allowing for sustainable growth. This dedication extends from pure research; like the Antarctic traverse, to more applied technology, such as providing cutting edge facilities that allow nearly instantaneous contact with some of the world's most important weather and communication satellites; to developing new ways to control environmental pollutants emitted by smokestacks, to finding creative ways to save energy or recycle materials.

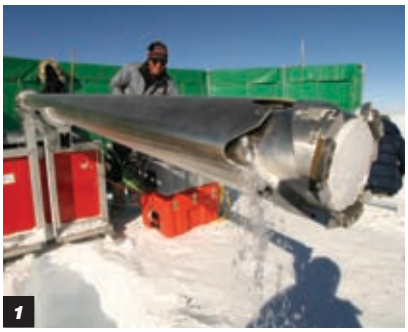
Exploring the Poles

One of the biggest milestones in polar history took place nearly 100 years ago, when the famed explorer Roald Amundsen planted the Norwegian flag at the South Pole on December 14, 1911 – the first person ever to reach the most inaccessible place on the planet.

The Norwegian-American Antarctic IPY traverse has allowed Norwegians once again to travel to the South Pole by overland travel – but this time they drove tracked vehicles called weasels to within 360 kilometres of the pole, stopping to take ice cores samples along the way – more than 700 metres worth in the first field season, which ended in early January 2008. The core samples will help researchers understand how the East Antarctic ice sheet will behave as the Earth warms from human-induced climate change.

"Climate change is one of the most pressing issues that humanity is facing," says Professor Eystein Jansen, director of the Bjerknes Centre for Climate Research, an affiliate of the University of Bergen and Norway's largest climate research group. "There are a number of unknowns and too little research on different topics. What we do know about the future is very rudimentary."

Norway has a special obligation to contribute to understanding climate change, Jansen says, because it is a nation whose wealth has been built on petroleum. "Using fossil fuels is the main reason we have a climate problem, so there is a moral obligation for Norway in particular to conduct research to help guide humanity," he adds.



© Stein Tronstad, Norwegian Polar Institute

1. Researcher Lou Albershardt removes an ice core from a 90-metre deep hole during the 2008 Norwegian-American Antarctic Traverse.

2. Researcher Mary Albert from Dartmouth College and the US Cold Regions Research Laboratory takes measurements on an ice core taken on the 2008 Norwegian-American Antarctic Traverse.

Mammals, Ocean Currents & Weather

This sense of responsibility has led to the launch of a veritable alphabet soup of Norwegian projects to better understand the Earth's environment. For the IPY alone, researchers have initiated MEOP – the Marine Mammal Exploration of the Oceans Pole to Pole; COPOL, Contaminants in Polar Regions – Dynamic range of contaminants in polar marine ecosystems; and THORPEX-IPY – Improved forecasting of adverse weather in the Arctic region – present and future. This last project has Olav Orheim, Director of Norway's IPY activities, hoping that scientists can truly come to understand how the changing climate will affect major ocean currents, such as the Gulf Stream. "There is a lot of speculation about what is happening but very few facts," he says in an interview in Science magazine.

At the Bjerknes Centre, researchers are cooperating with the THORPEX-IPY project, which is being coordinated out of the University of Oslo; they've also been working to understand how much carbon dioxide, the dominant greenhouse gas, is absorbed by natural systems. The Centre was also the only research group from Scandinavia to provide global climate simulations to the IPCC, the Intergovernmental Panel on Climate Change, which shared the Nobel Peace Prize with Al Gore in 2007.

CICERO (Center for International Climate and Environmental Research – Oslo), a University of Oslo affiliate, is a key partner in DAMOCLES (Developing Arctic Modeling and Observing Capabilities for Long-Term Environmental Studies), a European project that is particularly focused on the interactions between arctic sea ice and the ocean itself. The Research Council of Norway also has a broad-reaching decade-long research project called NORKLIMA, which with an annual budget of roughly NOK 85 million encompassing more than 50 projects ranging in scope from factors that control UV radiation in Norway to mechanisms for climate adaptation in forest trees.

View from the Poles

Norway is nearly unique among nations in having landholdings at the northernmost and southernmost reaches of the planet. This unusual situation has enabled the development of Kongsberg Satellite Services (KSAT), which operates a ground station for controlling satellites in Svalbard, and one in Queen Maud's Land in Antarctica, called TrollSat.

Prime Minister Jens Stoltenberg officially opened the TrollSat facility in late January 2008, calling it "a milestone in satellite surveillance of the environment." Data received from the TrollSat ground station will help support the IPY and research conducted by the Norwegian Polar Institute. TrollSat will initially receive data from the European Space Agency's satellite Envisat as well as from several of the US space agency NASA's satellites.

Norway's Antarctic research station, Troll, will also be home to a station for the European navigation system, called Galileo, which is similar to the American Global Positioning System. The Antarctic Galileo station will open in 2009, with the entire system due to be operational in 2013. The Norwegian Galileo station at Troll, which will be supported with NOK 130 million during the station's development, is absolutely critical to the network as a whole, because there are so few alternatives in the region.

Innovating New Solutions

Norwegians have long found ways to develop creative partnerships that lead to highly innovative environmental achievements. One such cooperative partnership is the work being done by the petroleum company Eni Norge and

© Stein Tronstad, Norwegian Polar Institute

Norway's Troll Station, located in Queen Maud's Land, Antarctica, is open year round and offers scientists a base for a variety of polar research.

the International Research Institute of Stavanger (IRIS), who together have started a new research project called iMARE. The project is designed to increase the petroleum industry's ability to prevent and limit environmental impacts of petroleum extraction in marine environments.

A new – and unusual – cooperation between Ottar, the North Norwegian potato growers association, and Stella Polaris, a seafood company, has resulted in an environmentally sound fertilizer based on shrimp shells. Stella Polaris has huge amounts of shrimp waste, but with the help of Nofima's Fiskeriforskning and Bioforsk Nord, this nutrient-rich substance is being transformed into an ecological fertilizer. Halgeir Jakobsen, Ottar board member, says the group's farmers hope to grow ecological potatoes, which makes the new fertilizer particularly attractive. "This project will create a win-win situation for agriculture in the north," he says.

© Kebony

Kebony AS is the only Scandinavian company that makes treated wood that has earned the Nordic Swan environmental label.

Finding an environmentally friendly alternative to impregnated wood was the driving factor behind the foundation of Kebony ASA, which uses bio-based waste material to modify wood. The result is an extremely environmentally friendly product, which currently is the only durable wooden material in Scandinavia that has been awarded "The Swan", the Nordic Ecolabel.

Controlling Pollutants

Most people think of carbon dioxide when they think of greenhouse gases responsible for global warming. And while carbon dioxide represents the majority of the problem, other gases are also contributors. Yara, a Norwegian fertilizer company, makes nitric acid for fertilizer, but these facilities emit nitrous oxide – which has 300 times the greenhouse effect of CO_2. After a decade of research, Yara scientists developed a catalyst that will reduce N_2O emissions by 70 to 90%. The company won the coveted Norwegian environmental prize called the Glassbjørnen (The Glass Bear) in 2007 for its efforts. "The changes in our climate system demand practical action and Yara's de- N_2O catalyst is an excellent example of how industry can contribute to climate solutions in a practical way," said Thorleif Enger, President and CEO of Yara International ASA, when receiving the award.

The Norwegian Institute for Water Research (NIVA) and the Norwegian Institute for Agricultural and Environmental Research (BIOFORSK) are joint project directors for an innovative cross-disciplinary project to solve international water pollution problems using an integrated water resources management approach. This programme, called Striver, is funded under the European Commission's 6th Framework, and includes participants from Germany, India, Vietnam, Cambodia, Portugal, Spain, Sweden and UNESCO.

The project pairs river basins in two countries, one in Europe and one in Asia, says Per Stålnacke (Bioforsk), scientific coordinator. "The basins function as test cases with the aim to compare results and methodologies, exchange experiences and widen the horizon and get a more holistic picture. We believe that such linkages can foster new knowledge and perspectives," Stålnacke says.

NORKLIMA

NORKLIMA (Climate Changes and Consequences for Norway) is one of the Research Council of Norway's large-scale programmes. The programme finances projects that help to gain a deeper understanding of the socioeconomic impacts of climate change in Norway.

For more information on the NORKLIMA programme, visit **www.rcn.no/norklima**.

tiny solutions
with a big impact

By David John Smith

Norway is a hotbed of activity within nanotechnology R&D, exploring ways to apply this fascinating technology to our everyday lives. Research organizations such as SINTEF and the University of Oslo's Center for Materials Science and Nanotechnology are working with a wide range of companies to find practical solutions that come from this microscopic world.

The Center for Materials Science and Nanotechnology at the University of Oslo is focused not only on the theoretical aspects of Nanotechnology, but also how theory can be applied to everyday life. Hallvard Angelskår, a PhD student at the Center, is engaged in a project to develop Diffractive Optical Elements (DOEs) into inexpensive optical spectroscopy tools for everyday use - in the grocery store, at the doctor's office - and eventually, even in the home. The fabrication of these DOEs employ nanotechnology, and are an integral part of the spectroscopy application. Today, optical spectroscopy tools of various kinds are found in many laboratories, but the goal of this project is to take a major leap ahead that will result in a broader use of DOE-based spectrometers.

SINTEF has worked extensively with these detectors, and earlier developed a design for a low cost spectrometer now used by Tomra Systems in material characterization of household waste such as polymer containers. Says Hallvard Angelskår regarding the project; "We are currently working on characterization and computer simulations of the diffraction from the DOEs. This may allow us to improve the design of the surface patterning in order to optimize the response from the DOE. The cooperative project involves Tomra, Simtronics, Balter Medical, OptoSense, Mole, Snipos, SINTEF and the University of Oslo."

Standing Tall

There is wide interest around Norwegian research regarding the fascinating strength of cellulose microfibrils. Fibrils make up the micro-foundation of trees, giving them the ability to stand tall even in the face of the strongest winds. Until now, fibrils have been a well-kept secret, quietly doing their job as reinforcements in nature as well as in the man-made world of paper-based products. That may all well change as a result of joint SINTEF, NTNU and Paper and Fibre Institute (PFI) research activities led by SINTEF's Bjørn Steinar Tanem and PFI's Kristin Syverud.

One of the aims of the project is to find ways to use these mighty nano-pillars of strength in developing environmentally friendly nano-composites of high strength. Since fibrils come directly from nature, such composites represent sustainable and future-oriented material solution, but there still is a great deal of work to be done in understanding their full value. As Kristin Syverud indicates; "Fibrils can be bonded easily to other substances, and this opens up a wide range of possibilities of use that include packaging materials that are biodegradable and at the same time preserves the food, antimicrobial paper products (for medical use), use as stabilizers of emulsions, as reinforcement in synthetic- or biobased polymers (plastics) giving improved strength and possibility to manufacture strong and low-weight composite materials."

NANOMAT

One of the Research Council of Norway's large-scale programmes, **NANOMAT (Nanotechnology & New Materials)** finances projects that develop expertise within nanotechnology and new materials. The programme's goal is to contribute to the development of new knowledge and research-intensive industry, and advance sustainability in traditional Norwegian industry.
For more information on the NANOMAT programme, visit **www.rcn.no/nanomat.**

ict sollutions
of tomorrow

By Nancy Bazilchuk

Norwegians are among the most wired people on the planet. Information and Communications Technology (ICT) is a natural part of life here as Norwegian scientists and engineers create innovative ICT technologies through focused research and development. Whether cutting-edge electromagnetic imaging, tiny sensors to change the face of science and medicine, or more traditional applications such as new types of mobile phone applications, computer games and search engines, the ICT solutions of tomorrow have come to Norway today.

ICT supports the Norwegian edge in the world economy, while maintaining the country's standard of living and high salaries. The innovative use of ICT technologies reduces the demand for personnel, an advantage in a country where salaries and expenses are high compared to the much of the world. "We have to use ICT to work smarter, to be more effective," according to Rune Foshaug, Senior Adviser at Abelia, the business association of Norwegian knowledge and technology-based enterprises.

Nearly NOK 30 billion was invested in ICT R&D in Norway in 2005, the latest year for which figures are available. This number represents 1.5% of the country's gross national product, and about 20% of all R&D expenditures in Norway, with 81% of that ICT research money provided by the business sector itself.

One important Government effort is a 10-year long ICT research programme funded by the Research Council of Norway called VERDIKT, which has an annual budget that is expected to grow to NOK 500 million by 2011. Fully 66 PhDs and 14 Post-doc positions have already been funded by the programme, which covers areas as varied as ICT in medical applications to ICT in traffic control.

A Perfect Medical Match

Few areas of society are as complex and information-laden as medicine – a fact that makes medical care a perfect candidate for ICT. Norwegian scientists are developing ways to use the power of ICT to decode the secrets of the human body with tiny sensors, or with advances in ultrasound and other imagining techniques. Other researchers are finding ways to manage patient information and the inner workings of the medical care system – with the goal of harnessing technology to improve human health and well-being.

A portion of Norway's medical ICT research is conducted with funding from VERDIKT, which directs 8.8% of its project funding to health care sector applications. The Research Council also supports health care research through programmes such as Centres of Excellence or Centres for Research-Based Innovation, and through the efforts of researchers at SINTEF and the Simula Research Laboratory, the major universities such as the University of Oslo, the Norwegian University of Science and Technology (NTNU) and the University of Tromsø.

The result of all this research has also led to the foundation of a number of Norwegian spin-off companies, such as Norchip, which makes a credit-card sized diagnostic kit, Alertis Medical, which makes sensors to measure blood gasses, and bio-information companies such as Interagon and Pubgene, which analyse genetic information.

Information Saving Lives

When it comes to patient care, information is everything. Doctors need to find relevant medical details amid the vast sea of a

Medical education may be transformed by the development of new ICT technologies that could change everything from patient record management to the monitoring of patient health after medical procedures.

© NTNU Info/Rune Petter Ness

patient's medical history. A patient has information he or she would like to share with the doctor. And in some cases, that patient-doctor sharing of information has to be bridged over considerable physical distances, as is common in the more rural areas of Norway. These demands have been an important driver in shaping the development of ICT tools for medicine in Norway.

One VERDIKT project coordinated by the Rikshospitalet/Radium Hospital Medical Centre in Oslo is developing ways for patients to communicate with their doctor and update their own medical records from a home computer or mobile phone. Researchers have developed a tool called Choice, which allows patients to enter their own symptoms and treatment needs on a computer. The tool has been tested with roughly 1,000 cancer patients at the Rikshospitalet-Radiumhospitalet Medical Centre.

Another VERDIKT project to develop flexible medical files, called POCMAP, is being headed by researchers at NTNU in Trondheim. The goal is to develop a mobile device so health care professionals can bring up a patient's electronic file no matter the location - whether at the patient's bedside or from an office computer.

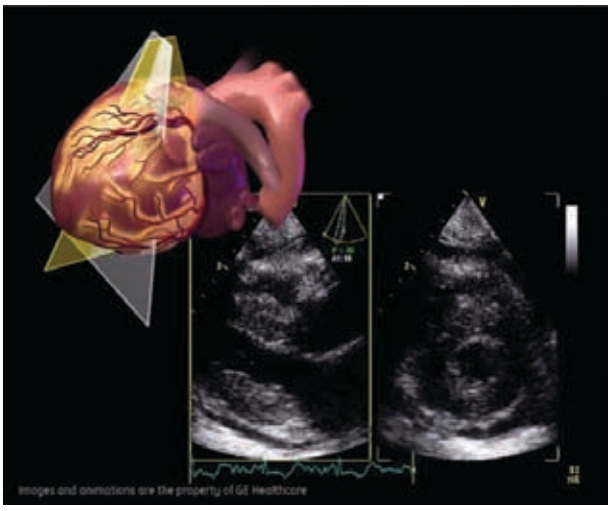
At the University Hospital of North Norway, the Tromsø Telemedicine Laboratory (TTL) has been established as a Centre for Research-based Innovation, funded by the Research Council of Norway at NOK 180 million over the eight years of the project. The TTL's partners are the University of Tromsø, Norut IT, Telenor, IBM, DIPS, Well Diagnostics, Norwegian Healthnet, and the Northern Norway Regional Health Authority. The goal of the TTL is to develop telemedicine approaches that can be commercialized, with a particular focus on enabling the Norwegian health system to provide the elderly and those with chronic illnesses with safe and effective home care.

Wireless Health Care

Miniaturization and advances in nanotechnology have made it possible to develop tiny sensors that can measure all kinds of critical changes in a patient's organs and tissues. According to Dag Ausen, Senior Adviser at SINTEF, this is one future of medicine. "What will be true is that in five to 10 years, doctors can take advantage of existing technologies, to get much more information about a patient from these kinds of sensors and wireless systems," Ausen says.

These tiny sensors are being evaluated in an initiative called "Wireless Health Care", which combines the efforts of researchers in Trondheim, Tromsø and Oslo, and is a part of a larger project called "Wireless Future", initiated in February 2004 by the largest telecom operator in Norway, Telenor, along with SINTEF, and the ICT branch of the Norwegian Trade Association, Abelia. More than 150 Norwegian businesses are now involved.

Among the companies established to take advantage of the biosensor market is Alertis Medical AS in Oslo. The company was founded in 2000 to commercialize a unique technology for the early detection of critical conditions related to blood supply and respiration, and was developed by researchers from Rikshospitalet University Hospital, Oslo. The company's first device is a miniaturized disposable biosensor that provides early warning of blood and oxygen deprivation in tissue, which can be a common complication of surgery, post-operative care and organ/tissue trauma.



Researchers at the NTNU's MI Lab are working with a variety of industry cooperators, including GE Vingmed Ultrasound AS. This image of the heart shows current ultrasound technology using a GE Vivid7 Dimension Ultrasound.

No Strings Attached

Researchers at NTNU's Medical Imaging Laboratory (the MI Lab) are using an ultrasound and MR imaging in a different approach to non-invasive ways of examining the heart and other organs. The laboratory was appointed in 2006 as a Centre for Research-based Innovation by the Research Council. The award involves yearly funding of NOK 40 million over the eight years of the programme.

One MI Lab project involves improving the visualization and quantification of blood flow, using ultrasound to assess blood flow in vessels, and through the heart chambers and valves. Still another project is designed to put advanced cardiac ultrasound techniques in the hands of non-expert users, such as general practice doctors. One of the major strengths of the MI Lab is its strong partnerships with industry leaders, such as GE Vingmed Ultrasound AS, Fast Search & Transfer and a host of other dedicated companies and non-industry alliances.

Hand in Hand with Oil & Gas

Overall, Norway's economy is dominated by the oil and gas industry, with Norway's ICT sector third or fourth in size, depending upon the statistics used to measure economic contribution. Those numbers don't show the whole picture, as ICT is fundamental to the success of Norway's largest industries. The oil and gas industry provides an excellent example, doing everything it can to use ICT research to continue to develop activities on the Norwegian Continental Shelf and beyond, turning challenges into Norway's advantage by developing new technologies that are being exported globally.

One company that has helped pioneer this ICT petroleum revolution is the Trondheim-based Electromagnetic Geoservices ASA, or EMGS. The company was a spin-off from Statoil in 2002 to commercialize the use of electromagnetic energy to help map oil and gas reservoirs under the ocean floor, in a process called seabed logging. ICT plays an important role in EMGS's operations, in the processing of all their electromagnetic data– in fact, the demand is such that EMGS operates a Dell Blade cluster computer with 1060 processors operating at 7.2 terra FLOPS – one of the most powerful computers in Norway.

IBM, one of the world's largest IT research organizations, is also an important player in bringing ICT solutions to the oil and gas industry, including its Oil & Gas Centre of Excellence in Stavanger. "We are leading an industry initiative for the rest of IBM from Norway," says Ingvild Grimstad, an IBM Norway spokesperson. "The solutions and technologies we develop in close cooperation with our partners, and supported by our research labs in the United States, will enable us to develop solutions for the industry as a whole. After we develop solutions for the Norwegian market, we'll market these ideas to the rest of the world."

Simula Research Laboratory is another good example of the strength of Norwegian ICT, conducting research in the fields of communication technology, scientific computing and software engineering. Established in 2001, the group is funded through the Research Council of Norway, but also cooperates with industry partners. In May 2007, Simula opened the Simula School of Research and Innovation. The school's graduate students are primarily supervised by researchers at Simula affiliated with the University of Oslo's Department of Informatics.

Many research efforts are conducted at Simula is in its Scientific Computing Department, where the Center for

Two-thirds of all ICT research in Norway is carried out at the Norwegian University of Science and Technology in Trondheim, which has contributed to major ICT companies such as Google and Yahoo locating R&D offices in the city.

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Biomedical Computing has been awarded a Centre of Excellence designation. Projects being undertaken by the Centre include a mathematical simulator for the electrical and mechanical behaviour of the heart. By creating this mathematical model, researchers can examine the functioning of the heart in both healthy and stressed conditions.

Simulating Reality

At SINTEF Petroleum Research, researchers are using techniques from the computer games industry to develop a new kind of interactive drilling tool, called “eDrilling”. Resembling a video game, the tool allows people who are thousands of kilometres from the well site to watch in real-time, supervise drilling or simply learn from experienced drillers. The eDrilling effort is just one part of the Center for Integrated Operations in the Petroleum Industry, a collaboration composed of the Norwegian University of Science and Technology (NTNU), SINTEF Petroleum Research and the Institute for Energy Research, some of the world’s major international oil companies, and researchers from the international environment.

Companies are also using visualization and 3D simulations to help in other areas of oil and gas production. This kind of development is of particular interest to StatoilHydro, which is working with StormFjord AS of Bergen to develop visualization of its dozens of oil platforms and other facilities in the Norwegian Sea. Scientists at the company’s Trondheim research division are working on converting all of StatoilHydro’s 3D construction files for a programme that turns them into a kind of 3D world for training and teaching.

Embracing Mobility

With over four million mobile phone subscriptions, Norway actually has more mobile phone subscribers than inhabitants. Thus, it should come as no surprise that Norwegian companies are strong players in the ICT market, and examples are numerous. Intelligent Quality AS from Vinstra has developed an ICT platform called Arc Communicate, which allows employees in an organization to share information and communicate with each other, no matter where they are in the world, and no matter whether they’re using a computer, a mobile telephone or a regular telephone.

Telenor Research and Innovation (R&I) has recently established iLabs, (innovation Labs), which has developed a set of application programming interfaces (APIs) and demonstrators based on open source, called the iLabs Mobile Toolbox. By using this toolbox, users can make their own mobile clients and participate in various network communities and blogs from a mobile terminal. The toolbox has also been integrated with Blogger, EZ Publish and Google Talk. iLabs is collaborating with Sun Microsystems, EZ Systems, NTNU and the University of Oslo in these efforts.

VERDIKT

VERDIKT (Core Competence and Added Value in ICT) is one of the Research Council of Norway’s large-scale programmes. The programme finances projects that maintain and advance the Norwegian ICT industry’s technical expertise so that it remains internationally competitive. The VERDIKT programme will span 10 years, ending in 2014.

For more information on the VERDIKT programme, **visit www.rcn.no/verdikt**.

© MTelenor, Damian Heinisch

Telenor’s building at IT Fornebu outside of Oslo has won a number of international architecture awards, including the Prix d’Excellence from the FIABCI.

strength
with vision

By David John Smith

The oil and gas industry is not only the largest one in Norway; it is also a power on the world stage. With this strength comes an environmental responsibility, taken seriously by the Norwegian Government, research organizations and companies here in this country, with special focus on carbon footprints that are created as part of the oil and gas production process. This environmentally-friendly perspective ties in well with OG_{21} – the Government's National Technology Strategy for R&D for oil and gas. The OG_{21} initiative has five focus areas: environment, increased recovery, deep water, small fields and the gas-value chain. This emphasis on research and development is combined with the vision of Norway as an innovation standard-bearer – a global industry leader.

It is the broad Norwegian goal to become carbon-neutral by 2030, an important success criteria driving many of the R&D activities here in this country, including the oil and gas industry. One important ongoing development programme in Norway is Demo 2000, an initiative partnered by the industry and the Norwegian Government. According to Morten Wiencke, Demo 2000 Program Director; "Demo 2000 is the result of the understanding that an ongoing cooperative effort is needed between the R&D environment and the oil and gas industry in order to bring new products and systems to a demanding market in continual development and change."

Mirroring the goals of the Norwegian National Strategy OG_{21}, Demo 2000's core focus areas include subsurface activities, drilling and wells, remote processing, deepwater technology and gas utilization. With an emphasis on new technology, solutions and emphasis on environmental sustainability, Demo 2000 supports companies and institutions in bridging the gap between R&D and commercialization. During the organization's eight years of existence, Demo 2000 has overseen project investments of nearly USD 500 million.

Recent projects selected by Demo 2000 for funding include SINTEF's Cold Flow project; an Aibel project focusing on HT VIEC with water profiling; Ziebel's ZipLog well-logging system using fiber optic technology; and a tracer test to measure oil saturation to be undertaken by the Institute of Energy Research (IFE). In addition, Aker Kvaerner's Subsea Hybrid Pump, a further development of the MultiBooster™; and ODIM's CTCU™ Fibre Rope Heavy Subsea Installation Handling System has been an important project of note.

Support in all Environments

Working hand in hand with the oil and gas industry are research organizations that include the Norwegian Institute for Air (NILU), conducting environmental research with emphasis on the sources of airborne pollution, atmospheric transport, transformation and deposition. Ensuring that the environmental aspects of the water are taken into account, the Norwegian Institute for Water Research (NIVA) is Norway's leading multi-disciplinary research institute in the field of use and protection of water bodies and water quality.

The emphasis on research and development is combined with the vision of Norway as an innovation standard-bearer – a global industry leader with the oil and gas industry.

© Manfred Jarisch (StatoilHydro)

INTSOK is the member organization promoting the Norwegian oil and gas industry. One important communication channel is the staging of events that profile Norwegian R&D status and breakthroughs, including the 2008 US Norway Technology Partnership event in Houston, Texas. Presenting Norwegian companies included FMC Technology with cutting-edge subsea solutions and Den Norske Veritas life extension of old platforms. Additional presenters included Aker Kværner's (Aker Solutions) MMO services; GE Vetco Grey subsea; ABB's integrated operations, as well as a host of other companies that included Framo Engineering, Norse Cutting & Abandonment, GTO Subsea and StatoilHydro.

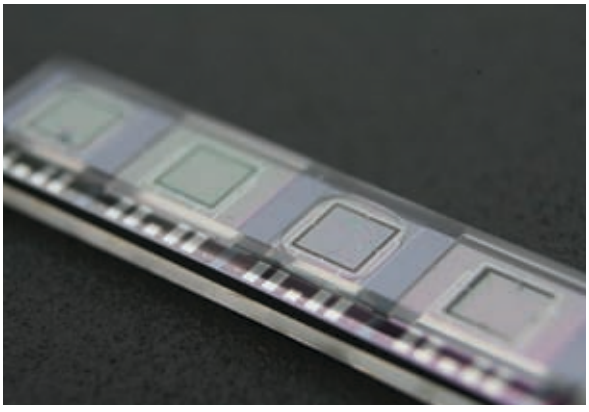
The importance of these international events cannot be underestimated, according to INTSOK's Werner Karlsson; "This communication of the R&D effort is one of the many keys to the longstanding success of the Norwegian oil and gas cluster, with an ongoing effort between the Norwegian Government, the Research Council of Norway, Innovation Norway and other organizations such as Kon-Kraft, OG_{21}, Demo 2000 and INTSOK."

Working Together to Increase Efficiency

Safety, continuity and effective decision-making based on correct information is essential for success in the oil and gas industry. Logistics are always a challenge, and common practice today in the industry often makes it necessary to transport personnel to check status and inconsistencies. Though some wireless solutions already exist, there is vast room for improvement, and the WiVib research project has the goal of increasing efficiency in general.

SINTEF, together with industry giants ABB and the Swedish SKF, are working to make this a reality. The WiVib research project has the potential for a wide range of applications through the use of small autonomous sensor nodes capable of identifying abnormal vibrations in equipment, then communicating them through a wireless network. Three types of sensor nodes are used in the WiVib network; sensor nodes, relay nodes, and a manager node, with rigorous tests being conducted in realistic environments.

SINTEF has developed a sensor element where the first packaging step is performed on wafer level. This means that a glass encapsulation is mounted on the top and bottom of each chip for hundreds of chips simultaneously. Since cost-effectiveness is always a premium in industry, making use of microsystem technology is a definite advantage. WiVib testing has been positive, making the technology potentially well-positioned for future mass production. SINTEF's expertise, coupled with ABB and SKF's vast expertise within the fields of wireless communication and vibration signal interpretation and supported by oil companies' knowledge of practical applications, gives a prognosis for potential success that could have a future impact far beyond the stormy North Sea.



The WiVib research project is developing small autonomous sensor nodes capable of identifying abnormal vibrations in equipment.

A Friend to the Environment

AGR Group is a Norwegian headquartered oil services business with a wide range of services ranging from constructing and managing drilling programmes to providing services and technologies for exploration, production and maintenance. The company is well known for its innovative R&D, with over 40 patents in commercial use, including pioneer RMR (Riserless Mud Return) technology.

Tom Hasler, General Manager AGR Drilling Services Asia Pacific, reflected on the companys innovative success using RMR; "The RMR technology is rapidly proving itself as a 'game changing' technology for operators undertaking offshore drilling in the Asia Pacific region. Some of our clients are utilizing the technology for the commercial benefits of saving a casing string,

some to reduce the risk associated with shallow hazards, and some to perform zero discharge drilling for environmental reasons. This wide range of complimentary benefits offered by the technology is a key to its market growth. In addition, with its recently first agreed use on a jackup, the RMR's prospective market is further expanded."

In A Class of its Own

StatoilHydro is globally respected for its ability to turn R&D activities into commercial success – all the time with an environmental focus. Three major R&D centres cover a wide range of programmes that include New Energy and New Ideas, on the front lines in the battle against climate change. Recognizing the need to continually develop new sources of energy, this programme focuses on management projects related to CO_2, Water Resources, HSE Management and others. All these projects demand – and receive – the excellence that StatoilHydro R&D provides.

The New Development Solutions programme draws in part upon technology developments from Tordis, Snøhvit, Tyrihans, Ormen Lange and other Norwegian Continental Shelf (NCS) installations, setting the stage for future R&D breakthroughs. This cutting-edge technology is related to increased oil recovery, integrated operations, deep water, offshore heavy oil and arctic areas through technology areas that include subsea processing, deep water risers and operations and solutions for sustainable development and operation in the Arctic.

StatoilHydro places great emphasis on the oil and gas value chain. An excellent example is its LNG (liquefied natural gas) activities taking place at the company's Melkøya facilities. This crucial technology development has been made possible through long and close cooperation with among others scientists from NTNU and SINTEF.

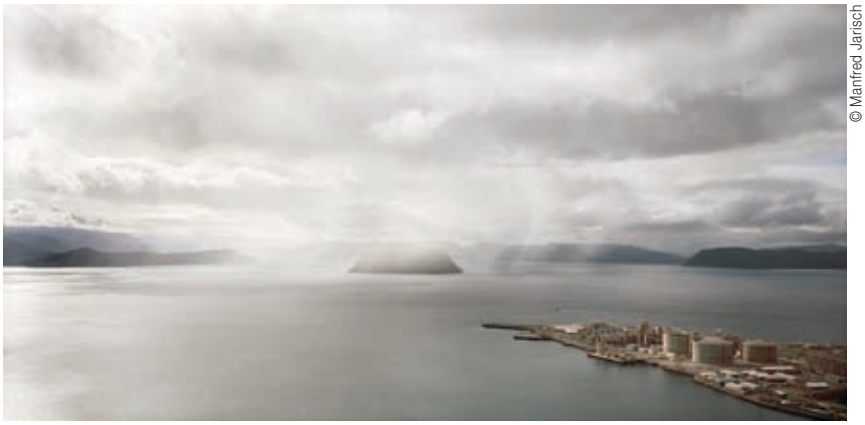
No one does it Better

Although the current recovery factor of StatoilHydro's fields is among the best in the world, the company has ambitious goals to increase that even further. The company's impressive R&D assets are focused on three main goals related to Oil Recovery; identifying the remaining oil, improving efficient drainage of reservoirs and integrating people, processes and technology. Specific projects within the StatoilHydro Oil Recovery Program include areas as new recovery methods, methods for identification of small pockets of remaining oil, real time production optimization, next generation well construction as well as future drilling and intervention.

Cooperation with other Norwegian companies that provide added-value technology is important to the company, including a major collaboration with WellDynamics, a leading provider of intelligent completion technology to the upstream oil industry. WellDynamics has been awarded two frame agreements for work in the North Sea, contracted to install electronic Venturi flowmeters, electronic pressure/temperature gauges in wells with WellDynamics' SmartWell completions, and additional electronic pressure/temperature gauges in wells where WellDynamics' flowmeters are installed. The terms of this contract will cover an eight-year period with deliveries totalling nearly USD 200 million.

Where Few Have Gone Before

StatoilHydro's Exploration programme include major projects related to developing new tools and technology, as well as others concentrating on the most actual basins, plays and prospects in Statoil-Hydro's portfolio. These areas of exploration include Imaging and Visualization, Geophysical Techniques, Global Exploration Concepts; Cost-Efficient Exploration Drilling, Petroleum Systems Analysis;,Carbonates, and Deep-Water Basins such as the Gulf of Mexico.



© Manfred Jarisch

StatoilHydro's emphasis on the importance of the oil and gas value chain is well-represented with the LNG technology taken place at the Melkøya facilities.

Deep-water depositional exploration in the Gulf of Mexico basin is a region where the company is applying its technology where conditions can be the most demanding on earth. Challenges include water depth, hurricanes, strong underwater currents, deep reservoirs with extremely high pressure, and layers of salt on the gulf floor that measure up to 4000 metres in thickness – making seismic measurement next to impossible. Working closely together with companies such as Mobil, Aker-Kværner, FMC and others, company technology successfully evolved on the NCS is now being put to good use in the Gulf in operative areas such as subsea solutions, FPSOs and long distance tiebacks.

Solutions All Around

Norwegians are of nature a practical people, thus Norwegian efforts seek R&D solutions that can be applied in practical applications. Aker Kværner, now known as Aker Solutions, is a company that emphasizes both theoretical as well as practical R&D – using its vast international operational experience to develop process and systems that have made it a leader within a number of industry sectors, including maintenance and operations in the oil and gas industry. A subsidiary company, Aker Kvaerner Process Systems (AKPS), offers wellstream separation and oil treatment systems, water treatment systems for desanding and oil/ water clean-up, solids handling systems, gas processing systems, MEG regeneration and desalting systems, as well as utility systems for a wide range of operational applications.

PETROMAKS

PETROMAKS (Programme for Petroleum-Oriented Research) is one of the Research Council of Norway's large-scale programmes. The programme finances projects that support the increased value and international competitiveness of Norway's petroleum resources.

For more information on the PETROMAKS programme, visit **www.rcn.no/petromaks**.

Peak Well Solutions is a dynamic Norwegian company known for finding real-time solutions within that include well construction, temporary abandonment, Completion/ intervention and casing accessories. An ongoing commitment to R&D investment with a focus on innovative solutions has helped the company attain their status as a world leader within barrier plugs and cementing valves for annulus barrier according to ISO V0 and NORSOK D10 standards. By reinvesting of 10% of its gross revenue in R&D to further develop new technology, PWS commitment results in continued customer satisfaction.

One of the company's most valued products is the Peak VMB Plug, recently installed at a record depth of nearly seven kilometres under the surface of the North Sea at Oseberg Sør for StatoilHydro. One of the world's leading companies within ISO 14310 VO tested Retrievable Mechanical Casing Plugs with more than 350 successful runs, mainly in North Sea wells and in Nigerian deep water, PWS success is based on solid R&D development in areas such as cost saving products and new technologies.

© Peak Well Solutions

The V0 Certified Peak VMB Plug was recently installed at a record depth of nearly seven kilometres under the surface of the North Sea.

Clavis Technology is another Norwegian company having a consistent emphasis on R&D, with a wide range of successful, and creative, products that include propulsion systems based on the nature's own efficient method, the fish tail. Research at Clavis Technology has turned this principle into a credible alternative to conventional methods. In addition, products including impulse pumps offer excellent potential for increased oil recovery. The advantages and efficiency of the impulse pumps include reduced power consumption, increased profitability for customers, and reduced effect on the environment in general.

working together
against cancer

By David John Smith

Designated as a Norwegian Centre of Excellence, the Oslo Cancer Cluster (OCC) is an affiliation of nearly forty members that include industrial companies, academic research institutions, health initiatives and support groups in the field of biotechnology with the spotlight on cancer.

OCC activities are geared to supporting and speeding up translational research, all the while allowing patients better access to innovative cancer diagnostics and treatment. As Oslo Cancer Cluster's CEO, Bjarte Reve, indicates; "The cooperative activities within the OCC are aimed at moving scientific progress from world-class research to the global market. This research takes place within OCC companies and universities, and represents the cutting-edge of cancer research today."

The OCC has ambitious goals that are supported by cooperation with world-class research at the University of Oslo and other university hospitals, a vibrant Norwegian biotech-industry, and an ongoing alliance with the Comprehensive Cancer Center (CCC). The transition from R&D to the marketplace is facilitated by cooperation with the CCC, the impressive coalition between the Radium Hospital and Rikshospitalet (see separate article). It is in this environment that clinical trials of new cancer treatment methods are carried out that support the ongoing activities of the OCC.

Projects in the Pipeline

Cooperation with the Comprehensive Cancer Center is just one element of the success formula that OCC has in place. Others include ongoing research at the new Cancer Center at Ullevål University Hospital, an epidemiological network, and its strong industrial base of oncology-related companies ranging from spinouts to international biotech companies.

Diversity of membership adds to the cooperative synergies of the OCC. With members that include Norwegian branches of major pharmaceutical companies, well-established Norwegian companies with international markets as well as start-up and venture companies, the ability to see – and act upon – research opportunities is increased. In 2007 there were 63 projects in the clinical pipe-line of the OCC's Norwegian-based membership. Only Pfizer, one of the world's largest pharmaceutical companies, can compete with this amount of oncology projects in different phases of clinical trials.

© AstraZeneca

Bjarte Reve, CEO of the Oslo Cancer Cluster.

Dynamic OCC goals are clearly defined for the next five-year period. These include increased productivity and competitiveness among the member companies, increased global attractiveness of research performed inside the Cluster, as well as increasing global market reach for diagnostics, therapies and products that are developed here.

Reaching Out

The OCC was designated as a Norwegian Centre of Expertise by the Norwegian Government in 2006, assuring long-term access to governmental support. This solid governmental backing, combined with the strength and focus of its membership gives the Oslo Cancer Cluster every reason for confidence and optimism in reaching their goals.

While the OCC website *www.oslocancercluster.no* communicates status and news to the external environment, be sure to look for the OCC in 2008 as it participates in events that include Bio2008 in San Diego, the OCC Forum (part of Oslo Innovation Week), and Genesis 2008, as the Oslo Cancer Cluster strives to achieve its vision of reducing the effects of, and, where possible, eradicating cancer.

from ideas to action –

oslo innovation centre

By David John Smith

The Oslo Innovation Centre is a "venue of knowledge", a place of development and synergy with over 140 companies working to achieve success in Norway and beyond. Here you will find new start-up enterprises working side-by-side with companies already experiencing breakthroughs, all with access to the best educational and governmental support Norway has to offer.

The results achieved by the Oslo Innovation Centre are impressive as it pursues its mission to identify and help transform companies showing commercially promising research results and project ideas. The goal is development into profitable enterprises, facilitated by a focus on sound commercial fundamentals. An active business development partner, the Centre also provides professional facilities conducive to creativity and growth.

Bird's-eye Perspective

From a bird's-eye perspective, working with many diverse companies in various stages of development enables the Centre's leadership to identify synergies and cooperative possibilities that might have otherwise gone unnoticed. This is all done in dynamic international surroundings where it is natural to keep a "finger on the pulse" on the wide and diverse range of research activities.

A recent survey shows many employees working with companies at the Centre are from outside of Norway, creating an environment truly mirroring sectors of the international research world. In fact, foreign companies frequently approach the Centre to gain a better understanding of developments, and often lease office space to work more closely with the innovative activities here.

Foreign companies frequently approach the Centre to gain a better understanding of an environment mirroring the international research world.

From Start to Success

The process begins when companies approach – or are approached by – the Oslo Innovation Centre, and are identified as having potential for success. Companies then work together with the Centre, from start-up through to final development, marketing and commercial success. Support may take the form of assistance to finalize a business plan, seek funding, pinpoint target markets, develop marketing programs – in other words – the Centre provides sound guidance through all phases.

© Oslo Innovation Centre

There are a number of excellent examples of companies on the road to success, including Lauras, with research centring on development of immunostimulatory drugs that stimulate and improve the function of the immune system. Lauras' research is especially focused on HIV infection, common variable immunodeficiency as well as certain types of cancer, all based on new knowledge showing that activation of a signal pathway inside the immune cells inhibits the function of the immune system.

Also working to improve life quality is OstomyCure, developer of the first-ever implantable device compatible with living soft tissue. The next major milestone will be testing in humans, beginning during 2008. According to Christer Jacobsson, OstomyCure CEO; "The fact that tests show our implantable device is accepted by soft tissue represents a potential major breakthrough with possible uses in many other applications. We look forward to presenting our findings to the 8th World Biomaterials Congress in Amsterdam."

The Oslo Innovation Centre aims to be a European leader for innovation and business development – with many companies on the road to success. When in Norway, come to the centre for innovation, the Oslo Innovation Centre.

norway's renewable energy future

By Nancy Bazilchuk

In January 2008, the Norwegian Government pledged to make the country carbon-neutral by 2030, fully 20 years earlier than had been previously planned. This promise rocketed Norway into a leadership role with the most ambitious climate policy target on the planet. "The agreement gives Norway a long-term climate policy that can stand regardless of shifts in governing parties," says Prime Minister Jens Stoltenberg.

As one of world's largest exporters of oil and gas, Norway has long held itself responsible for tackling problems caused by climate change. The Government's carbon-neutral pledge is the most visible evidence of that commitment, but Norway's dedication to solving climate problems is both broad and deep, particularly when it comes to research and development in power generation.

"Norway will be an environmentally friendly energy nation, and will be a world leader in the development of environmentally friendly energy technologies," Guri Størvold, state secretary for the Oil and Energy Department, said in late January at a wind power conference in Trondheim. "We are in an excellent position to do this – with power generated by wind, waves, water, or salinity ... the solution is renewable energy."

Strong governmental and societal interest in renewable energy have led to comprehensive research and development projects at Norway's universities, research institutes and industries; ranging from hydrogen, bioenergy, windpower and solar cell technology research at the Centre for Renewable Energy, a cooperative among the Norwegian University of Science and Technology (NTNU), SINTEF and the Institute for Energy Research (IFE), to new offshore wind technology development at private companies such as Chapdrive, Lyse and OWEC Tower.

Because of its ready availability in Norway, wind is the renewable resource that has recently attracted the most attention. In fact, the January climate agreement brought an extra NOK 150 million for an offshore windmill demonstration project, as just one example. But wind is only part of the equation: another NOK 70 million will be spent in 2008 on additional renewable energy and carbon sequestration research, with that amount increasing to NOK 300 million by 2009 and to a minimum of NOK 600 million by 2010.

As Oil and Energy Department State Secretary Guri Størvold says, "It is not a question of whether renewable energy will come, but when it will come."

Working Smarter, Saving Energy

By far and away, the largest renewable energy related programme in Norway is Enova, which in 2008 had a budget of NOK 1 450 million, an increase of NOK 660 million over 2007 funding levels. Oil and Energy Minister Åslaug Haga says the increase in support reflects the Norwegian Government's determination to establish the country as a leader in the production of environmentally friendly energy resources. "This increased budget in 2008, which will

OWEC Tower has built two towers for wind turbines installed in the Beatrice oilfield off the coast of Scotland.

promote efficient energy use, and heating and electricity from renewable energy resources, is one of the cornerstones in the Government's efforts to guarantee that Norway is an environmentally friendly energy nation," Haga says.

Enova's successful efficiency projects cover everything from large industries to family-owned businesses. Norske Skog in Skogn, one of the world's largest producers of newsprint paper, was the beneficiary of an Enova project that began in 2007 and will finish in 2011, with the goal of cutting the company's energy consumption by 250 GWh. The company has invested NOK 300 million in efficiency upgrades, with Enova's contribution totalling NOK 50 million. Another recent Enova project involved Hennig-Olsen Is AS, a family-owned ice cream company in Kristiansand that made nearly 25 million litres of ice cream in 2005. Hennig-Olsen was granted NOK 580,000 from Enova towards the purchase of hybrid heat pump. "Our calculations say that this heat pump will enable us to save 2 million kWh per year," says Jarl Westergård, the company's project leader.

All told, Enova supported Norwegian businesses and industries with more than NOK 200 million in 2006, the latest year for which figures are available. That investment paid considerable dividends, saving 900 GWh in the same year.

Energy 21: Clean Energy for the Future

In early February 2008, Oil and Energy Minister Åslaug Haga took delivery of a comprehensive energy report called Energy 21, which was commissioned by Haga's predecessor Odd Roger Enoksen. In delivering the report, Energy 21 chairman Sverre Gotaas, Innovation Director for Statkraft AS, said that comprehensive investments in renewable energy could help transform Norway into a green energy exporter. "In 20 years we can double Norwegian production of renewable energy to 240 TWh with a great percentage of Norwegian suppliers. The potential for building a new industry is enormous. Norway's oil and gas industry resulted in a blossoming of Norwegian technology suppliers. There's nothing that prevents us from doing the same with renewable energy," Gotaas says.
The report calls for a national focus on five critical areas; energy efficiency, climate friendly power, CO_2 neutral heating, flexible energy systems and a supportive energy and business climate. Additionally, the report recommends a doubling of the Oil and Energy Department's research and development funding in 2009, with public investments increasing to at least NOK 400 million per year, which together with private investing should result in a minimum of NOK 2.4 billion in energy-related R&D.

The Research Council of Norway already supports RENERGI, which focuses on clean energy production for the future, with an annual budget of approximately NOK 150 million, and CLIMIT, which is managed jointly by the research council and Gassnova SF to develop gas power technologies with CO_2 capture and storage (CCS), with an annual budget of approximately NOK 130 million. Both of these programmes include cooperative projects with industry, which substantially leverages the funds supplied by the research council.

© Paul Sigve Amundsen; Montasje: Tone Kvenild/NTNU Info

Offshore wind farms are a promising area for new renewable power generation.

At the Centre for Renewable Energy, the cooperative between NTNU, SINTEF, Scandinavia's largest private research institute, and the Institute for Energy Research (IFE), a RENERGI project is allowing researchers to look at creative ways of developing wind farm networks on the Norwegian continental shelf that would both power Norway's offshore oil platforms and ship power to the Norwegian electric grid.

Chapdrive AS has also worked cooperatively with the Centre for Renewable Energy and Viva AS on a NOK 7.5 million project to reduce the weight of turbines that would be needed in large offshore wind tower structures; about a third of the budget is from RENERGI. By using hydraulic pumps and motors, the groups have succeeded in cutting back weight at the top of the tower where it is commonly located, near the blades.

Natural Resources: More than just Oil

Everyone knows that Norway's most valuable natural resources lie in the giant petroleum reservoirs under the North Sea – but wind energy researchers like John Olav Tande, with SINTEF Energy Research, have a decidedly different view of things. Norway's long, crenulated coastline makes an ideal location for harvesting the strong winds that can blow off of the North Atlantic. "Norway has tremendous physical potential," he says. Tande and others estimate that land-based windmills alone could generate in excess of 1,000 terawatt hours (TWh) per year, or nearly five times Norway's net domestic energy consumption of approximately 225 TWh. Already, land-based windmill projects owned by Statkraft AS, Europe's second largest provider of renewably generated electricity, churn out megawatts from wind farms in Smøla and Hitra in mid-Norway, and Kjøllefjord in northernmost Finnmark. Statkraft, Agder Energy AS of Kristiansand and Lyse of Stavanger also have pending applications to build a number of wind parks across the land.

But wind power doesn't have to be limited to the countryside. In fact, far more wind can be harvested if wind turbines are built in the ocean, whether as turbines fixed to the ocean floor, or floating in the deep ocean. All told, the potential available in Norway's offshore wind resources is a whopping 14,000 TWh per year, SINTEF's Tande estimates. "Norway could be a big exporter of renewable energy in addition to oil and gas," he says. "This offers us a unique possibility for developing a new industry in a global market."

Wind Enterprises Expand

Norway is already home to key industrial wind power stakeholders, such as ScanWind, which builds large wind turbines; StatoilHydro, which is working on Hywind, a floating wind turbine technology, and SWAY, which has its own floating technology; while Aker Kværner, Nexans, Devold AMT AS, Umoe are all large subcontractors providing a number of key components for wind turbines.

The market is sufficiently attractive that the Grieg Group, and Scatec AS, a Norwegian technology company started by the giant REC solar cell company founder Alf Bjørseth, have joined forces to develop offshore wind energy through a company called NorWind; the companies have also jointly invested in OWEC Tower AS of Bergen. While NorWind doesn't have any wind farms on the immediate horizon, in late 2007, Lyse applied for a pilot project that would allow the testing of five offshore wind turbines not far from the town of Utsira. And early in 2008, the company said it would like to build a wind park in the North Sea 130 km southwest of Lista. If all goes according to plan, Lyse would begin construction of the 200-turbine, 1,000 MW wind park in 2014.

© Statkraft

Virtually all of Norway's electricity comes from hydropower installations like this one owned by Statkraft AS.

Developing wind turbines that can withstand the strong stresses in the open ocean requires considerable technological expertise. That's where Norway's previous experiences working with oil platforms in the North Sea give the country a specific advantage. For example, in partnership with the IFE, Marintek, NTNU, Statkraft, Hydro, Statnett and Lyse, SINTEF Energy Research is coordinating an NOK 18 million project called "Deep sea offshore wind turbine technology."

A key aspect of the project involves the use of Norway's advanced testing facilities, particularly at SINTEF and NTNU, where researchers can take advantage of everything from Marintek's 50 x 80 metre Ocean Basin Laboratory, capable of submitting scale model wind turbines to severe battering by wind and waves; to a wind tunnel, a materials fatigue testing laboratory and an electronics laboratory.

Even the best wind turbines won't perform optimally if they aren't located in the right places. That's where the Tønsberg company Windsim has made its mark, by developing a 3D-simulator that can be used to find the best locations to site wind farms. A correctly sited wind turbine can increase its energy production by as much as 10%, says Windsim founder Arne Reidar Gravdahl. The programme also helps calculate the correct height for the turbines.

Wind farms will be sprouting across Norway's landscape as the country moves to take advantage of its wind power resources, which are some of the best in Europe.

Let the Sun Shine

Norway may be the land of the midnight sun, but it's not necessarily the sunniest place on the planet. That does not deter the Norwegians – R&D related to solar cell technology is big business here, as evidenced by the presence of REC, the Renewable Energy Corporation, the world's largest manufacturer of multi-crystalline silicon wafers for solar cells. In late 2007, for example, REC signed a NOK 4 billion wafer sales contract with Solland Solar Cells BV, under which REC will deliver silicon wafers to the Dutch company until 2015.

REC's success is due in no small part to the inventive genius of Alf Bjørseth, who founded a series of solar energy companies that later merged to become REC. Bjørseth saw an opportunity while at Elkem AS, one of the world's largest producers of pure silicon, in the early 1990s: solar cells need pure silicon, and Elkem had a ready source of the stuff, so why not build the basic components for solar cells in Norway? Bjørseth founded his own solar cell wafer producing company, ScanWafer AS in 1994, and the rest, as they say, is history. While Bjørseth retired as REC's CEO in 2005, he hasn't stopped in his pursuit of renewable energy resources; his company Scatec continues to allow him to develop new business ideas for renewable energy and advanced materials.

Norway's leading edge in solar cell technology has been bolstered by research efforts at SINTEF and NTNU, with the two research groups working together in the PV-Solar Cell Materials Gemini Centre, which includes a joint laboratory facility called "Heliosi". The facility includes a casting and clean room laboratory; pilot scale equipment for the metallurgical production and refining of silicon feedstock, including a rotary plasma furnace; and an etching and preparation laboratory where ingots can be cut, polished and etched. The group also has started working on a nano-level, with thin films and quantum structures.

Some of the most cutting-edge solar cell research at NTNU is looking at using a greater percentage of the sun's energy than is currently used. Solar cell technology now only converts visible light into electricity, or just 17% of the sun's energy. If solar cells could also use the infrared spectrum, cells would be able to use fully 50% of the sun's energy spectrum.

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Other companies, such as SolarNor AS, have developed solar heating technologies in which roof mounted panels allow the sun's heat to be absorbed and stored, to be used as hot water and as a home heating source.

Dreams of Hydrogen, Biofuel & Energy from the Sea

Norway's main renewable energy R&D focus has been wind and solar energy, but research into other options is ongoing as well. Across the globe, hydrogen power has been of great interest as a possible transportation fuel. Norway has explored this possibility with the development of HyNor, a Norwegian joint industry hydrogen infrastructure demonstration project along a 580-kilometre route from Oslo to Stavanger. The development of the highway is such that Mazda, the Japanese car manufacturer, selected the HyNor route in late 2007 as a test road for their new hydrogen-powered cars.

In recognition of the progress being made in hydrogen research, the Norwegian Transportation Department has increased its research and development budget for hydrogen projects to NOK 29 million in 2008, up from NOK 23 million in 2007.

Biofuel is another renewable energy resource that is just beginning to attract more research attention in Norway, spurred in part by a RENERGI Foresight Report issued in 2007, which observed that Norway's enormous forest and biomass resources were largely underused as a biofuel source. While researchers at SINTEF are at work on an NOK 250 million EU project on the development and use of bioenergy, Norwegian companies have been moving ahead to expand the markets for these products. With support from Innovation Norway, for example, Esta in Trøndelag has become Norway's first producer of biodiesel from salmon waste. Another private company called Uniol AS is also ramping up its biodiesel production from a plant in Fredrikstad, with the goal of producing 100 million litres of biodiesel for the Scandinavian market.

A company called Cambi AS of Asker has developed a Thermal Hydrolysis Process (THP) for anaerobic digestion of municipal and industrial sludge and bio-waste, which also allows for the production of biogas. Cambi THP plants can be combined with cogeneration plants, which produce green electricity and provide hot steam for the Thermal Hydrolysis Process. The biogas can also be cleaned to be used as vehicle fuel or as a replacement for natural gas.

Waves and tides also offer potential energy sources, providing that cost-effective techniques can be developed to harness the power they represent. WAVEenergy AS of Aalgard is developing the Seawave Slot-Cone generator (SSG) concept, a wave energy converter that uses three reservoirs placed on top of each other, in which the potential energy of the incoming wave is stored. The company has support from Enova, RENERGI and the European Union. A NOK 20 million pilot installation is planned for Kvitsøy.

© Damian Heinisch

REC manufactures wafers for solar cells at its Herøya, Norway plant. The company is the world's largest manufacturer of multi-crystalline silicon wafers for solar cells.

Another company that is pioneering the use of ocean energy is Hammerfest Strøm, which is among the leaders in developing tidal power generation. In 2002 the company installed a 300 kW turbine, powered by underwater propellers, at the bottom of Kval Sound, outside of Hammerfest. The turbine house for the structure is 50 metres under the water, and the propellers have a diameter of 22 metres. The test has ended, and the company is now working to bring power production costs to around 30 øre/kWh, and is looking for partners to help with the commercialization of the technology.

Statkraft also has its toe in the water, so to speak, in a partnership with Hydra Tidal Energy Technology (HTET). A pilot project is situated in a different Kval Sound outside of Tromsø. The company's concept is based on a floating, anchored steel structure that produces electricity when tidewaters drive four large turbines. The hope is to produce approximately 3.6 GWh per year.

Saving the World

Renewable energy is all about the future, with new structures and technologies built to supply the energy demands of the 21st century. That is fine for the future, but what can we do now? Climate change is no longer thought to be an unproven theory; glaciers are melting and temperatures are rising. Norwegian researchers are not only on the cutting-edge of developing renewable energy resources, but are at the forefront of helping develop carbon neutral technologies that will enable the use of conventional fossil fuels without damaging the environment.

The showcase for Norwegian efforts in this area has long been StatoilHydro's Sleipner field, the world's longest running commercial carbon dioxide storage project, where more than 10 million tonnes of CO_2 have been deposited in a capped sandstone formation 1000 metres below the sea floor on the Norwegian continental shelf. That only represents the beginning of the actions Norway is taking to succeed in this critical aspect of energy production.

The Research Council of Norway's CLIMIT programme, which is jointly administered by Gassnova SF, has funded a number of innovative research and development projects on CO_2 capture and storage. One such project is called BIGCLC, a 4-year, NOK 19 million cooperative effort between NTNU, SINTEF, Shell, Statkraft, StatoilHydro, Total, Conoco Phillips, Aker Kværner, Alstom and DLR are working on developing a chemical looping process, which involves running exhaust from coal- or oil-fired plants through two chemical reactors to remove the CO_2. The research group is currently building a pilot-scale reactor in Trondheim. The ultimate goal of the research is to capture CO_2 at a cost of under NOK 240 per tonne, with an energy loss of no more than 6% as compared to a conventional power plant without CO_2 capture.

The Gas Technology Centre, a cooperative effort between SINTEF and NTNU, is working with the University of Oslo, and the Cicero Centre for Climate Research on a CLIMIT cutting-edge carbon capture project called BIGCO2, which had a

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REC has become an important employer with its ScanCell plant in Narvik, northern Norway.

NOK 14 million budget in 2007 and a NOK 12.5 million budget in 2008. Its industrial partners include StatoilHydro, Statkraft Development, Aker Kværner and General Electric Global Research. The goal of the effort is to examine CO_2 capture and storage from the capture of the gas at the power plant to its eventual storage and sequestration. “We have a two-part goal,” says SINTEF’s Nils A. Røkke. “We’ll develop our expertise, to increase the likelihood that CO_2 free gas power plants can be built in Norway. Additionally, participants will get value out of the programme by being able to deliver products and processes for these kinds of facilities.”

SINTEF is also in charge of the European Union’s newest research project on CO_2 handling from coal and gas fired power plants. The project, called DECARBit, has 14 partners from eight lands, and a four year budget of NOK 120 million, of which between NOK 30 and 40 million will support research at SINTEF and NTNU. The group’s kick-off meeting was held in early 2008 in Trondheim.

It is not just research institutions that are taking the challenge of CO_2 capture seriously. In late January 2008, the Norwegian industrial group Aker ASA announced plans to invest NOK 875 million in a facility to capture carbon dioxide at a power plant to be built in Kårstø. The plant is expected to begin operations in 2009. Aker’s efforts reflect the fact that carbon dioxide capture and storage, while not required now, will someday be an accepted part of any fossil fuel power plant. “The objective is the development of construction methods and effective execution models that make carbon sequestration so inexpensive that it become cheaper to clean emissions than to pollute,” Aker says of the project.

Norway’s efforts to capture and store CO_2 have attracted the attention of the United States, which produces fully 25 percent of the world’s CO_2 emissions. In late January 2008, James Connaughton, environmental advisor to President George W. Bush, met with Norway’s Environment and Development Minister Erik Solheim and Bellona head Frederic Hauge. “There’s quite a bit of movement in the US to reduce greenhouse gas emissions,” Connaughton said to reporters in Oslo after the meeting. “But to combat climate change will require new technologies. Capture and storage of CO_2 will be important, and Norway has taken a leadership role inCO_2 capture and storage.”

RENERGI

RENERGI (Future Clean Energy Systems) is one of the Research Council of Norway’s large-scale programmes. The programme finances projects that develop knowledge and solutions as the basis for environment-friendly, efficient and effective management of the country’s energy resources, along with security of supply and internationally competitive economic development related to the energy sector.

For more information on the RENERGI programme, visit **www.rcn.no/renergi**.

beyond
the horizon

By David John Smith

The Research Council of Norway is the backbone of an extremely strong Norwegian R&D network, working closely with the Government, research and educational institutions, and private companies. The Research Council leads this coordinated effort, using knowledge-based research combined with applied innovation in order to turn solid R&D into successful products and services – and better quality of life.

Stimulating activities within the R&D environment is a primary success factor for the Research Council, and its overall strategy has been fine-tuned with this goal in mind. *Research Expands Frontiers* complements the three main areas of activities: environment, advanced equipment and open competition for applied research.

This overall strategy is further defined by five strategic priorities developed to guide efforts to generate insight, enhance opportunity and promote innovative solution. Enhancing research quality, increasing innovation research, expanding the dialogue between research and society, continuing the internalization of Norwegian research and fostering more national talent are all key success criteria.

Working Together

The Research Council's focus is in line with national objectives set in close cooperation with all areas of the Norwegian Government. Extending to all sectors of R&D, this cooperation includes working with the extensive health network within the country, featuring the impressive coalition between the Rikshospitalet University Hospital and the Norwegian Radium Hospital, two hospitals internationally recognized and designated as a Comprehensive Cancer Centre (see separate article).

In addition, such initiatives as the High North strategy are part of the growing recognition of the importance of the far northern areas for Norway as a whole. This recognition extends far beyond the oil and gas industry, encompassing other sectors as well, with environment and societal considerations central in the process. This includes the broad-based governmental initiative that will strengthen the Norwegian commitment in furthering its long-term climate policy by providing a major boost to research and innovation within climate and energy research.

Reaching Out

While its primary focus is on Norway, the Research Council looks far beyond the country's borders in stimulating international alliances that aid in increasing the quality and capacity of Norwegian research to strengthen Norway's pivotal role as a global partner. These activities are of great importance for the knowledge-based innovative development of Norway as it continues to become more globally competitive.

The Research Council administrates and distributes public funding through more than 130 research projects, including seven large-scale research programmes. These include the FUGE (Functional Genomics in Norway) programme, combining marine, medical and basic biotechnology, with environmental science and ethics also representing important aspects of the project. This wide range of projects and research allows the Research Council of Norway to keep the overall perspective in addressing policy research priorities that are of crucial importance to society. This perspective is important in assisting the national

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The Research Council distributes funding to more than 130 research projects, including seven large-scale research programmes.

government in its goal of continuing to strength Norwegian research and industry's positive impact on the international stage.

The Norwegian Research System

According to the Minister of Research, Tora Aasland, knowledge and technology will be essential in the goal of Norway becoming carbon-neutral by 2030. This is one important success criteria that drives many of the R&D activities here in this country. A research system is often described as being divided into three levels: a research policy level, a research strategy level, and a research-performing level.

On the policy level, the Government and its ministries, as well as the Norwegian National Assembly (Storting) are central in the process. Responsibility for strategy falls upon the Research Council of Norway, coordinating with governmental, educational and research institutions to optimize and focus planning. Finally, the research-performing level consists of the higher education institutions, private industry, as well as the independent research institutions described in the following section.

Outstanding in Their Field

There are certain areas of research that naturally complement Norway's policies and strategies. Energy and its effective use is the focus of Institute for Energy Technology (IFE), the research institute for energy and nuclear technology in Norway. Specializing in commercial software solutions and research activities within applied geophysics and seismology, and operating some of the world's largest seismological observatories, NORSAR is international recognized as expert in its field.

The prime institution responsible for defence-related research is the Norwegian Defense Research Establishment (FFI); and the Norwegian Institute for Air (NILU) conducts environmental research with emphasis on the sources of airborne pollution, atmospheric transport, transformation and deposition and is also involved in the assessment of the effects of pollution on ecosystems, human health and materials. Finally, the Norwegian Geotechnical Institute (NGI) offers research and services within geotechnics, engineering geology, hydrogeology and environmental geo-technology.

The Kjeller Science Park works closely with these five major Norwegian Research Institutes as well as the education institutions in order to fulfil its mission to move forward the commercialization process of research ideas and technology. With a focus on energy, environmental technology and social safety, Kjeller Science Park is committed in it goal to be at the centre of innovation and commercialization of these technologies.

Excellence is as Excellence Does

Initiated by the Research Council, the Centres of Excellence (CoE) programme is devoted to long-term basic research, the main objective to enhance business sector ability to innovate by focusing on long-term research, facilitated by forging close alliances between research-intensive enterprises and prominent research groups. With the addition of eight new Centres added in 2006, there are now a total of 21 Centres of Excellence working diligently to further their respective areas of activity. These new CoEs include the Centre for Software Components for Biomedical Flows (CBC), hosted by Simula Research Laboratory AS.

CBC's goal is to develop algorithms and software to perform extremely complex simulations such as the flow of blood through the heart, simulations that can be used in biology and medicine research. Although fluid flow has been studied with computer simulations for many years, flows in the body are very complicated because

SINTEF is the largest research organization in Scandinavia, working closely with the Research Council.

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they occur in complex, moving geometries, and they often interact closely with other processes such as electrical signals and chemical reactions. These simulations represent a huge potential for proving medical research as computer simulation is relatively inexpensive and convenient compared to traditional experimental techniques.

Spanning All Biotechnology

Other CoEs related to Biotechnology include the Aquaculture Protein Centre, focused on improved utilization of protein resources based on knowledge about the nutritional requirements of fish; the Centre for Molecular Biology and Neuroscience, taking a leading role in elucidating the role of DNA repair and genome maintenance mechanisms in preventing neurological disease and brain ageing; and the Centre for Cancer Biomedicine, a part of the Comprehensive Cancer Centre (see separate article).

Research at the Rikshospitalet University Hospital extends from clinical studies involving patients to cellular and molecular research as part of the Centre for Immune Regulation; the Centre for Research-based Innovation in Aquaculture Technology (CREATE) carries out research related to improving the grow-out phase of marine fish culture; and the Centre for Marine Bioactives and Drug Discovery (MabCent) lays the foundation for the development of high-value bioactive products by screening organisms from the arctic marine environment.

Innovation & Expertise

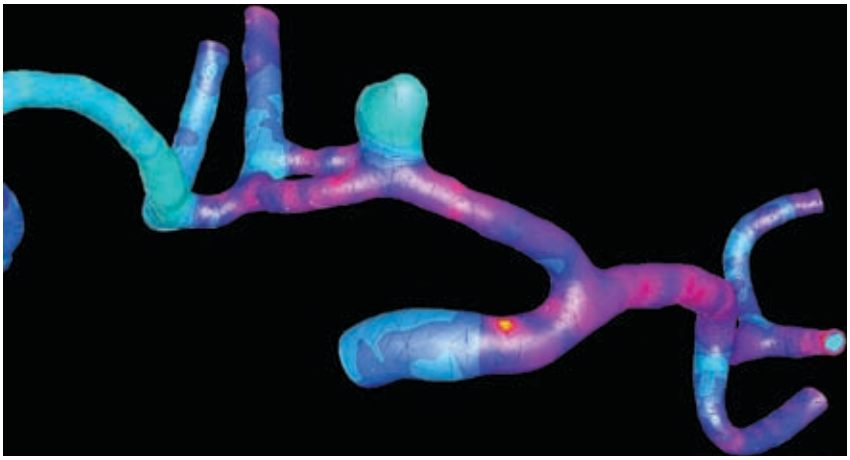
In cooperation with the Research Council, Innovation Norway works with companies through different phases of their business development process, beginning with assessment of marketing opportunities and priorities, and moving onwards to entrance strategies, establishment and expansion. The ultimate goal is to help them to increase their product or service impact within Norway and on the global market.

To achieve this goal, Innovation Norway offers a number of services and has a network of advisers working all across Norway as part of the process that covers a large area of business development, including how the product or service will be produced, what costs are involved, the planned sales and market channels to be used and how the customer will perceive the process. Striving to create identity and quality, Innovation Norway knows it has done its job well when its Norwegian business clients achieve success in Norway and beyond.

Other institutions working to further the R&D effort on a practical level include the Oslo Innovation Centre, with the goal is to help nurture commercial sound project ideas and research results, providing the opportunity to develop into successful companies (see separate article). Another success programme is called the “Centres of Expertise”, initiated by Industrial Development Corporation of Norway (SIVA) in close cooperation with the Research Council and Innovation Norway. The target of this programme is to provide support to regional clusters of companies who show international potential.

A Bright Future

There are a great many indicators pointing to the fact that the Research Council of Norway and its national R&D network is achieving success. These indicators include the number of published scientific articles, with Norway posting the highest growth in number during the period from 2002 to 2006 among Nordic countries. These statistics – and this country’s R&D environment in general – show clearly that Norway is forging forward in a wide range of fields, laying the groundwork for an even stronger and brighter future for innovative Norwegian companies in Norway and beyond in the years to come.



A Centre of Excellence, CBC software simulations includes blood vessels reconstructed from MRI pictures of patients with aneurysms.

making an impact

By David John Smith

The Norwegian Radium Hospital and its Institute for Cancer Research has long been internationally recognized for its innovative and efficient approach to cancer research and innovation. Since establishment more than 50 years ago, basic and translational cancer research has been the priority, and the recent merger with the Rikshospitalet University Hospital has improved an already bright future.

The impressive coalition between the two hospitals has been internationally recognized and designated as a Comprehensive Cancer Center (CCC), an achievement that ranks it with centres such as Memorial Sloan-Kettering, Dana-Farber, MIT, the Curie Institute in Paris and the Ludwig Institutes for Cancer Research in Brussels and London. The CCC became a member of the Organization of European Cancer Institutes in 2007, part of a growing European cancer research network, and is currently working to increase transatlantic interaction on cancer research and innovation together with Innovation Norway, Medinnova and the Research Council of Norway

The Radium Hospital/Rikshospitalet coalition is also the base for the Center for Cancer Biomedicine, recently awarded status as a Centre of Excellence (CoE). With this status comes the guarantee of substantial governmental funding for the next decade. This CoE, led by Professor Harald A. Stenmark, is comprised of seven research groups dedicated to gaining a deeper understanding of various types of cancer.

Radium Hospital/Rikshospitalet also hosts the Center for Research-based Innovation, led by Stefan Krauss and Ola Myklebost, spotlighting stem cell research within the cancer field. In cooperation with the University of Oslo, Ullevål Hospital and industry partners such as Invitrogen, Dynal, Affitech, Alpharma and Photocure/PCI Biotech; this Center will research the relationships of stem-like cells in tumour development. The identification of their unique properties may lead the way in finding new diagnostics and therapies.

Best in their Class

The Rikshospitalet University Hospital is a coalition of a number of different hospitals that are located in southern and eastern Norway. Rikshospitalet's major objective is to serve in the capacity as national reference hospital that will safeguard and develop highly specialized medicine within six core areas: transplantation medicine, children's illnesses, women's illnesses, oncology, coronary disorders and disorders of the brain and nervous system.

Research at the Radium Hospital has shown a high level of productivity and success, with seven research departments covering the entire spectrum of cancer-related research. Centering on translational research, these areas include the Departments of Biochemistry, Cancer Prevention, Cell Biology, Immunology, Radium Biology, Tumor Biology and the Department of Genetics.

A wide range of Radium Hospital research programmes are also ongoing, including Functional Genomics, Immunotherapy, Micrometastasis, PCI/PDT, Radiation Research, Stem Cell Projects and Gene Therapy. In addition, the Radium Hospital carries out ongoing clinical research in order to test new methods of cancer treatment. This impressive research effort is reinforced by the Oslo Cancer Cluster, an affiliation of nearly forty members, including industrial companies, academic research institutions, health initiatives and support groups.

The Genes Hold One Key

Headed by Anne-Lise Børresen-Dale, the Radium Hospital Department of Genetics researches processes, including the successful discovery of five different

© Rikshospitalet HF

With a focus on cancer, research at the Radium Hospital has shown a consistently high level of productivity and success.

molecular subclasses of breast cancer through examination of gene expression profiles – molecular "portraits" of the disease that predict different survival rates.

As Dr. Børresen-Dale indicates; "We want to build the whole picture from risk, early diagnosis, development, progression and treatment of the disease by taking a systems biology approach," she says. "This means gathering as much information as possible, including molecular profiles of healthy tissue and of tissue at various stages of the disease from diagnosis through to relapse or recovery."

As with all research departments within the Radium Hospital, the goals of the Department of Genetics are ambitious but achievable. These include joining forces and expertise within the Oslo medical and education environment to create a world-leading Breast Cancer Research Center; to follow the linear time course of predisposition, initiation, early stages and advanced disease, then dissect the molecular mechanisms triggered at each stage; and finally, to follow the multidimensional interactions at various levels in a systems biology approach.

Strength in Cooperation

The list of successful biotechnology companies affiliated with Radium Hospital/ Rikshospitalet is impressive. These include Diagenic, a company using gene expression measurements in blood to detect diseases. Currently finalizing tests for early detection of Alzheimer's disease and of breast cancer, the company has already presented detailed study-results of these tests to the international environment. In addition, studies are currently being conducted with blood samples from patients in Europe, USA and India, with both tests targeted for CE approval during 2008 with subsequent FDA approvals. The first commercial agreement is already in place for the breast cancer test.

Other Diagenic activities are continuing to gain international attention, including a research collaboration with the Harvard Medical School's Clemens Scherzer Group, a study funded by The Michael J. Fox Foundation for Parkinson's Research (MJFF). Company techniques will be used in developing a test for early Parkinson's disease detection, Diagenic's third product.

Spinning-off to Success

Spin-off stories have included Biomolex, a joint-venture between Ideas ASA and the Radium Hospital established in 2001 based on technology within autoradiography, genomics and proteomics; and the successful GemVax, sold in 2007 to the Danish pharmaceutical Pharmexa. The well-known company PhotoCure was formed as a result of photodynamic therapy based on in-house research, which in turn generated another spin-off, PCI Biotech, on the forefront of the novel drug delivery technology, photochemical internalization (PCI).

PCI is a technology for light-directed drug delivery and was developed to introduce therapeutic molecules in a biologically active form specifically into diseased cells, enhancing the delivery of all molecules taken into the cell by endocytosis. This includes most types of macromolecules, drugs carried by antibodies or nanoparticles, as well as some small molecule drugs. In 2007, PCI Biotech filed two patent applications covering the combination of siRNA (short interfering RNA) and the PCI technology, and the company will continue to explore the outer reaches of PCI-technology.

The positive results that have been generated by the Radium Hospital/ Rikhospital cooperation are impressive. Look for this success to continue to generate success as they work together with the Norwegian health environment academia, clinical research, and industry in a common effort to reduce the effects of various forms of cancer in the world.

Using the most advanced technology, Diagenic uses gene expression measurements in blood to detect diseases.

securing the future

By Nancy Bazilchuk

Norway's postcard-perfect coastline, rugged mountains and charming cities and towns seem far from the hustle and stress of 21st century life. Indeed, Norway is consistently ranked either first or second in the United Nations Development Programme's Human Development Index, a measure of quality of life. But in spite of these idyllic conditions, or perhaps because of them, Norwegian researchers, government officials and industry leaders have developed impressive expertise in the management of security and risk.

Norway's pioneer in risk assessment may be Det Norske Veritas, or DNV, founded in Norway in 1864 to inspect and evaluate the technical condition of Norwegian merchant vessels. Since then, the company has expanded into risk assessment and management for everything from oil platforms to satellites. But Norway's efforts in security and risk management have grown to include businesses that help predict tsunamis or develop computer security software. Elsewhere, researchers and industries are taking the long view on security and risk issues under a NOK 12 million programme called SAMRISK, Societal Security and Risk, funded by the Research Council of Norway.

Society's Response to Risk

Jon Bing, chair of SAMRISK's programme board, says it's important even for safe countries such as Norway to examine issues of societal risk. "We have surprisingly little knowledge about societal risk and vulnerabilities," he says.

SAMRISK is currently funding eight projects, which together are intended to increase Norway's basic understanding about the country's threats, dangers and vulnerabilities, how unwanted events can be prevented, and how crisis management can be strengthened – all the while guaranteeing that basic human rights and privacy are respected. Bing says it is important to remember that threats to security include natural disasters and infrastructure problems, not just terrorist activities.

"Our results will be a better understanding of what to look for, advance warning of trouble ahead," he says. "We're looking at infrastructure, vulnerability, and coordination between the different authorities."

One SAMRISK project is called SORISK, The Social Determination of Risk, in which researchers are looking at critical infrastructure and mass transportation protection in the Norwegian civil aviation sector. Project leader Prof. James Peter Burgess, from the International Peace Research Institute in Oslo, says the project is taking a less conventional approach to the issue of security and air transport.

"Traditionally, security has been about the walls being high enough, or the glass being thick enough, and on better detection of weapons," he says. "The move has been away from people ... but security is about people, too. In the social determination of risk, we're trying to reopen that dimension – where are the people? Where are the social issues, the cultural issues?"

In the context of civil aviation, that might mean bringing security standards at different sized airports into line with the social and cultural context of the airport, Burgess says. "Our point is that there are different security problems at a local level and at a metropolitan level," he says. "We're trying to bring the local situation back into the equation."

© Knut Bry / Oslo Lufthavn AS

Security experts are studying how cultural and societal settings can be used to fine-tune security at Norway's airports, such as Gardermoen, Norway's main airport outside of Oslo.

From Ships to Tsunamis to Internet Security

DNV may have gotten its start by assessing ships, but these days, the company is working on a variety of topics, whether it's controlling risks from computer malfunctions to certifying an automobile company's management systems. Late last year, in fact, DNV was asked by the Norwegian Government for advice on international quotas and carbon capture and storage techniques, as the country institutes its ambitious pledge to make Norway carbon-neutral by 2030.

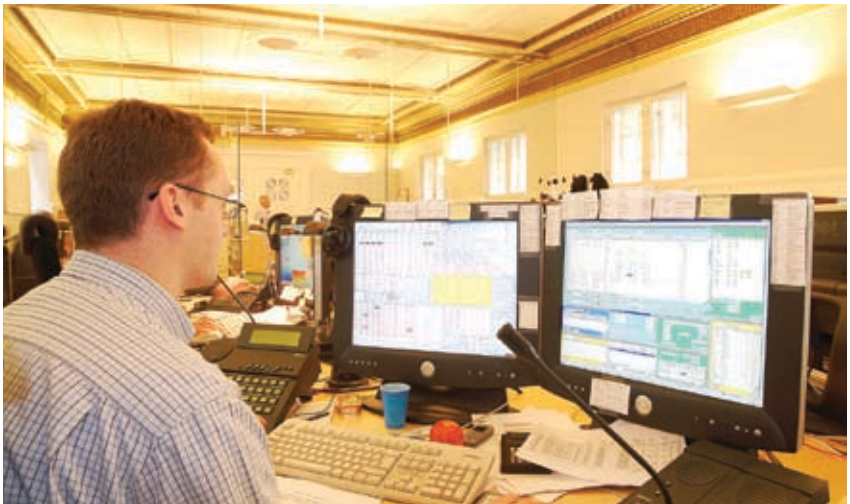
"With our risk-based approach and technology base, DNV aims to help business and society to focus on the critical needs for change due to global warming," says Henrik O. Madsen, DNV President and Chief Executive Officer.

The International Centre for Geohazards (ICG), hosted by the Norwegian Geotechnical Institute, has been designated by the Research Council of Norway as a Centre of Excellence. ICG researchers are among the leading scientists in geohazard prediction and mitigation, with their work visible around the globe. For example, they've created a landslide database for the country of Nicaragua, and helped with tsunami risk assessment in Southeast Asia, particularly in the aftermath of the December 2004 Indian Ocean tsunami.

Companies like Fugro Oceanor AS of Trondheim help reduce risk by providing integrated real-time environmental monitoring and information systems for oceans, rivers and lakes, groundwater and soil. While the company's floating buoy-based monitoring systems are often used to collect scientific data, they also provide information to offshore oil and gas companies, and in harbour monitoring, sea and fresh water quality monitoring and weather forecasting. The company was recognized by the Research Council of Norway and Innovation Norway by being included in a Norwegian Centre of Expertise in Instrumentation. Other companies in the NCE are Kongsberg Maritime, Roxar, Q-Free, Kongsberg Seatex, Sicom, Norbit, Cavotec MicroControl, Noca and StatoilHydro.

The ocean may be immense, but the information ocean is equally vast, with computer and Internet security a growing business worldwide. Norwegian companies have developed strong expertise in these areas, with companies such as Kantega, which specializes in Internet-based identity services to enable Internet businesses, Internet banks, and public and private web pages to safely identify the person who is logging in to use the various services. Kantega's subsidiary Kantega Secure Identity has already built Norway's largest security portal with 12 million potential online users. The company is now planning to expand into Europe.

At Secustream Technologies AS in Trondheim, researchers have been developing content protection systems for all kinds of interactive networks, such as IPTV and interactive cable. Secustream Security System ensures any digital movie, video, TV channel or game can be securely shared over any IP-based device, because it protects streaming digital content "second by second," not just at the beginning or end of a movie or TV show. Hollywood studios spend billions of dollars every year on security, "but it is still easy to break into systems," says Gisle Østereng, company founder and CEO. "So we have created a very robust mechanism to ensure that information can be securely shared."



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Computer security is an important part of today's economy, enabling e-commerce to take place.

uniting for the environment

By Edward Milsom

Estimates in 2006 by the International Energy Agency (IEA) and the Stern Review on the Economics of Climate Change provide compelling evidence that shipping is the most efficient and environmentally responsible transport industry, especially given the large volume of goods carried globally by this means. The IEA estimates that the industry's global share of CO_2 emissions is around 10%, compared to 76% from road transport, and 12% from aviation. In addition, the European Community Shipowners' Association (ECSA) produced a paper earlier this year with the support of the International Chamber of Shipping (ICS), describing the industry as the "backbone of globalization" (*Climate Change and Shipping ECSA Position Paper*, January 2008). Compared to ECSA's estimate that shipping carries some 90% of world trade, the corresponding percentage of emissions are impressively low.

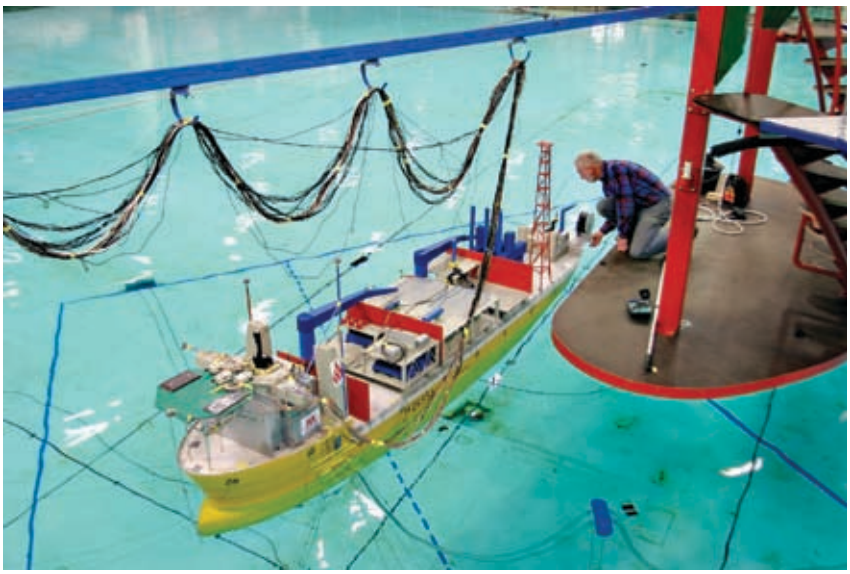
The Norwegian shipping industry takes the challenges related to emissions and climate change very seriously. Working closely with the industry, the Research Council of Norway and Innovation Norway support a wide range of initiatives related to innovation, development and application of new techniques and technologies that aim to make the industry even more environmentally responsible. These include the Research Council's programme for maritime activity and offshore operations (MAROFF), emphasizing the importance of strengthening the Norwegian maritime cluster and developing cooperation between the business, technology and research elements of the industry.

The Norwegian Marine Technology Research Institute (MARINTEK), concentrates on developing marine technology research solutions together with national and international companies and authorities. Finally, the MARUT initiative was established in 2004 by the Norwegian Trade and Industry Department with the aim of increasing value creation in the maritime sector, emphasizing the potential of a close-knit national maritime cluster.

Common to all the initiatives is co-operation found throughout the industry. Just one example is MARUT, working with the Norwegian Shipowners' Association, Norsk Industri, the Research Council, Innovation Norway, Marintek, Det Norske Veritas (DNV), and others. This is the synergy of Norwegian organisations, operating within a common framework with the goal of increasing the profile of the Norwegian maritime industries and producing solutions that ensure the continued development of environmentally-supportive technologies.

MARINTEK – Researching Holistic Environmental & Safety Solutions

Together with the Department of Marine Technology at the Norwegian University of Science and Technology (NTNU), MARINTEK constitutes the Marine Technology Centre in Trondheim, with research facilities that include the Ocean



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Marintek Ocean Basin Lab
Unique research opportunities are offered at the Ocean Basin Laboratory in Trondheim, where scientists can examine the effect of wind and waves on floating and fixed structures over a depth of ten metres.

Basin Laboratory. This simulation tool allows scientists to monitor wind and waves over a depth of ten metres – unique testing conditions for fixed and floating structures and offshore deep-water structures. Other MARINTEK's facilities include a Ship Model Tank, a Marine Structures Laboratory, and a Cavitation Tunnel. The opportunities for developing a wide range of technology within these facilities are nearly unlimited.

MARINTEK's current programmes include the international collaborative project "Flagship", (European Framework for Safe, Efficient and Environmentally-Friendly Ship Operations). MARINTEK's e-Maritime Department Research Director, Jan Ørnulf Rødseth explains; "In my opinion, the whole Flagship project is directly or indirectly concerned with the environment. The idea is to produce safe and efficient shipping by developing new solutions that will also benefit the environment."

The four-year Flagship project budget is EUR 19.4 million, and is co-ordinated by the European Community Shipowners' Association (ECSA) in Brussels, with MARINTEK providing project management support. Synergy is an important theme for Flagship, with a general vision being to pool expertise in order to address practical problems faced by ship operators in relation to the vessel, its day-to-day operation, and emergency occurrences.

"One sub-project deals with the technical operation strategy for ship owners, managers and equipment and service suppliers," says Rødseth. "The idea is to use new information technology to find better ways to perform the business processes. This will in turn have the potential to lower the environmental footprint of shipping, although this is very low already," he says.

Flagship adopts a holistic approach to the environment that takes into account indirect causes of inefficiency. Rødseth pointed out, for example, that the project is also involved with increasing safety levels in shipping, therefore reducing the likelihood of accident-related environmental spills, adding that "Another sub-project is directly dealing with energy-efficient operation and will look into the problem of reducing the carbon footprint by better technical solutions, better logistics and better operational procedures. This activity is also looking into ways to handle the environmental issue at the legislative level."

Arctic Emergency Operations – MARINTEK's Commitment to Cold-climate Safety

MARINTEK is a specialist when it comes to shipping in cold climate conditions in rough weather, with several projects in focus, including Arctic Emergency Operations (AEO), an international project, with participants from Japan, Germany, France and the Russian Federation This three-year project, supported by the Research Council of Norway, is coordinated by MARINTEK at its facilities in Trondheim. Safety is a key issue, with the goal to produce guidelines on emergency operations for disabled tankers in ice-infested waters and collision scenarios for vessels in Arctic Waters. The Ship Manoeuvring Simulator is the basis for MARINTEK's developing proposals.

Tor Einar Berg, Principal Research Engineer of Marine Operations and Simulation, was full of praise for the latest of a series of workshops held for an international environment related to emergency towing operations, this held at Ship Manoeuvring Simulator Centre (SMS). "It was a very successful workshop," says Berg. "There were around 40 participants from a number of countries - Iceland, Sweden, Germany, France, Spain and England. The mixture of operators presenting current cases, and experts from different environments within the maritime industry, gave grounds for good discussion and input into new training elements in simulator practices. It also

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Emergency towing operations are a theme at this international workshop at the Ship Manoeuvring Centre in Trondheim, where participants from many different countries come to learn from Norway's extensive experience and research.

provided material for the presentation of current, fresh cases for teaching in colleges and universities."

The Research Council and MAROFF are important to AEO's continued development, again showing the synergy so effectively modelled by the Norwegian industry. Berg highlights the importance of MAROFF's seminars in making the AEO project visible to national maritime actors; "In addition to finances, the information spreading through MAROFF's seminars contributes towards the presentation of the project to maritime actors in Norway. The project will also participate at the MAROFF seminar which will be held in Svalbard in the beginning of March."

Financial Incentives for Innovative Projects

R&D financial support continues to open up new possibilities, including additional funding to MAROFF for user-steered innovation projects (BIPs) that prioritize methods of reducing NOx leaks from the shipping industry. MAROFF, working together with MARUT's new "Coast Gas" initiative, are geared towards projects encouraging the use of gas as fuel for ships, looking to further Norwegian progress within the field. The hope is that this collaboration will provide new cost-effective contributions to the industry's applied research into emissions.

MAROFF has selected 14 programmes for the 2007-10 timeframe, including Det Norske Veritas' Maritime Emission Mitigation; Safe and Cost Effective Ship-to-Ship Operations in Arctic Waters by Bergesen Worldwide Gas; a system for secure and effective surveillance and control of underwater operations by Rolls-Royce Marine AS; as well as a project investigating hydrodynamic aspects and control strategies for ship-to-ship operations. MAROFF's broad scope and ability to finance a wide range of projects is a sign that the industry has the real opportunity to match its ambitions. Also, the Norwegian Trade and Industry Minister, Dag Terje Andersen indicated further good news for the shipping industry with the government's maritime strategy "Steady Course" contributing additional budget funds for both the industry in general as well as MARINTEK.

Working to Strengthen the Norwegian Cluster

As MARUT enters its fifth year working to make Norway a more competitive maritime nation, the role of "Strategisk Råd" (Strategic Council) is central. The Council is led by the Ministry of Trade and Industry, and its aim is to debate the challenges of the shipping industry, and to contribute to MARUT's direction and development. MARUT emphasizes their policy conviction when they indicate the great potential to be gained with a tighter working cluster within maritime research and innovation, and that Norway's clear goal must be to "have the most competitive and innovative maritime cluster in the world," These high aims reflect the reality that the Norwegian maritime industry is already experiencing, that in fact solutions to environmental and safety problems benefits transcend individual shipping companies and have a clear positive effect nationally and internationally.

Norwegian "Grassroots" innovation and research create synergies that have the potential to resonate across the huge global shipping industry. It is in this light that Norway's shipping industry should be viewed. Specific programmes, such as AEO and Flagship, have excellent chances for success with this multi-level support from the R & D community in this country.

ECSA and the International Chamber of Shipping have laid down a fundamental principle for the international shipping industry as it faces climate concerns. "International shipping must work for international solutions…applicable to all ships regardless of flag". At a national level, the Norwegian shipping industry is already modelling that philosophy, with support and guidance coming from a wide range of governmental and research organizations.

MAROFF

The Research Council of Norway's **MAROFF (Maritime Activities and Offshore Operations)** programme supports projects that build and develop expertise within areas that are necessary to realize innovation within maritime activities and offshore operations.
For more information on the MAROFF programme, visit **www.rcn.no/maroff**.

the sky is no limit:

norwegian satellites show the way

By Edward Milsom

At 78º north, braving the bitter cold beneath the Breinosa Mountain on Svalbard, a group of scientists and dignitaries gathered for the opening of a new research centre. The sense of anticipation at this most northerly of stations was similar to what was found on the other side of the planet, at 72º south, where, just a few weeks earlier, another Norwegian ground station opened on Queen Maud Land. The Kjell Henriksen Observatory, part of the University Centre in Svalbard (UNIS), and Kongsberg Satellite Services' TrollSat station in the Antarctic, both began operations in the early months of 2008, a time of unparalleled excitement in Norwegian space research. Together with plans for a new satellite, these new Centres provide the Norwegian space industry with the opportunity to propel itself to the forefront of key areas in global environmental research and to strengthen its role as a vital member of the European Space Agency and as a leader in international research.

Now, more than ever, there is a broad understanding that the international space industry is a race for individual countries and organizations, but a global, collaborative project in which all must play their part. Norway, with its historical maritime experience and extensive polar satellite knowledge, has the goal to contribute more than its part as a rising space nation. Challenges such as climate change, polar ice-melt, the increase in maritime traffic, and even environmental incidents such as oil spills are high on the agenda for cooperative activities between the Norwegian Space Centre (NSC) and the Norwegian Industrial Forum for Space Activities (NIFRO).

As part of the Minstry of Trade and Industry, the NSC functions as a co-ordinator of national space interests.

Commercial properties managed on behalf of the Norwegian Government include the Andøya rocket range and Kongsberg Satellite Services (KSAT). KSAT in turn owns the ground centers TrollSat on Queen Maud Land, and SvalSat on Svalbard, giving the NSC a strong presence in the polar satellite field.

A National Space Network

Responsibilities to the European Space Agency (ESA) necessitate close cooperation on all levels in Norway. NIFRO cooperates with the NSC as industrial liaison in industry areas of key importance as well as with implementation of national space strategies, with main focus areas including telecommunications; navigation and positioning earth observation; environment and resource surveillance; and R&D. NIFRO members include the Andøya Rocket Range, KSAT, and universities such as UNIS. Institutes such as the Research Council, which supports the utilization of Norwegian investments in scientific infrastructure in the ESA; the Norwegian Polar Institute, the Meteorological Institute, EISCAT, and the Nordic Optical Telescope all have major roles in the national space industry. It is an industry network that both requires and facilitates a strong sense of collective identity.

One of the many advantages that Norway's high latitude confers is the opportunity to observe the so-called "Northern Lights" (Aurora Borealis). The newly built Kjell Henriksen Observatory, on Svalbard, offers unparalled views.

The Plant Biology Centre in Trondheim is among the world leaders in examining the reaction of plants to weightlessness, even having a seed experiment on the International Space Station (ISS). Solar physicists at the University of Oslo and Norwegian astronomers are leading the way in combining observations with the modelling of phenomena in the sun's atmosphere. A contract has been secured with JAXA, the Japanese space organisation, to receive data from the sun satellite Hionodo, with data read on Svalbard. According to Terje Wahl, the NSA's Chief Scientist; "Norway is perfectly situated for studies of important aspects of the Sun/Earth connection; these are the processes that cause the Northern Lights or Aurora Borealis."

Top of the World

Located 500 metres above sea level, the Kjell Henriksen Observatory (KHO) was opened in early 2008, a historic moment for Norway and its scientific community looking to contribute even more as global leader in the field of aurora research. Tore Aasland, the Norwegian Minister of Research and Higher Education, provided high praise for the new station; "I am convinced that this new research facility will represent a central addition to the research infrastructure in Svalbard, and I believe KHO will produce significant results in the future." Well equipped with more than 15 optical instruments, and other non-optical instruments for the research of the middle and upper atmosphere, KHO is positioned to further enhance the international reputation built upon Svalbard's unique observational opportunities.

KHO activities are international in scale, with 16 scientific organisations from 7 nations, including University College London and the National Institute of Polar Research in Japan all taking advantage of the new facilities. The observatory looks set for a bright – and global – future. As Terje Wahl commented; "This is a big contribution to environmental research," he says. "It is both a focal point for students from all parts of the world, and a hub for polar environmental studies collected at and from Svalbard."

Satellite Potential – North & South

The Kjell Henriksen Observatory joins a vibrant scientific community on Svalbard, which includes a number of ground stations for polar-orbiting satellites involved in Earth Observation. "Our northern location is a big advantage," says the Space Centre's Deputy Director General of Corporate Communications and Education, Marianne Moen. "We have the advantage of having well-placed ground stations for polar-orbit satellites, and can therefore be interesting cooperative partners for those who own satellites," she adds.

These stations on Svalbard include SvalSat, a commercial venture that is partly-owned by the Norwegian Space Centre. The world's best-placed station for polar-orbiting satellites, it provides an invaluable contribution to the field of Earth Observation. Operators at SvalSat are able to perform data dumps for each satellite orbit at one site, which includes Telemetry Tracking and Commanding (TT&C). The establishment of fibre cables, supported by the contributions of the NSC and NASA in 2004, enables the operation of real-time services including the monitoring of oil spill areas all over the world.

Earth Observation is one of the most important developing areas within environmental research. Norway's contribution is increasingly significant, and

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TrollSat is Kongsberg Satellite Services' ground station for data reception and the control of polar orbiting satellites. It is hoped that the centre will help improve both weather forecasting and the surveillance of remote waters.

early 2008 saw the opening of another pioneering centre, TrollSat, on Queen Maud Land. With this opening, KSAT is only company in the world offering satellite data readings both in the Arctic and the Antarctic. “TrollSat opens for faster access to environmental data measured from Earth Observation and meteorological satellites. Fast access will improve the weather forecast as well as monitoring and surveillance of remote waters,” says Rolf Skatteboe, KSAT’s President.

Earth Observation is one of the Norwegian Space Centre’s key areas of focus. Satellite data processed at SvalSat and TrollSat can contribute to studies of environmental processes and the effect of human activities on the planet. Among the issues currently being explored are biological diversity, water pollution, monitoring of the ozone hole and glaciers, the extent and changes to the Gulf Stream, and the charting of ice edge and sea ice extent. “The Arctic is the place on the earth where the climate changes will be shown the quickest,” explains the NSC’s Marianne Moen. “Therefore it is important to keep an overview over the changes, both in relation to ice conditions and in vegetation in these enormous areas. Since nobody lives north of 79ºN, satellites are the only rational way to acquire information. The polar orbit satellites cross the North Pole area 14 times a day, and coverage in the north is better than in areas that lie closer to the Equator. The reading station in Svalbard has a strategic location because it is possible to make contact with the satellites every time they pass.”

Contributions to European Programmes

Norway has traditionally being a driving force in field of marine environment monitoring, especially seen in the context of the European Space Agency’s programmes. The ESA’s two polar orbiting satellites, ERS-2 and ENVISAT, are both used in the monitoring of the seas and the wider environment, with their data downloaded at Tromsø and Svalbard. “In Norway, we have traditionally had a strong reputation within satellite communication,” says Moen. “We have always had to communicate with trade and fishing vessels while they were at sea, and in the 1970s, the development of offshore-work started. In Svalbard, there were people who wanted to watch TV and talk with their relatives on the phone. This helped to develop technology within communication via satellite that is still going strong in Norway.”

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The Norwegian Space Centre at Skøyen, Oslo, is a government agency promoting national space interests, research and activity. It also supports Norwegian involvement in the European Space Agency (ESA).

The massive global initiative, GEOSS, coordinated by the Group on Earth Observations (GEO), came into being in February 2005 at the Third Earth Observation Summit in Brussels. This followed high-level meetings at the G8 Summit and the 2002 World Summit on Sustainable Development. The broad 10-year goal is to foster international cooperation with regard to Earth Observation, so that global environmental strategies can be discussed based on the best available information. The ESA’s branch of the GEOSS project is known as GMES (Global Monitoring of the Environment and Security).

The NSC has offered GMES its expertise in the far north by financing EuroCryoClim, a collaborative project with the ESA. EuroCryoClim uses a range of data from different satellites including the ESA’s ENVISAT, and in the future will also use the European satellite family, Sentinel. On a local level, EuroCryoClim the contribution

of the NSC, the Meteorological Institute, the Norwegian Polar Institute and the Norwegian Water Resources and Energy Directorate with the aim of making as much data as possible available to climate researchers. “Norway knows a lot about snow and ice,” says Moen. “Therefore we have got involved in these areas of GEOSS. The aim of the project is to make maps and an overview that shows the development of sea ice in the Arctic over long periods of time. Eventually, the aim is to develop long series on iceberg ice and snow quantities, but at the moment we have only started with the sea ice,” she adds.

EuroCryoClim is Norway’s biggest contribution to the GEO, and might be described as Norway’s environmental flagship within the field of Earth Observation. Furthermore it provides evidence of the national industry’s niche expertise. The challenges presented by global environmental change may be immense, with no single nation alone have the resources to solve them, and EuroCryoClim shows that, through local, national and international cooperation, great and highly practical achievements are still possible.

Norway’s other significant addition to GMES is in the field of sea pollution and surveillance. “Norway got started very early using radar satellites for oil spillage and the uncovering of pollution in the seas,” says Moen. Kongsberg Seatex is again the pioneer, last year winning a contract with the European Maritime Safety Agency (EMSA) for surveillance of Europe’s coastal seas. KSAT processes satellite images and relays them to the Agency’s headquarters in Lisbon usually within 30 minutes.

The EMSA’s programme, the CleanSeaNet satellite-based oil spill detection service, began producing results just a day after it became operational on 16 April 2007, capturing images of four possible oil spills between England and the Netherlands and relaying the information for assessment in Lisbon. That picture was produced by the European Space Agency’s ENVISAT and downloaded at KSAT’s ground station in Tromsø. Last autumn, a large oil tanker sank during a strong storm in the Kerch Strait area of the Black Sea. The resulting oil leakage represented an environmental hazard causing concern for the areas around the strait. The EMSA began monitoring the situation immediately by requesting routine coverage of the area, gathering data from both ENVISAT and the Canadian Radarsat-1 satellite. Data was transmitted at Tromsø and Grimstad in South Norway, showing a number of spills in the area.

On Track for Norway’s First Satellite

Keeping track of large ships and recording their names, positions, speeds, courses and cargoes is an essential and basic component of maritime safety. Vessels have long benefited from Norway’s pioneering Automatic Identification System (AIS) transponders, which transmit information from ships larger than 300 GT to neighbouring ships and the coastal

© NSC. Illustration: NSC/Pål Nordberg.

Satellites including the European Space Agency’s METEOSAT, orbiting the earth at a distance of 36,000 km. Plans are already at an advanced stage for the launch of an experimental AIS (Automatic Identification System).

authorities. At ground level the system is limited, with the existing shore-based arrangement, operated by the Norwegian Coastal Administration, extending no further than 40 nautical miles. In short, a huge percentage of the Norwegian ocean areas have been simply out of range.

When the then Director General of the Norwegian Space Centre, Rolf Skåv, outlined the centre's essential motivational philosophies in his farewell speech less than two years ago, he declared that "The Norwegian Space Centre prioritizes the beneficial in preference to the more spectacular or media focussed, such as national astronauts or its own scientific satellites," Research, however, was already sounding out the possibility of launching a Norwegian satellite in the 2009-10 timeframe – a satellite that may bring ships in the far northern seas into communication contact.

Rather than representing a change in policy from the "beneficial" to the "spectacular", this satellite is very obviously aimed to be the embodiment of both adjectives. Its purpose is clear: to introduce a space-based AIS system, with a dramatically improved coverage. "There are two goals, so to speak," says NSC's Chief Scientist, Terje Wahl. "The application-related goal is to demonstrate that it is possible to receive signals in the northernmost waters. We want to extend AIS coverage beyond what is available now at ground level."

"The second goal," he continues, "is the industrial side, which will show that, by starting early, we will be able to secure a good role for the Norwegian industry in the field of AIS satellites for the future." The opportunity for the new satellite will not only enhance Norway's international standing as a pioneering space nation, but will also provide genuine safety enhancements for the maritime industry, in keeping with the NSC's stated aim that its activities support needs both in research and public administration.

International Cooperation

The AIS receiver is being developed by Kongsberg Seatex in Trondheim, and cooperation with the University of Toronto Space Flight Laboratory will secure the production of the satellite platform. In keeping with the NSC's "use-value" catchword, the satellite's dimensions are to be just 20 x 20 x 20cm, and this, Wahl confirmed, will significantly reduce the cost of launch.

The Norwegian Government's broad strategy for the High North lists among its recommendations that satellite-based AIS research should continue. With this encouragement, research is entering a crucial stage. "The design phase will be complete soon," Wahl confirms. "What we call the Critical Design Review will take place at the end of February. The plan is to start construction after that."

Launch within the next two years now seems highly likely, and a Norwegian satellite looks set to join the industry's remarkable recent achievements. Norway's historical rapport with ice and snow, its access to the very northernmost reaches of human settlement, and its proud coastal and seafaring traditions are fine advantages to bring to the international space community. The pragmatic "use-value" focus at the NSC, the vision and optimism of the GEO for worldwide cooperation in Earth Observation, and a concrete role in the ESA, ensures that these advantages will be put to practical use, whether for ships sailing in busy Norwegian waters, or for future generations reaping the rewards of better-informed environmental management at a global level. For the Norwegian space effort, the sky poses is no limit, it represents challenges - and opportunities.

a market full of options

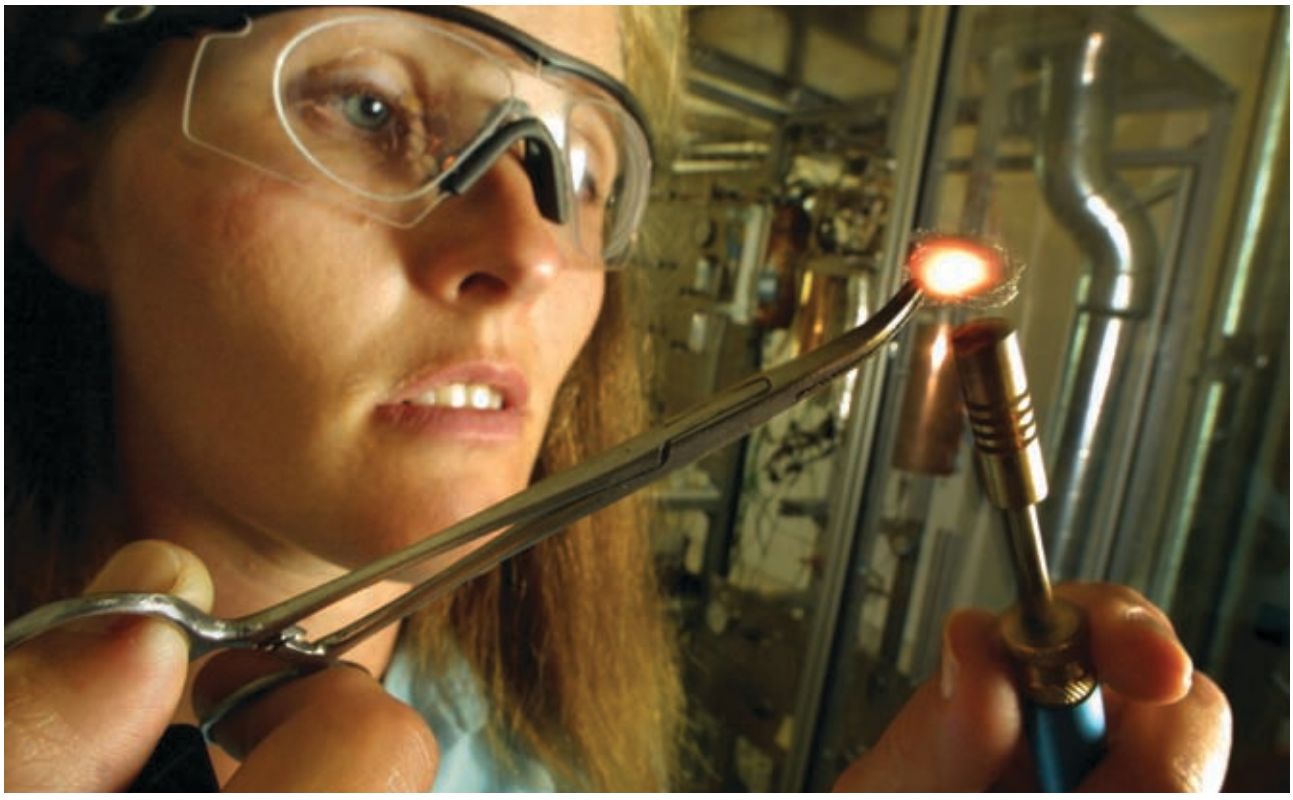
By Nancy Bazilchuk

Norway's booming economy, fuelled by oil and gas revenues and by emerging developments in science and technology, needs highly educated scientists and engineers – lots of them. The Norwegian research institution NIFU-STEP has even put a number on the demand: 480 PhD candidates need to graduate every year for the next 10 years to meet the economy's growing appetite for skilled expertise in science, engineering and technology.

The demand is good news for foreign students and researchers who might be interested in living and working in Norway, says Nina Therese Maubach, advisor at the Research Council of Norway and national contact point for the People programme, a part of the European Union's 7th Framework programme. "For foreigners with the expertise we need – science, technology and engineering – they will come to a market full of options," Maubach says. Studies show that foreign researchers choose Norway due to its excellent working conditions and first-rate research communities. Along with its highly developed infrastructure and optimal career opportunities, most research and development work in industry is closely linked with universities and colleges – which makes for a dynamic learning situation. Other important reasons for choosing Norway are a generally high standard of living and a family-friendly society.

The EU's 7th Framework programme includes EUR 4.75 billion to support the People Programme and funding for researcher mobility under the Marie

Norwegian research encompasses a broad range of topics, including chemical processing.



© Thor Nielsen/NTNU Info

Curie Actions programme. The Marie Curie programme is applicable to PhDs and postdocs as well as more seasoned researchers, Maubach says.

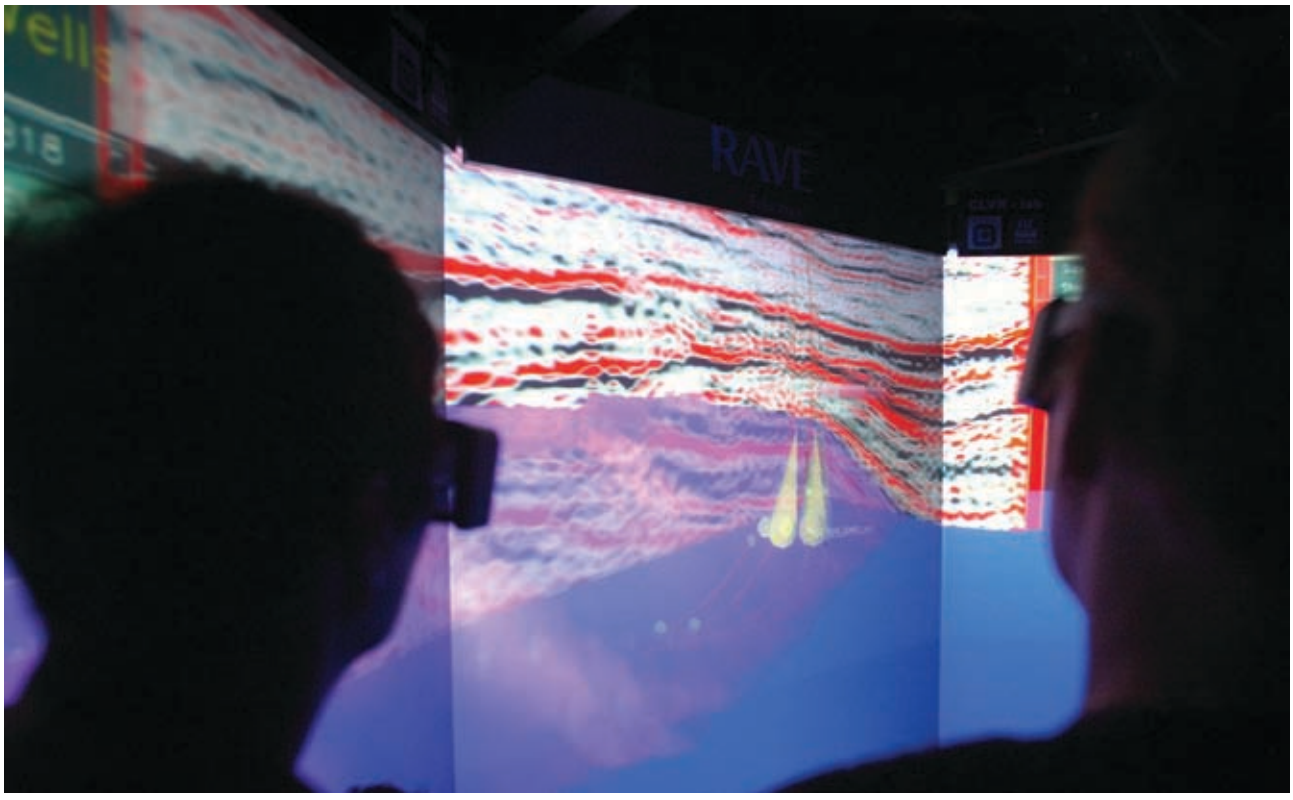
Climate Research to Bioprospecting

Some of the hottest research areas in Norway are being funded by the Research Council in the form of broad-based "Large-Scale Programmes" currently covering seven different disciplines – including functional genomics, climate research, information and communications technology, and petroleum research. Another Research Council focus is the Centre for Research-based Innovation (CRI) programme. Over the next eight years, the Research Council will allocate a total of NOK 1 billion to the initiative, which is based on a collaborative effort between Norwegian research and industry.

Norway's cutting-edge research in information and communications technology combined with other areas of research allows for the creation of virtual-reality programmes that help in petroleum technology.

Basic research is funded partly through the Research Council's Centre of Excellence (CoE) programme. Twenty-one centres are spread throughout Norway's academic institutions to take advantage of the country's considerable expertise in fields as diverse as aquaculture and the study of geohazards. A foreign researcher interested in working in any of these projects would typically seek a position with the university or institute housing the programme instead of applying directly to the Research Council for funding, Maubach says.

"The Norwegian economy depends largely on natural resources, and we also have emerging new research fields, such as thorium as an energy source, and bioprospecting," Maubach says. "These are fields where we need scientific expertise, which to some extent we do not have."



Applied Research & Teamwork

Researchers interested in applying their expertise to real-world situations will find themselves at home in Norway's universities and research institutes. The country's economy depends on the use of natural resources – whether it's winning oil from the deeps of the North Sea, or farming healthy, fast-growing salmon – which often poses technological challenges that are solved by collaborative efforts between industry and research institutions.

That was one of the big appeals for Karen Valencia, a research scientist at SINTEF Petroleum Research in Trondheim. Valencia came from the Philippines with a PhD in petroleum engineering, and was particularly attracted by the close cooperation between SINTEF and its corporate clients. "Usually when you're a researcher crunching numbers, you don't have real numbers to work with," she says. "But here, we can apply our clients' actual data – and you can see real results."

Another key feature of Norway's research environment is the willingness of people to work cooperatively in teams, says JoLynn Carroll, an American who is research director at Akvaplan-niva's Polar Environmental Center in Tromsø. "It's not so cut-throat," she says. "People here tend to work better in teams – they're more willing to accept people's differences in a positive fashion."

At the Doorstep of Europe

Carroll says she thought it was easy for foreign researchers to be accepted into a Norwegian research team, partly because Norwegians are quite comfortable speaking English. "English is the primary language of research, and Norwegians are very used to doing their science in English," she says. "Many of the universities are teaching certain courses in English, and it is opening up more and more every year."

Ra Cleave, a senior engineer at the Norwegian Geotechnical Institute, says a major difference between Norway and his native land of New Zealand in terms of research was that Norway was far less bureaucratic. The Research Council "is great in how they organize their applications for research funding," he says.

But Cleave says perhaps the most enjoyable aspect of his research was Norway's participation in European Union projects, with all the associated cross-cultural experiences. Norway participates in approximately 10% of all EU research programmes, with the EU financing roughly NOK 2 billion in Norwegian research. During the funding for the 6th Framework programme, Norway took part in 1,480 applications, of which 390, or 26%, were recommended for funding. That's a success rate 9% over the EU average (17 percent).

"The EU projects are big, they're ambitious, and they involve a lot of different countries," Cleave says. "You find yourself working with people from Spain, Italy, France – you get this incredible dynamism, a lot of energy and different ideas. And you learn about the cultures too."

Researcher's Gateway to Norway

Mobile researchers planning a stay in Norway can find career opportunities and other relevant information and assistance at **www.eracareers.no**.

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Alpharma AS is a leading manufacturer of active pharmaceutical ingredients (APIs), serving the global pharmaceutical industry with high-quality products and services. The company has a strong position in bioprocess development, chemical synthesis, semi-synthesis and advanced separation and purification technologies.

The Company

Alpharma AS is a subsidiary of Alpharma Inc, a global specialty pharmaceutical company listed on the New York Stock Exchange. The company is a leading manufacturer of active pharmaceutical ingredients (APIs) for finished dosage-form drugs, an innovator of branded products for pain management and a dominant producer of medicated feed additives for food producing animals. Alpharma, with its 1,400 employees, is active in more than 70 countries and has an annual turnover of around USD 700 million.

Products & Technologies

Alpharma AS is one of the leading Norwegian biotech companies, with more than 50 years of experience in the development and manufacture of antibiotics. Alpharma is recognized for its expertise in fermentation and specialized recovery and purification technologies. During recent years, Alpharma has also established a solid platform in chemical synthesis and semi-synthesis.

Alpharma is specializing in the development of technologically difficult manufacturing processes for high-value APIs, many of which are used in hospitals for the treatment of life-threatening infectious diseases and cancer. The company is also developing and manufacturing finished dosage-form pharmaceuticals (mainly injectables) on behalf of industry customers.

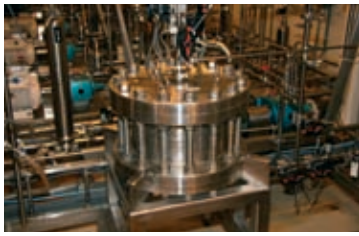
Development & Manufacturing Capabilities

Alpharma's API R&D staff is highly skilled (about one-third have Ph.D.s), with an average of more than ten years in the pharmaceutical industry. Competencies comprise all aspects of classical and modern biotechnology, including:

- Strain development (UV and chemical mutagenesis, recombinant DNA techniques)
- Fermentation and cell cultivation (short and long term, fed-batch)
- Separation and purification techniques (filtration, chromatographic separation, solvent extraction, crystallization)
- Final handling (drying, milling and blending)
- Process scale-up, technology transfer and production implementation

The R&D staff has broad experience in developing organic synthesis strategies and pathways, employs a wide range of analytical methods, is aggressive in seeking IP protection of inventions and has established a broad, international R&D network.

All marketed APIs are manufactured according to cGMP (current Good Manufacturing Practice) at FDA-approved facilities in Oslo, Norway; Copenhagen, Denmark; Budapest, Hungary; and in China. The products are sold globally to more than 700 pharmaceutical companies, many of which are also collaborating with Alpharma in developing new products and processes.



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Alumox AS is a leader in the aluminium recycling industry and it specializes in recycling aluminium from aluminium skimmings. Alumox was established in 2004 and became a part of Aleris International Inc in 2007. Aleris International Inc operates 50 production facilities throughout the world and is a global leader in aluminium rolled products and extrusions, aluminium recycling and specification alloy production. Alumox AS is located in the midst of beautiful scenery that features fjords in the county of Møre and Romsdal.

Products

Alumox produces aluminium sows of 500 kilograms each (110 x 110 x 28 cm) delivered with a certificate of analysis and full specifications. Beyond Alumox's own purchase of skimmings, the company also undertakes tolling, which is the smelting of materials owned by the client and smelted on rental basis.

Technology

Alumox AS has access to the best available technology. The plant has three tiltable rotary furnaces with oxyfuel burners and three baghouse filters for cleaning the off gases. The furnaces are monitored and controlled through a HMI system (Siemens WinCC) with direct data exchange to the ERP system. The plant's maximum capacity is 70-80,000 metric tonnes of incoming material.

Skimmings are the most important raw material of the operation. The smelting process is carried out into specially designed tiltable furnaces and it converts skimmings into aluminium blocks. During the melting and refining operation of aluminium and aluminium alloys the metal oxidizes in contact with oxygen, forming a thin layer of oxide. The oxide film captures liquid aluminium metal to form a skim floating on top of the melt. Because of the oxide layer, the metal cannot be recovered in standard melting or holding furnaces, but has to be processed in specially designed rotary furnaces.

Environment

One of the outcomes in the process of the process of recovering aluminium from skimmings/dross is salt slag. Salt slag is a product containing salt, aluminium oxide, aluminium metal and silicon oxide.

Alumox's sister company, REOX, extracts aluminium metal and aluminium oxide from the salt slag. Through the use of technology and practice the environmental impact from the operation is minimal. The recovering of metal at Alumox and the recycling of the salt slag at REOX gives off practically zero waste.

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ARR is a limited, ISO 9001:2000 certified company which is 90% owned by the Department of Trade and Industry, and 10% by Kongsberg Defence and Aerospace. ARR supports sounding rocket and balloon operations both from Andøya and Svalbard. Its client list includes ESA, NASA and JAXA as well as hundreds of universities and research institutions worldwide. ARR is located on the Norwegian island of Andøya, 2° north of the Arctic Circle. Andøya's airport is capable of handling all sizes of aircrafts. Daily connections to Tromsø and Bodø make getting to and from the island convenient.

Payload Services

ARR has developed a reliable and cost-effective Sounding Rocket Payload Service, aimed at scientific research in the middle atmosphere and ionosphere. ARR offers complete service including payload structure, housekeeping systems, qualification program, rocket motors and launch services for a fixed price.

ALOMAR Observatory

ALOMAR (elevation 380 metres) is a modern facility where scientific groups from several nations do research of the atmosphere using lidars and radars as well as passive instruments like radiometers and spectrometers. ALOMAR instrumentation covers all atmospheric layers from the troposphere to the lower thermosphere. In addition, being able to look at physical parameters in the ionosphere, magnetosphere and auroral oval makes ALOMAR a complete Arctic atmosphere laboratory.

Long Duration Balloons

Safe, energy-efficient and cost-effective, long duration balloons are perfect platforms for both astronomy and atmosphere observation. In cooperation with the Italian Space Agency, ARR is working to establish the Nobile Amundsen Svalbard Balloon Center in Longyearbyen, Svalbard. From there balloons can exploit high altitude stratospheric winds to circumnavigate the North Pole and possibly stay aloft for weeks or months at an altitude between 40 and 50 kilometres – much cheaper than a satellite mission and still providing in-situ measurements.

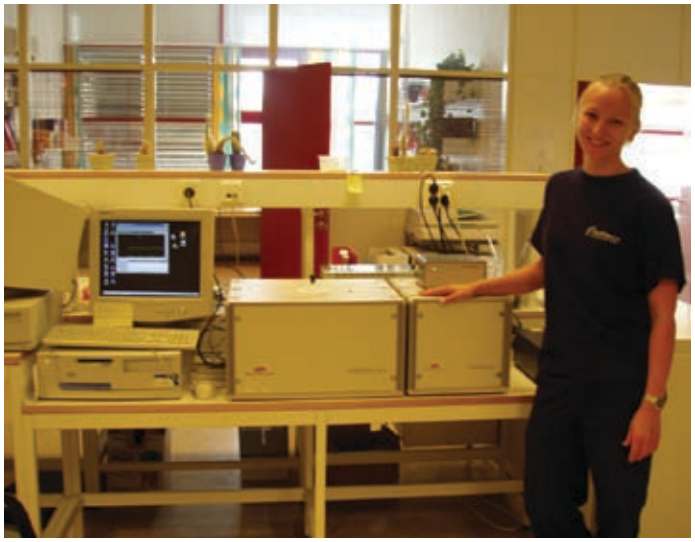
NAROM

NAROM (Norwegian Centre for Space-related Education) initiates, develops and performs educational activities, courses and seminars at all levels within subject areas related to space, such as space technology and space physics and also within the atmosphere and the environment. One example of the activities at NAROM is the annual European Space Camp, a week-long summer camp for young scientists (ages 17 to 20) at ARR. It is organized by the Norwegian Association of Young Scientists and NAROM in cooperation with the Norwegian Space Centre and the European Space Agency (ESA).

ATC

The Andøya Test Center (ARR subsidiary) offers virtually unlimited space for the testing of aerospace and/or ship-based applications. ATC can conduct a wide range of operations, both civilian and classified military. Forty years of experience in this field is a significant factor in mission success, even for high risk applications. Sharing the premises with ARR, ATC draws upon the experienced manpower, infrastructure, instrumentation and administration at ARR.

ALOMAR Observatory - 380 metres above the town of Andenes.



@ntek

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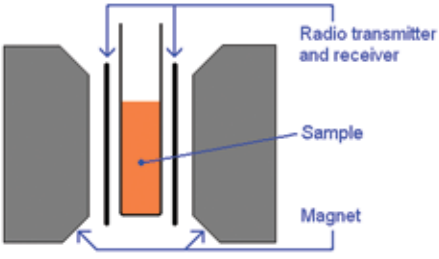
Anvendt Teknologi AS offers software products that give customers a quick, easy and extremely reliable analysis of a system's components with the help of NMR (Nuclear Magnetic Resonance) spectorscopy. The company's business objective is to supply a more precise analysis tool, with lower operating costs than traditional methods, which provides a short payback on investment period, and reduces pollution to both indoor and outdoor environments.

Anvendt Teknologi AS was established in 1998 as a result of a PhD study carried out at NTNU Trondheim. All application development is based on scientific methods, which in turn has led to the publication of scientific articles in the Journal of Magnetic Resonance and active participation in a number of international conferences. Anvendt Teknologi AS is located in Harstad in North Norway.

Unique Niche Expertise

Anvendt Teknologi has specially developed unique niche expertise in the measurement of fat and/or oil content in food stuff using NMR and is a world leader in this area. The company is currently focusing on NMR software and hardware for rock core analysis for the oil industry. The company is alone in the market in offering NMR-based analysis as an alternative to traditional chemical or mechanical analysis methods. Its largest customer and collaborating partner in this context is StatoilHydro.



The development of software has been carried out in close collaboration with potential clients. In the context of this type of developmental process, Anvendt Teknologi AS gains direct contact with customers' problem areas and a good insight into customers' products. Advanced learning occurs in both directions, a prerequisite for such an approach: both parties are to have clear commercial benefits from the collaboration.

Optimalization of Software Efficiency

Anvendt Teknologi AS' key strategy is to be an independent supplier of software for different types of NMR-equipment. The company is at all times seeking to optimalize software's efficiency through the use of the best possible hardware. The company is therefore always involved in processes of evaluating suppliers' hardware systems and considering potential collaborations with hardware manufacturers for further optimalization.

Collaborative Focus

Anvendt Teknologi AS is a network company where the philosophy is to utilize competency in-situ, without being required to maintain a large staff. The company therefore collaborates closely with the Centre of Integrated Petroleum Research at the University of Bergen and Uglestad laboratory at NTNU. In addition, the company is at all times involved in dialogues with different industries with an eye towards exploring potential collaborations.

aptomar
Safety at sea

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Apto Maritime AS is to become a world leader within the maritime HSE segment by developing and delivering advanced safety and navigation solutions for a safety critical field of activity. Through its SECurus system the company helps its customers in everyday activities like passage aid, day and night vision and surveillance, as well as in extreme situations like search and rescue and oil spill operations. Together with its customers Apto Maritime redefines safety at sea, and strives to achieve offshore activities with no incidents and no accidents.

The SECurus System – Safety at Sea

Apto Maritime (Aptomar) has developed the SECurus system, a technical and functional enhancement of today's maritime safety and navigation tools. By incorporating advanced control systems with image processing and marine navigation data, a unique spear-point maritime safety and navigation tool has been developed.

The SECurus system is based on the unique Aptomar stabilization solution, making the system unaffected by the movement of the ship. Through the powerful, but user-friendly, graphical interface, SECurus is a tool for situation awareness where a situation can be comprehended efficiently, the problem can be identified and counter-measures in a vast range of areas can be effectuated.

Day & Night Vision

One of the most safety critical properties is the ability to visually confirm and understand the objects and situations that can compromise the integrity of the vessel. With the SECurus system what is out there, what the radar is detecting, the AIS objects, the chart elements, and situations that are about to take place can be seen – regardless of the weather, the movement of the vessel or the visibility conditions.

Passage Aid

The increase and diversity in activity, both geographically and operational, in combination with an increase in new vessels and a shortage of experienced maritime personnel, has lead to a decrease in experience and regularity-based operations. SECurus aids maritime personnel with limited experience in unknown waters and during different operational situations, letting them base their decisions on visual material and discussions with onshore and offshore personnel.

Search & Rescue

The responsibility every vessel has for aiding in a crisis situation is one of the most important responsibilities for avoiding casualties, damage to property and strain on the environment. The SECurus system is an effective, precise and flexible tool for minimizing the operational overhead and eliminating limitations imposed by human anatomy in any search, retrieval or rescue operation.

Oil Spill Monitoring

Strain on the environment due to increase in activity and operational complexity is one of the most challenging areas of focus for all offshore operations. SECurus is a tool that can minimize exposure to oil by increasing the efficiency of the assessment process and by helping operators implement counter measures where it will have the greatest effect.

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Aqua Gen AS is a major provider of genetically improved seed for the salmon industry in Norway, with considerable export also to Chile and the United Kingdom. The company's main product is fertilized eggs of Atlantic salmon and rainbow trout. Hatcheries are the next step in the value chain, where the eggs are hatched and reared to the smolt stage – with subsequent transfer to marine sea cages for grow-out to harvest size.

Selective Breeding in Aquaculture

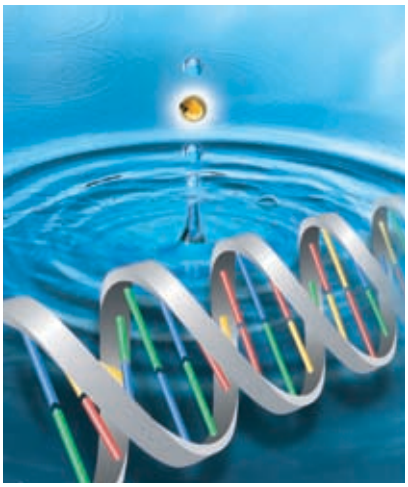
Genetic research initiated in the 1940s has resulted in remarkable developments in increasing the productivity of domestic mammals and birds. The first large-scale selective breeding programme for fish was initiated in Norway in the early 1970s by livestock scientists and was developed in parallel with the emerging salmon industry. Aqua Gen manages the commercial continuation of this breeding programme, and after several generations of systematic genetic improvement, the seed stock populations can now be considered the heirloom of Norwegian fish farming. Important traits in the breeding scheme include growth rate, improvement of filet quality, and improved survival and overall resistance to infectious diseases.

Research & Development

Selective breeding in fish employs the scientific methods developed in livestock animal breeding. The traditional approach is based on quantitative genetics, but today's research has a much greater emphasis on refining and elaborating the selection by means of molecular methods.

Aqua Gen is a partner in Biobank AS, which makes a systematic storage of biological material possible. This is a unique platform for development of new breeding technology based on state-of-the-art molecular genetics. Aqua Gen carries out both in-house R&D activities and external collaborations with Norwegian and foreign research institutions.

The breeding populations, with systematic pedigree information over nine generations and linked to millions of recorded phenotypic data, represent an invaluable source of data and information for genetic research. Beyond genetic research, Aqua Gen is also involved in research in the fields of reproduction technologies and fish health, such as prevention of vertical transfer of fish pathogens via gametes.



Aquadyne

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Since 1995 Aquadyne has supplied underwater positioning and mapping systems from some of the world's leading subsea equipment manufacturers. The company focuses on tailor-made and integrated solutions to meet customers' requirements. During the last few years Aquadyne has engaged in a growing number of R&D projects to enhance the performance of existing equipment and to prepare for future challenges in evolving markets.

Tailor-made Solutions

Aquadyne works closely with customers to ensure a thorough understanding of requirements, deadlines and budgets for subsea and survey projects. The company provides tailor-made and integrated solutions to meet these parameters, and ensures that the total delivery process is monitored from product development and manufacturing, through to installation and commissioning.

Close co-operation with customers and manufacturers creates an awareness of future requirements. Based on this, Aquadyne encourages and supports the development of innovative equipment to meet the requirements of an evolving market.

Development & Testing

In response to a market request, Aquadyne coordinated the development project for an ROV version of Innomar's parametric sub-bottom profiler that has been in use on ROVs in the North Sea since 2004.

During July 2007, Aquadyne took a newly developed attitude and heading reference sensor, the Sonardyne Lodestar, to a successful performance test in the Arctic, at Spitsbergen, 78° North , to prepare for new areas of exploration.

Oil and gas exploration and development in environmentally vulnerable Arctic regions call for rigid control of emissions. Aquadyne has already been involved in a number of projects related to hydro carbon leak detection and locating hazardous objects and fluids in the ocean. In response to the increasing demand for methods to detect leaks, Aquadyne, in cooperation with Reson, has completed a three-year Petromaks project to prepare the ground for developing a cost effective system to maintain such operations.

In order to enhance the performance of the existing positioning and mapping products, awareness of acoustic and electromagnetic noise on ships and ROVs from which the equipment is operated is critical. Aquadyne is in the process of developing an acoustic and electromagnetic measurement pod, in order to be able to quantify noise and interference that can be a problem in the working environment of high-tech subsea equipment.

Equipment

Aquadyne aims to provide state-of-the-art equipment from leading manufacturers in their fields. In the areas of acoustic navigation and control, hydrographic survey systems, motion sensors, echo sounders and GPS, Aquadyne represents companies recognized for their innovative products, engineering excellence and high level of customer support. Principals include:

- Sonardyne
- Reson
- Teledyne TSS
- Innomar
- Applanix

In order to be able to work even more closely with customers, Aquadyne has established a new branch in Bergen, in connection with which a co-operation with Hydro Force Technologies AS (www.hft.no) was introduced.

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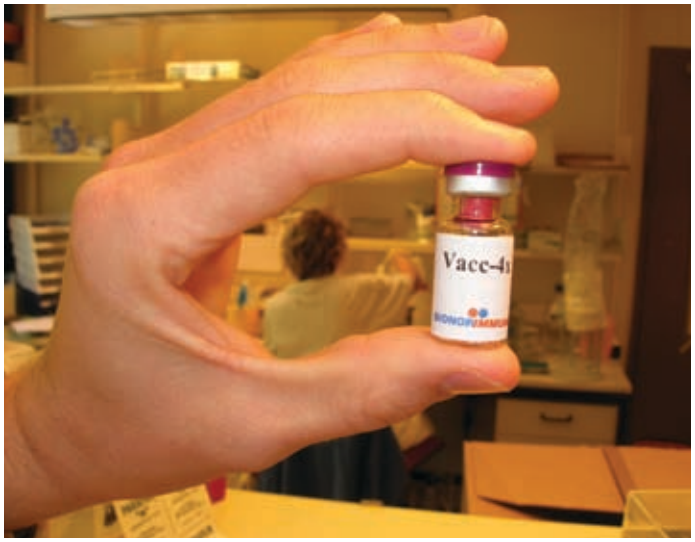
Bioforsk – the Norwegian Institute for Agricultural and Environmental Research – is a national R&D institute under the Norwegian Ministry of Agriculture and Food. The main areas of competence are agricultural and environmental research, and innovation based on the utilization of land resources. Bioforsk has a total staff of approximately 450, with an annual turnover of some EUR 50 million. The R&D activities of Bioforsk are organized in seven research divisions, located in different regions of Norway. The head office is located in Ås, just outside Oslo.

R&D Activities

Bioforsk encompasses a wide range of competence within natural sciences, with long traditions in field- and laboratory-based experimental studies. Food production, agricultural development and environment protection represent key R&D areas. Bioforsk's main objective is to contribute to productivity and viable economic activities through the sustainable utilization and management of natural resources. Strengthening of research networks and increased international co-operation is a high priority issues. Bioforsk's R&D activities are linked to a number of issues, as demonstrated by the following examples:

- **Sustainable agricultural practices and production systems** – for long term food security and protection of the environment, including bio-diversity, and the enhancement of the multifunctional role of agriculture.
- **Food quality and safety** – to provide consumers with safe and healthy products; emphasizing nutritious quality and substances with possible health benefits, while being free from potential harmful substances.
- **Plant health** – develop environmentally-friendly and cost-efficient plant protection methods and ensure crop quality and food safety through sensitive and reliable diagnostic methods, reduced use of pesticides and integrated pest management.
- **Genetics and bio-technology** – develop pre-breeding knowledge to improve food, feed and ornamental plants, develop molecular methods for diagnosis, and understand the pest-plant interaction at molecular level and the genetic control of the synthesis of important metabolites in pests and plants.
- **Wastes, wastewater and sanitation** – recycling of valuable resources and preventing the degradation of waters and soils by appropriate treatment technologies, solutions and management strategies.
- **Watershed management** – integrated land and water resources management to reduce the environmental pressures from anthropogenic activities such as agriculture, industry, urban and rural activities, e.g. based on the principles of the EU Water Framework Directive.
- **Soil quality and land degradation** – to protect key resources for multifunctional purposes including future production in agriculture by appropriate soil conservation measures and strategies, e.g. by erosion control, carbon sequestration, and reducing contamination from toxic substances.
- **Climate change** – terrestrial processes related to climate changes, impacts and adaptation and strategies related to agricultural production and other land based activities, and minimizing the possible adverse impacts on land and water resources.
- **Methods and tools for decision support** – in order to enhance cost-efficient environmental measures and sustainable practices in agriculture, i.e., early warning systems for plant pests and diseases, planning tools for good agricultural practices, risk analysis and systems for risk management, life cycle analysis, modeling of different ecosystem processes, and environmental monitoring



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Bionor Immuno AS, located in Skien, Norway, is a multidisciplinary biomedical drug development company with a well-established platform technology for the development of immune-based therapies for infectious diseases using a modified peptide-based approach.

Mission & Area of Focus

Bionor Immuno specializes in the development of safe and effective peptide-based therapeutic vaccines for chronic infectious diseases such as human immunodeficiency virus (HIV), hepatitis (HCV) and cervical cancer (human papilloma virus). In addition, the company is developing a universal preventative vaccine for both seasonal influenza and in the event of a pandemic.

HIV Therapeutic Immunization

More than 33 million people are living with HIV worldwide (UNAIDS 2007). At present, the only treatment option for HIV infection is combination anti-retroviral therapy (ART), a lifelong daily medication. Although effective at controlling infection, ART is limited by the development of drug resistance, adverse side effects and high cost.

Bionor Immuno's therapeutic vaccine for HIV aims to complement ART by inducing HIV-specific immune responses that can combat the infection and sustain immunological fitness in the absence of ART for prolonged periods. In this way ART, if supported by therapeutic immunisation, can become intermittent or alternatively the initiation of ART delayed.

A successful therapeutic vaccine (giving immunological support) that can minimize exposure to ART has the potential to alleviate adverse side effects, impact upon the development of resistant viruses, significantly reduce the financial burden of ART on healthcare services and substantially improve the quality of life of infected individuals.

The leading candidate HIV therapeutic vaccine, Vacc-4x, completed a phase I clinical trial at the University of Bergen, Norway, and a phase II clinical trial at Ullevål University Hospital in Oslo, Norway. The phase II clinical trial enrolled 40 patients and showed that Vacc-4x was safe and induced strong immune responses against HIV, resulting in long ART-free periods. Half of the patients achieved an ART-free period of 31 months. All patients were well controlled when ART was resumed showing no problems with resistance to ART.

Development of a successful therapeutic vaccine will lay the foundation for the development of a successful preventative vaccine.

Clinical Trial

Bionor Immuno is now carrying out a double blind placebo controlled phase IIB TOC (Test of Concept) study in Europe and the United States. This multi-centre study (enrolling 345 patients) will be completed in the beginning of 2010.

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Bioparken AS was established in 1991 in order to facilitate collaboration between the research institutes and the industry. Today this R&D collaboration counts 10 research institutes, R&D partners and the University of Life Sciences (UMB). The fields of operation cover technology transfer, commercialization and business development.

The Bioscience Innovation Environment

- **The Norwegian University of Life Sciences (UMB)** – The University's research represents international cutting-edge expertise in the fields of the environmental sciences, food science, biotechnology and aquaculture
- **The Norwegian Institute of Aquaculture (Akvaforsk)** – One of the world's leading research institutes in the field of aquaculture, Akvaforsk has become a specialist in breeding and genetics, nutrition, product quality and marine species. The institute also undertakes research activities connected to fish health, the environment and operational optimization
- **The Norwegian Institute for Agricultural and Environmental Research (Bioforsk)** – This is Norway's leading centre of expertise within research and development in the fields of soils, plants and the environment
- **The Norwegian Food Research Institute (Matforsk AS)** – This is Norway's leading centre of expertise in the fields of fish, fruit and berries, vegetables and potatoes, meat, cereals, dairy produce and end products. Services include expertise in the fields of analysis, packaging, consumer surveys, food and health, foodstuff/ HACCP, manufacturing processes, trial manufacture and ecology
- **The Norwegian Forest Research Institute** – This is Norway's leading research institute in the fields of sustainable management of forestry resources, value creation based on forestry and environmental aspects of forestry and a provider of nationwide, unbiased data relating to Norway's soil, forestry, vegetation and landscape resources aimed at ensuring long-term management and exploitation

Competence & Expertise

Bioparken offers competence and experience in the fields of technology transfer and business development based on biological and natural sciences, such as:

- Life science
- Food
- Biotechnology
- Aquaculture
- Land and natural resource management
- Veterinary sciences
- Bioenergy and environment

Main Areas of Operation

- Commercializing innovative business ideas based on new technology results and research activities
- Assisting start-ups

Technology Transfer & Business Development

- Technology and market assessment
- Protection of intellectual property (IPR)
- IP-management
- Licensing or selling intellectual property rights, for application of new technologies
- Project development
- Business concepts, development of new products or technological processes
- Business development – co-partners in new enterprises
- Incubation
- Financial support
- Connecting R&D, start-ups, entrepreneurs and industry - networking
- Innovation management

BIS Industrier

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BIS Industrier AS is recognized as one of Norway's major and leading suppliers of multidiscipline services within non-mechanical trades. Most of the activities are related to the oil and gas industry, and BIS is a typical supplier to clients who have a special focus on HSE, quality, capacity and multidiscipline ability. BIS Industrier is a member of the German BIS Group, which has more than 20,000 employees mainly in Europe. In Norway about 2,500 people were employed at peak level in 2007.

Services

BIS Industrier offers the following services:

- Insulation, including acoustic, cold and cryogenic insulation
- Interior outfitting/architectural work
- Surface preparation/industrial painting
- Passive fire protection
- Metallizing/thermal spraying
- Scaffolding
- Rope access technique
- testing and flushing
- High/ultra high pressure cleaning
- Subsea insulation
- Engineering and design services within all the company's trades
- Site and project management
- Materials (procurement and logistics)
- Education programmes within all the company's trades, including multiskill
- Multidiscipline turn-key projects

BIS Competence Centre

The BIS Competence Centre is the company's school which educates and further develops personnel within all relevant trades, as well as helping them become multidisciplinary. The Competence Centre, which also offers management courses and various HSE courses, is an important tool in securing adequate competence throughout the company to secure the customers assets. Courses can be arranged at almost any location. In total, the BIS Competence Centre has been instrumental in more than 1,000 trade certificates being obtained and the signing of more than 200 apprentice contracts. Every year, 600-800 of the employees attend courses organized by the Competence Centre.

Development

BIS has developed and qualified new technology, which in this context is equipment, methods and HSE-improving conversions. The objective has been to improve HSE aspects, cost effectiveness (services) and to provide new and improved solutions (products).

BIS has developed, tested and certified a number of products within thermal, noise/acoustic, fire and explosion insulation, single and multiple pipe penetration seals and system scaffolding improvements. All the products are commercially available.

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Bodø University College has more than 5,000 students and a total staff of 510. The total budget is NOK 400 million (2008). Bodø University College is made up of four faculties: the Bodø Graduate School of Business, the Faculty of Biosciences and Aquaculture, the Faculty of Social Sciences and the School of Professional Studies.

Courses Offered

Bodø University College has one of Norway's most modern campuses. The school is in a very exciting and important period in its work to establish the University of Nordland.

The University College offers two courses at the doctorate level in business and sociology. In addition there are 14 different lines of study at the master's level and about 90 different bachelor's programmes.

The Bodø Graduate School of Business

The Bodø Graduate School of Business (HHB) is one of three business schools in Norway. The school covers business teaching, research, post-school training and business development. Today, HHB has approximately 80 academic positions and roughly 1,000 students distributed throughout the bachelor's, master's and PhD programmes.

Bodø Graduate School of Business has started several international business programmes. For those who want a flexible program, HHB offers MBA and MSc programs where students can choose where to specialize. The school also offers executive MBA programmes abroad. The High North Centre for Business has 15 years of experience in Russia and other high northern countries, and it is an expert in High North challenges. Presently HHB educates managers of the Russian oil company Rosneft in cooperation with MGIMO University in Moscow. In cooperation with universities in Russia and the USA HHB also offers more specialized programmes such as a MSc in Energy Management and a MSc in Sustainable Management.

The Faculty of Biosciences & Aquaculture

The Faculty of Biosciences and Aquaculture (FBA) offers several bachelor programmes in the areas of aquaculture, fisheries, biology and export marketing, a master's degree in aquaculture and a doctorate in aquaculture is being set up.

The faculty has specialists with a high level of international competence, and internationalization at the faculty along with collaboration with the aquaculture industry is highly important. FBA is a partner in the Norwegian Centre of Expertise for Aquaclture, and has more than 40 externally financed projects – many of them with both national and international cooperative partners.

The Faculty of Social Sciences

The Faculty of Social Sciences (FSV) has active researchers in disciplines such as sociology, anthropology, history, journalism, political science, social work and psychology. They are engaged in both pure research, and in applied and cross-disciplinary projects. There is a close cooperation between FSV and Nordland Research Institute in research topics like welfare, rehabilitation and municipal administration. Several researchers at FSV are also engaged in international research networks.

The School of Professional Studies

The School of Professional Studies (PHS) offers studies in teacher education, art studies, cultural studies, nursing, health, sport and practical knowledge. The faculty has about 85 years of experience in the education of nurses. In addition, the faculty has many years of experience with decentralized and ICT supported courses.

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Cambi AS is a privately owned company based in Asker, Norway, with subsidiaries in Denmark and the UK, and an international network of agents and representatives. Cambi has been involved in the development of environmental technology since 1989. Cambi's position with regard to ownership and capital provides it with the freedom to make investments in process and product development, and the resources for plant building, ownership and operations.

Cambi delivers complete plants with the option of operations and maintenance. Its mission is to offer customers profitable processes, now and in the future. Cambi's plants suit customers with a focus on energy production and high-quality end products.

Patented THP

Developed to meet tomorrow's needs, Cambi's patented Thermal Hydrolysis Process (THP) is a high-pressure, steam pre-treatment of sewage sludge and/or bio-waste before anaerobic digestion. The THP application results in increased biogas production, a pathogen-free and stabilized biosolids product (cake), doubled digester loading and increased cake dewaterability. This saves both transport and energy costs, whether the product is directly applied in agriculture or dried for use as fertilizer or bio-fuel.

Most of the existing Cambi THP plants produce electricity by combusting the biogas in cogeneration plants, which also provides most of the steam required in the Thermal Hydrolysis Process. The THP plant itself consumes only a small fraction of the electricity produced; the remainder is enough to cover a significant part of the electricity requirements of wastewater treatment plants, with any surplus sold to other users or the grid.

Delivery Scope

Cambi's scope of delivery varies from the core THP to complete sludge and bio-waste treatment plants, including dewatering, pre-treatment, anaerobic digestion, cogeneration units, steam boilers and plant operations and maintenance. The THP plants normally treat sewage sludge and/or bio-waste for populations upwards from 150,000, or from approximately 5,000 dry metric tonnes per year of raw materials. Smaller Cambi THP plants are under development and will be on the market soon.

Since 1995 Cambi has delivered 14 plants worldwide, and has five more plants under construction.

R&D

In addition to this, Cambi is currently carrying out research and development work to improve and adapt its pre-treatment technology for new feedstocks. THP-E will be an essential and integrated component of future lignocellulosic ethanol production plants.

Based on valuable know-how and experience from many sludge and biowaste projects, Cambi has further developed its high dry-solids biogas technologies for use with other types of biomass, including stillage, the primary residue of the bioethanol industry. By implementing Cambi's Biogas technology with nutrient and water recovery bioethanol plants can eliminate fossil fuel dependency.

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The mission of Campus Kjeller is to initiate and operate the commercialization process of research ideas and technology from the Science Park Lillestrøm, in Kjeller. The company's vision is to be the preferred partner in Norway for innovation and commercialization of technologies, with a focus on energy, environmental technologies and societal safety.

Commercialization

The focus of Campus Kjeller's work with commercialization is on developing ideas based on innovative technology for market-oriented products and services. Although an idea may be both innovative and creative, Campus Kjeller ensures the presence of two significant factors: the technology must have great commercial value and an international potential. In addition the IPR must be clarified and ensured. Campus Kjeller has over the course of many years developed experience and competence in the creation of a good commercialization process – from idea to market. It achieves this by having a broadly diverse team and a network of specialists.

Campus Kjeller's Incubator

The initial years can often be extremely demanding for a new company. Campus Kjeller has therefore developed its incubator, where newly started companies can receive the support they need to launch their ideas on the market and create a profitable business as quickly as possible. At any given time there are 10-15 companies in the incubator and they often remain there for two-three years. At the beginning of 2008 Campus Kjeller had a total of 11 companies in its incubator.

Portfolio & Value Development

Campus Kjeller's goal is for every project and company to have the optimal amount of capital to secure rapid and sustainable growth. For early-stage projects, Campus Kjeller is active in attracting national and international (EU/EUREKA) funding, and assists portfolio companies with seed, follow-up and expansion capital, by using a combination of own funds and taking a lead role in raising money from a network of angel investors or venture funds.

Campus Kjeller's current portfolio consists of a mix of early and late stage companies. Examples of recent successes are Oceansaver – ballast water treatment systems, and OPAX – industry-strength intelligent video surveillance.

Campus4Kommerce™

Campus Kjeller has developed a unique ISO-certified process for increasing the productivity and efficiency of the commercialization process – Campus4Kommerce™.

In 2007 it became clear that a number of Norway's commercialization players have a need for a good interactive tool for the development of business ideas. Campus Kjeller therefore established the subsidiary IC Platform AS to develop and sell system licenses. The product launched in January 2008 is called CPI (Collaboration Platform for Innovation).

Photo: Stig Martin Solberg

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CIENS
Oslo Centre for Interdisciplinary Environmental and Social Research

CIENS
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Webiste: www.ciens.no

CIENS is a strategic research collaboration between independent research institutes and the University of Oslo. The centre is built on a shared scientific strategy and research programme (Strategies and Actions for Common Research – SACRE), co-operation on research and information projects and the consolidation of about 500 researchers under a single roof in environmentally sound offices in the Oslo Innovation Center.

Focal Point for Environmental & Society Research

CIENS represents a new arena that spans from pure science to applied science, innovation and invention within the Oslo Innovation Center at the University of Oslo. CIENS will be a leading national and international focal point for interdisciplinary and multidisciplinary research on environment and society.

Today's society faces significant challenges with respect to climate, air quality, water and coastal management, biodiversity, urban development and transport. Researchers at CIENS will help address these challenges by generating new knowledge and finding cost-effective, good solutions. Well over 200 of the researchers hold doctorates in their areas of expertise. The centre is located at Blindern, close to the University of Oslo.

Members of the CIENS Partnership

Members of the CIENS partnership include:

- Center for International Climate and Environmental Research – Oslo (CICERO)
- Norwegian Meteorological Institute (met.no)
- Norwegian Institute for Urban and Regional Research (NIBR)
- Norwegian Institute for Air Research (NILU)
- Norwegian Institute for Nature Research (NINA)
- Norwegian Institute for Water Research (NIVA)
- Norwegian Centre for Transport Research (TØI)
- University of Oslo (UiO)

An associate member of CIENS is the Norwegian Water Resources and Energy Directorate (NVE).

CICERO Center for International Climate and Environmental Research – Oslo
Meteorologisk institutt met.no
NIBR
NILU
NIVA
NINA Norsk institutt for naturforskning
NVE Norges vassdrags- og energidirektorat
TØI
Universitas Osloensis MDCCCXI

1. The new CIENS building.

MANAGING RISK

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DNV is a global provider of services for managing risk. Established in 1864, DNV is an independent foundation with the objective of safeguarding life, property and the environment. DNV comprises 300 offices in 100 countries, with more than 7,000 employees.

Globalization has resulted in the internationalization of business and innovation. In order to stay competitive, companies must maintain an appropriate breadth of technological competence. In 1954 DNV had already established its own Research Department to identify, explore and test new technologies in a business context. Six major strategic areas have been selected for current focus for DNV Research and Innovation:

- **Biorisk Management** – with a focus on developing methodologies for effective management of the hazards posed by biological agents
- **Energy Sector** – with attention on the security of energy supply, sustainability, and risk management
- **Information Process and Technology** – at the interface between technology and organizations
- **Maritime Transport** – where environmental concerns are balanced against cost-benefit considerations
- **Materials** – targeting corrosion protection, risks posed by nanotechnology and water quality issues
- **Arctic** - with a focus on knowledge and techniques relevant for industrial activities in the Arctic

Some highlights of ongoing projects:

Helping Shape the Way Biorisks are Managed in the Laboratory

Biosafety and biosecurity (biorisk) are hot topics due to the threats from bioterrorism and the natural outbreaks of diseases such as bird flu and SARS. DNV is managing an international project to develop a biorisk management standard, which will help laboratories around the world responsibly handle and store dangerous agents while they work to contain and mitigate the risks that these pathogens represent to society.

Developing Fuel Cell Systems for Ship Use

In the near future, it is likely that conventional power-generating equipment will be challenged by fuel cells that offer ultra-clean and silent operations with up to a 50% reduction in fuel consumption.

DNV, together with its industry partners, considers that the present fuel cell technology has matured to the stage where it may be used on board ships. Hence, DNV has teamed up with leading European suppliers of fuel cells to develop and demonstrate marine fuel cell power packs. Utilizing MCFC and SOFC technology, these projects will develop fuel cell systems for auxiliary and propulsion ship power. DNV also contributes to classification services as well as technology qualification schemes.

Polymer Film to Protect Against Corrosion

Corrosion continues to be a major challenge in shipping and the industry is permanently looking for new solutions, particularly those that are cheaper and more reliable in production, offer lower in-service costs and include new functions or advantages. Polymer film has been identified as a possible new solution which could replace conventional corrosion coating, and possibly anti-fouling coatings, in ship-building. DNV initiated the MarFilm project, together with 8 other partners, to evaluate the possibilities and limitations of this new technology and to conduct cost-benefit analysis.

Information Process & Technology

Modern industry and society depend heavily on digitally available information. Complex assets such as oil rigs and cruise ships typically have about 5,000 documents related to them. The lifetime of such physical assets spreads over decades and, with an annual growth rate in general data storage of 30%, a critical need for trusted methods that enable businesses to manage their records over time has arisen. In this area, DNV has initiated the Long-term Records Management Project (LongRec). LongRec seeks to provide support for records that are in active use over decades, with the preservation of access rights, semantics (meaning) and trustworthiness of the contents. The aim is not only preservation, but also business support. This implies a need to manage continuous transitions in technology, organizations, people and ownership. The three-year joint industry project is partly funded by the Research Council of Norway.

Qualification of New Technologies – Power Generation with the Capture of CO_2

DNV is developing, in collaboration with StatoilHydro, Statkraft and Aker Kvaerner, a guideline for qualification of technologies for power generation with the capture of CO_2. The procedure is designed to give guidance to what actions should be undertaken to ensure that the technology will function as expected with a certain level of confidence. It will secure a cost-effective way of implementing the technology and focusing on managing risk.

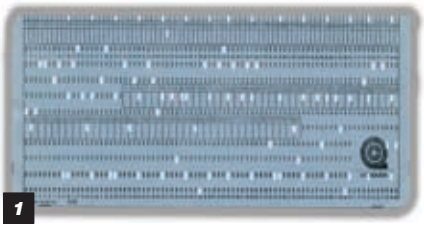
The procedure is being tested on 3 selected CO_2 capture technologies (case studies). These case studies are the Nexant technology from the Carbon Capture Project, Aker Kvaerner's Just Catch Bio and the ZENG oxy-fuel process. Feedback from these case studies is currently being used to update and issue final guidelines.

CO_2 – How can it be Stored Safely?

The geological storage of CO_2 provides a significant option to mitigate CO_2 emissions in a world which will continue to depend on fossil fuels for the next few decades.

One important factor in this process is the lack of a generally recognized verification protocol that is fit-for-purpose for CO_2 storage projects. This project aims to help fill this gap by participating in a portfolio of demonstration projects organised under the US Department of Energy programme known as Regional Partnerships for Carbon Sequestration.

Three Norwegian partners – DNV, Aker Kvaerner Geo and the Norwegian Geological Survey – have received support from the Norwegian Research Council CLIMIT programme specifically to participate in the US DOE regional partnership programme during the period from May 2006 to December 2008.



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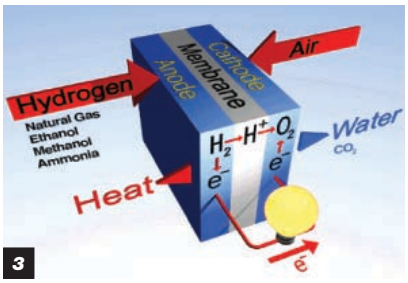

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1. LongRec seeks to provide support for records that are in active use over decades.

2. Polymer film – to replace conventional corrosion coating?

3. Fuel Cell Technology:
Silent – no moving parts.
Clean – water only.
Efficient – low fuel consumption.

4. Developing a biorisk management standard.

Clinic of Innovation

CLINIC OF INNOVATION
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A new innovative concept from Ullevål University Hospital in Oslo.
Ullevål University Hospital and Medinnova have opened the Clinic of Innovation (Idepoliklinikken) in order to build a bridge between research, innovation and socially useful services and products.

The Clinic of Innovation

The purpose of this Clinic is to facilitate the conversion of ideas from research and medical practice into new services or products for the benefit of both patients and society. The Clinic wants to offer the same kind of service to ideas generated outside the hospital, offering its medical and research expertise. The Clinic of Innovation is organized as any other out-patient clinic, offering diagnostic work-ups, treatment and follow-up.

What

The Clinic is a joint venture between the Ulleval University Hospital and Medinnova, a Technology Transfer Office with 20 years of experience in innovation. The Clinic has two main customers; first of all, people working within the health system with new ideas on how services, treatment, organization or products can be improved or developed. Secondly, the Clinic acts as a bridge into the health system for people, commercial parties, biotech companies and other research-intensive businesses.

Why

Culture and language is quite different in the public health system than in the private enterprise, and the goal here is that the Clinic of Innovation may serve as a meeting point and as a translator. Its employees have experience from both the private and public sectors. This is the outpatient clinic where clients can refer themselves.

How

The Clinic of Innovation offers diagnostic work-ups entailing evaluating an idea's potential in both research and commercial context, or calling for external competence as necessary. Depending on the diagnosis, the idea (and its owner) will be offered treatment that may entail:

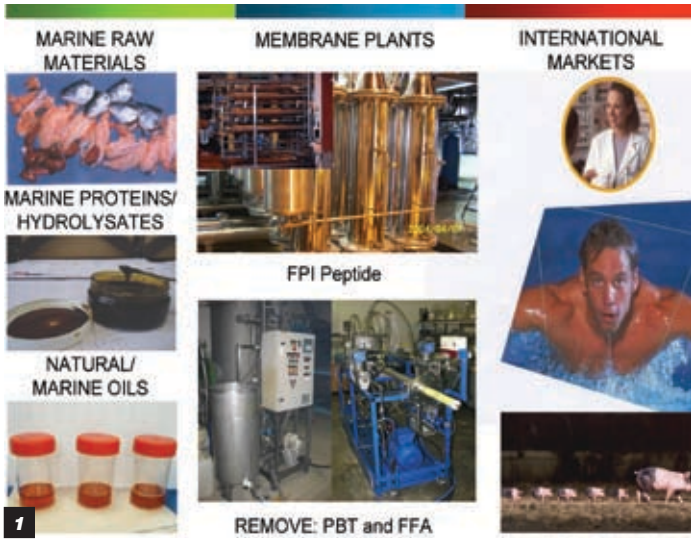
- direct problem solving
- development as a joint venture/active project
- establishment of contact with new networks that can help develop the idea
- referral to group therapy with other innovators facing similar problems

The Clinic of Innovation is also a tool to inform about the importance, possible economical impact and sheer pleasure of innovation. The tools for this activity include media coverage, advertising and visiting relevant people and communities inside and outside of the hospital.

Who

New ideas are best submitted by a webform located at the home pages mentioned above or by phone. Everyone with an idea is welcome.

The Clinic of Innovation has weekly intake meetings, so clients can expect an answer within no more than two weeks. The Clinic may contact clients ahead of the intake meeting to better understand their concepts. A referral is guaranteed full confidentiality, confirmed on the return receipt a client gets on his or her referral form. The Clinic of Innovation will also sign a confidentiality agreement at the first appointment.



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SINTEF
Website: www.sintef.no

DUE MILJØ AS has an active network, a core organization of five employees and a turnover of MUSD 4. In DUE MILJØ's vision, environmental challenges are resources astray. The company strives via international R&D and engineering to convert process industry's environmental problems into patented sustainable processes and profitable products.

Business Idea

DUE MILJØ's business idea is to create value through the development and marketing of environmental technology, membrane filtration plants, processing equipment and packaging machinery for the feed, food, pharma and technical/chemical industries. One of the company's focuses is on fish processing (see fig. 1).

International R&D Projects

DUE MILJØ contributes to international R&D projects together with research institutes, e.g. SINTEF, suppliers, such as GE WPT and customers. The company manages licenses for PCT patented technologies including WaterCatOx, which is a catalytic membrane technology for oxidizing organic contaminants and FPI - a marine/fish protein/ peptide refining process and application.

Unique Membrane Plants

DUE MILJØ markets unique membrane plants for fragmentation and separation on a molecular level. These include units for marine proteins/peptides separation and natural oils purification as well as plants for the recovery of difficult process and effluent water (for example phenol removal). All new R&D-based processes and products have large economic and/or qualitative advantages compared to conventional technologies. As an example, the equipment used in the new PBT (Persistent Bioaccumulating Toxins) oil removal process is pictured below, in fig 2.

R&D Success Story – FracSep

One R&D success story for DUE MILJØ is the FracSep membrane plant for marine oil purification. Through a multidisciplinary EUREKA project, partially funded by the French-Norwegian Foundation, the company has developed a mild, solvent-free and significantly more cost-efficient method for removing contaminants from fish oil for use in food and feed.

The R&D project was started due to the need to remove amongst other things, PBTs like PCBs and dioxins from fish oil in order to comply with new EU regulations. The project R&D team consisted of SINTEF (Norwegian research institute), Ifremer (French research institute), Copalis (French fish oil producer), and Novasep-Applexion (French membrane producer). The technology removes PBTs to levels below the EU legislation. It also removes high-melting compounds and oxidizing enzymes, thus producing pure and clear oil after processing at mild conditions. By correct choice of auxiliaries, colour and smell are also removed. Through further research, the technology will be extended to handle other PBTs and a larger variety of oil types. The technology is currently being patented and marketed for installation at fish oil production sites.


2

SINTEF Materials and Chemistry is research partner of DUE MILJØ. The institute has high competence within fields such as materials technology, applied chemistry and biology. It works closely with the industry to develop advanced materials, products, processes and tools. Through international collaboration projects, DUE MILJØ and SINTEF have developed new, environmentally friendly processing methods which yield higher quality, improved economy and increased productivity.

invitrogen | DYNAL® invitrogen bead separations

DYNAL BEAD BASED SEPARATIONS
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Dynal is the world-leading provider of biomagnetic separation technology. Moving into areas that increasingly impact the patient, Dynabeads® show an exciting potential to improve current methods and advance healthcare as a whole.

History

In 1976 the late Professor John Ugelstad developed a process for the manufacture of polymer particles of identical size and shape. The patented technology was licensed to Dyno Particles in 1980, and lead to the development of magnetic monosized particles – the Dynabeads®. Apothekernes Laboratorium and Dyno Particles established Dynal AS in 1986 to market Dynabeads® for biomagnetic separation. In 2000 Dynal Biotech ASA acquired Dyno Particles, thereby gaining control of the entire production process.

In 2005 Dynal Biotech ASA was acquired by Invitrogen Corporation, an American company providing essential life science technologies, products and services. The Oslo site remains a centre of excellence for bead-based separations. Dynabeads® are recognized as the gold standard for biomagnetic separation. The technology is a perfect match for Invitrogen in many key application areas.

Application Areas

The magnetic magic of Dynabeads® is brought to play in a vast number of research areas. Specific ligands on the bead surface act as “bait” for the capture of target molecules, allowing simple magnetic separation of biological material (cells, nucleic acids, proteins, etc.).

Magnetic cell separation allows for studies of specific blood cells that are important to fight disease, and is also used for immunotherapy. Dynabeads® are used to isolate and detect harmful pathogens such as viruses, *E.coli* and *Cryptosporidium*. Dynabeads® also support many molecular and proteomic applications in both research and routine laboratories, as well as in *in vitro* diagnostics. The technology secures high sensitivity, high throughput and an unparalleled level of reproducibility.

The patented technology offers the possibility for custom-based synthesis. Dynabeads® are sold both to end-users and on an OEM basis to leading biotech, diagnostics and pharmaceutical companies.

Technology & Expertise

Dynal is known for its unique products and innovative work. The company builds R&D competence in future technologies and collaborates closely with research institutions in Europe and the United States. Dynal holds a strong portfolio of patents, intellectual property and in-licensed technology for processing and application of biological substances. The annual revenue for Dynal Bead Based Separations in 2007 was USD 53.4 million, with 10% of the total revenue devoted to R&D.

The educational level in the company is very high. Thirty-two of its 161 employees are connected to R&D. Of the 25 employees with a Ph.D. degree, 52% are women. There are 50 research scientists and engineers, of which 66% are women.

Dynal’s high level of competence within R&D, process development and manufacturing is a very valuable asset for Invitrogen, holding ambitious targets for future growth and expansion.

1

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Eidesvik AS is a shipping company located in Bømlo on the west coast of Norway. The company has approximately 600 employees. Eidesvik operates a modern fleet of highly specialized vessels. By the spring of 2008 the fleet will consist of 20 vessels in operation plus four newbuildings under construction.

Operational Areas

Eidesvik has its operations in three main segments. These include:

- Supply and offshore logistics
- Subsea light construction and IMR
- Seismic survey and cable laying

Several of the company's vessels are developed by Eidesvik's own project department. The company has a strong focus on the environment and seeks to develop vessels with the best possible environmental profile.

LNG-fuelled Supply Vessels

Through the use of gas power, NOx emissions are reduced by up to 90% and emissions of CO_2 by approximately 20% compared to using diesel. Eidesvik initiated, developed and put into operation (2003), under contract with Statoil, the world's first gas powered cargo ship, the *Viking Energy*. The company's experience with gas power has been so encouraging that Eidesvik now has a second LNG-fuelled supply ship and a third will be delivered late in 2008.

A qualification test of a 320 kW MCFC fuel cell unit is now being planned for onboard the third LNG-powered ship in 2009. This programme has received considerable financial support from the Norwegian Research Council and Innovation Norway.

Fuel Cell Technology

Eidesvik is confident that a move away from oil-based fuels and towards gas-based fuels is necessary in order to fulfil national environmental goals and safeguard the security of fuel supply. The search for better efficiency and better environmental performance has led the company to look into fuel cells. For several years the company has been involved in FellowSHIP, a joint industry project which has the aim of developing a complete, full scale, fuel cell-based ship machinery system. The other participants in FellowSHIP are Det Norske Veritas, Wärtsilä Ship Automation, Vik-Sandvik and CFC Solutions.

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3

1. This is the *Acergy Viking*, a ROV and Survey Vessel. It was delivered to Eidesvik in the autumn of 2007.

2. The *Viking Queen*, delivered in January, 2008, is the company's second Platform Supply Vessel powered by LNG.

3. The *Viking Vision* is a Seismic Survey Vessel that was delivered to Eidesvik in the autumn of 2007.

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Eltek Valere AS is a uniquely positioned Norwegian telecom equipment company with a global reach, a first-tier customer base, leading engineering capabilities and focused product range. With business activities in 100 countries, Eltek Valere has one of the strongest R&D and engineering pools in its industry as well as access to resources on the global scale. Eltek Valere's mission is to empower its customers' businesses by delivering critical, cutting-edge power solutions and services.

Locations

Eltek Valere's R&D resources are centralized and located in Drammen, Norway; Stockholm, Sweden; Shenzhen, China; and Richardson, Texas. These four centres cooperate closely under common management according to a joint development plan. Advanced technical support is also centralized in Drammen and Richardson. Custom engineering is decentralized to the local daughter companies in the group to satisfy the customer needs.

Standing Out

Eltek Valere develops and markets DC power systems, based on leading technology and state-of-the-art components. A strong range of high power density, flexible and cost-efficient rectifiers/converters form the core of company's offering. Apart from turn-key solutions, Eltek Valere develops embedded system solutions for original equipment manufacturers.

Eltek Valere's product portfolio covers applications in the following areas:

- Mobile
- Fixed
- Industry and power generation
- Railway

Eltek Valere is, together with Nera Networks (telecom transmission), a part of Eltek ASA, which is listed on the Oslo Stock Exchange.

New Green Strategy for Eltek Valere

Eltek Valere kicks off the company's new green strategy by introducing High-Efficiency DC Power Systems. These systems reduce the operator's energy bill by 4 to 8% cutting the power loss by 50 to 66%, compared to today's state-of-the art AC-to-DC conversion technology.

Eltek Valere estimates that the 160 billion kWh needed to maintain global telecommunications operations cause emissions of more than 98 million tonnes of CO_2 into the atmosphere every year. Between 60% and 70% of that electricity is used to power the network, meaning that the electricity must flow through an AC-to-DC power system.

Flatpack2 HE

The first product in Eltek Valere's new green line, the Flatpack2 HE rectifier, offers 96% efficiency in comparison to the industry standard of between 88 to 90%. Eltek Valere already offers 92% efficiency, the highest in the industry. This increased level of efficiency can save the environment of approximately 3 to 6 million tonnes of CO_2 emissions or the equivalent of between 1 and 2 million cars (depending on whether they are already using Eltek Valere equipment). In addition, the telecom operators will save millions of dollars in operating costs annually.

In the future, the company will extend its power saving technology across its entire rectifier product line as well as its controllers and systems, and could adapt it to products for IT/data centres, alternative energy generation, industrial and utility markets.

EURO INNOVATION PARTNER AS (EIP)
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Euro Innovation Partner AS (EIP) is a national competence centre for operations embraced by the EEA financial mechanism. The financial mechanisms aim to reduce social and economic disparities within the European Economic Area (EEA), and to enable all EEA countries to participate fully in the Internal Market. Through this financial mechanism the three EEA-EFTA states (Iceland, Liechtenstein and Norway) will make a total of EUR 1.3 billion available for the countries that joined EU and EEA from 2004 and onwards, whereof Norway contributes with close to EUR 1.2 billion of this funding. EIP offers a full range of services from partner search and project sketches to project management and accomplishment. The focus is on both R&D and non-R&D projects.

Objectives

- More Norwegian participants in European R&D projects
- Strengthen the cooperation between R&D environments in Norway and the EEA area
- Connecting regional innovation systems
- Increase the number of companies in international trade
- Contribute to increased productivity and competitiveness
- Exchange of students within the educational environment

Strategic Partners

- Norwegian Association of Local and Regional Authorities (KS)
- SIVA – The industrial Development cooperation of Norway (governmental organization)
- Møre and Romsdal County
- Molde University College
- Molde Kunnskapspark AS

Strengths

Over time EIP has established good and strong networks within and outside of Norway. Through strategic partner KS, EIP has access to all municipalities and counties in Norway and within the EEA area. EIP has further established working relations with Public Authorities both in Norway and an increasing number of EEA countries. EIP's competence is within national and international agreements and finance mechanisms, regional business development, public administration and operation and project management.

Focus Areas

- Partner search
- Project sketches
- Project description
- Application
- Contracts
- Project accomplishment and management
- Evaluation

Molde University College

EIP builds R&D projects through a close cooperation with Molde University College and its partners. Molde University College is Norway's leading institution for education and research in transport economics and logistics.

Molde University College offers master's degree programmes within logistics, european logistics, transport and distribution, informatics, change management and the health sciences. It also offers a doctoral degree in logistics

The school conducts R&D within logistics and informatics, transport and economics, social science and management and health sciences.

Molde University College

EWOS AS
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The EWOS Group is a leading international player in the production of fish feed for the fish farming industry. The Group, which primarily produces feed for salmon and trout, has independent units in the four salmon-producing countries, Norway, Chile, Canada and the UK. The EWOS companies have a total of around 750 employees and an annual turnover of NOK 5,9 billion (2007). Approximately 10% of the employees in EWOS Group are employed in the Group's R&D company - EWOS Innovation.

Operating Companies

The four operational companies in EWOS Group – EWOS AS (Norway), EWOS Chile S.A., EWOS Canada Ltd and EWOS Ltd (UK) – produced a total of 875 thousand tonnes of fish feed in 2007.

The various EWOS companies have an independent market responsibility in their respective geographic areas – with regard to both production and sales. At the same time, however, the companies cooperate closely on functions such as purchasing, product development, R&D, marketing and information systems.

The EWOS Group's head office is situated in Norway in the town of Bergen.

Research & Development

EWOS Innovation is the R&D company that supports EWOS and Cermaq activities in salmonid aquaculture (both feed and farming). The company's ambition is to be internationally recognized as the leading innovator for the salmonid aquaculture industry and a leading company in organizing industrial innovation, attracting outstanding employees and partners.

Main research activities focus on the development of new diets for the salmonid farming industry, through processing, raw material and nutritional improvements and breakthroughs. This may be achieved by changing current formulations or including new raw materials and additives to improve the performance of the feeds and the growth, quality and welfare of the fish. Research into the technology of feed production is also carried out to ensure the production of diets with the required technical quality – which will allow EWOS Group customers to feed their fish to the best of their ability.

This research is carried out both in-house and in collaboration with outside research institutions and companies. The more static part of the organization is the R&D operational facilities which are situated in Dirdal and Lønningdal in Norway and Colaco in Chile.

On the trial farms, technical equipment enables detailed monitoring, control and recording of water conditions and fish growth parameters necessary for optimizing fish production performance. This provides the company's researchers with an important basis for continued R&D work. Comprehensive field studies and research programmes are in progress at all times on all the trial farms, both on land and at sea. EWOS Innovation's trial farms are also used in a variety of cooperative projects with other research institutions, as well as commission trials for other parts of the industry – like raw material suppliers.

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Finnmark University College (HiF) is the northernmost university college in the world and has 1,900 students, a staff of 240 (of which 150 teach and are in research positions) and an annual budget of NOK 190 million. Approximately 7% of the budget comes from external revenues. The subjects of study offered include some 15 bachelor's programmes and two master's programmes.

Bachelor's Programmes

- Hotel administration
- Child welfare
- Child welfare, part-time
- Outdoor recreation and physical education
- Pre-school teacher training
- Pre-school teacher training, part-time over a four-year period
- Teacher training
- Information technology
- Media production
- Nature-based added value
- Tourism and travel
- Social work
- Social work, part-time
- Nursing (full time/part time)
- Economy and administration
- Border business studies

Master's Programmes

- Special needs education and Accommodated learning
- Tourism and travel

One-year Foundation Courses

- Business administration
- English
- Finnish
- Physical education and outdoor recreation
- Media studies
- Politics in the High North
- Russian for business
- Management

Campuses

Finnmark University College's main campus is in Alta, but there are also campuses in Hammerfest (health studies) and Kirkenes (border business studies). It has a decentralized teaching structure and holds IT remote-learning courses. It also carries out teaching commissions for trade and industry and the public sector. In 2008/09 a study programme will be carried out for Innovation Norway in the field of international marketing for the tourism and travel industry.

International Collaboration

Finnmark University College collaborates via the network "University of The Arctic", takes part in The Barents Euroarctic Region collaboration and has joint venture agreements with universities in a number of different countries. HiF is interested in developing its international collaboration and is on the lookout for new collaborating partners for teaching and research work.

Research Activity

Finnmark University College carries out research through the resources of its staff, through PhD candidates and through commissions for the public sector and trade and industry.

The main areas of research activity are:

- Nature and culture-based travel
- Natural resources and resource-based development of trade and industry
- Societal development in the High North
- Student-teacher fieldwork

Examples of Ongoing Projects

- Measures towards regional innovation
- Multicultural meeting places – daily life in ethnic border zones
- Special education and basic skills in the school
- ArctiChildren – about children and young people's psychosocial well-being in the Arctic regions of Finland, Northwest Russia, Sweden and Norway
- Use of IT in health care services

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FLOWTITE Technology AS, founded in 1977, is a Glass Reinforced Polyester (GRP) pipe and tank technology organization. FLOWTITE Technology provides R&D in the area of manufacturing, equipment and systems know how for these exceptional products. The parent company, Saudi Arabian AMIANTIT Company, is one of the world's largest manufacturers of pipe systems.

FLOWTITE Technology Mission

FLOWTITE Technology's primary mission is to provide R&D, know-how and equipment for the manufacture of GRP pressure and non-pressure pipes, as well as storage tanks. Research and product development by FLOWTITE Technology covers both product improvement programmes as well as programmes aimed at better understanding and defining the installation and use characteristics of these fine products. FLOWTITE Technology, with its multi-million dollar "Center of Excellence" in Sandefjord, Norway, leads the world in research GRP-pipe technology.

Leadership Role

FLOWTITE Technology is committed to a leadership role when it comes to process and product improvements. The company carries out basic "materials" research which has led to significant improvements. For example, the direct manufacturing cost of GRP-pipe has been reduced considerably, while long-term performance has steadily improved. The philosophy has been carried forward to include the process and equipment used to manufacture the product. Throughput is ever increasing, without sacrificing quality, as a result of the introduction of better process controls aided by sophisticated programmable logic controllers and computers.

FLOWTITE Technology also takes on leadership in GRP-pipe specification development. Its personnel are in leadership positions for all significant global standardization organizations. This includes International Organization for Standardization (ISO), American Society for Testing Materials (ASTM), American Water Works Association (AWWA) and the Committee for European Normalization (CEN).

Technical Support Role

FLOWTITE Technology's market assistance includes everything from developing a comprehensive marketing plan, which covers the introduction of a new product, to direct sales support with a major customer.

FLOWTITE Technology always provides process assistance for a new operation during start-up. The FLOWTITE Technology team is on the leading edge of new technology for GRP-pipes and is ready to help adapt this latest technology at a pace consistent with needs.

Pipe Products

FLOWTITE Technology has the manufacturing and product technology for both small diameter (80 mm – 250 mm) and large diameter (300 mm – 4000 mm) pipes with pressure classes up to and including 32 bars and stiffness classes meeting international and national requirements (typically 2500, 5000 and 10000 N/m^2). The products utilize glass fibre reinforcements, both continuous filament rovings for high hoop tensile strength and chopped rovings for balanced hoop and axial design considerations, in conjunction with polyester resins and inert silica sand. The resulting composite wall construction allows for the economical production of a GRP-pipe, yet with the high strength and corrosion resistance commonly associated with a glass reinforced plastic pipe. The standard joint is a Flowtite ™/ Double-bell/ REKA coupling with elastomeric sealing gaskets. Typical fittings (tees, wyes, elbows, reducers), as well as restrained joints (flanges, lay-ups, locking coupling), are also part of the product line.

FFI Forsvarets forskningsinstitutt
Norwegian Defence Research Establishment

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In Norway the Norwegian Defence Research Establishment (FFI) manages the main responsibility for defence-related research. The establishment is also the trusted adviser on defence-related science and technology for the Norwegian Ministry of Defence.

The demand for transformed and flexible armed forces requires constant renewal, and Norway's commitment to defence technology keeps FFI busy. Developing the Armed Forces in a way that secures its principal role as the security policy tool of society comprises great challenges.

As the Armed Forces are no longer purely a national emergency tool, but also one of international security, even R&D requires greater international cooperation. FFI collaborates with national and international scientific institutions and industry in order to ensure its position at the forefront of science and technology within chosen areas. FFI also has a close working relationship with its partners and customers.

R&D for Protection of Norwegian Interests

Demand for FFI's research increases as the nature of armed conflict evolves, creating the need for new communications technologies in new areas of conflict or for new forms of protection against biological and chemical weapons. These are just two of the fields in which FFI is working. The overall goal is to enable men and women in uniform to be more effective in the field, and, inevitably, to return home alive.

FFI seeks to resolve such challenges by covering a broad research spectrum, ranging from assisting operational units, to supporting security policy via defence planning, to technology studies.

1. Environmental assessment of white phosphorus and toxic compounds in military ammunition.

2. FFI command & control systems and synthetic environments laboratory turn knowledge and ideas into efficient defence.

www.ffi.no

FFI turns knowledge and ideas into an efficient defence

GASSNOVA

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Gassnova SF was established on 3 July 2007. Its main task is to manage governmental interest and support technology development within the area of CO_2 management (capture, transport, injection and storage of CO_2). Gassnova SF is based on a vision to promote environmentally friendly gas power technology with CCS in Norway through innovation, technology development and demonstration in pilot and full scale.

CLIMIT – Profitable Gas-Fired Power Generation with CO_2 Capture & Storage

CLIMIT is the Norwegian RD&D Programme on Power Generation with CO_2 Capture and Storage. Gassnova and the Research Council of Norway administer the Programme on behalf of the Norwegian state. The Programme is designed to promote projects in all phases from research, development to the demonstration of technologies. Gassnova is responsible for coordinating the Programme. Through the CLIMIT Programme, the Norwegian Government annually allocates more than EUR 16 million to projects. Including co-funding by the industry, this may result in activities totalling more than EUR 50 million per year in Norway.

CLIMIT's Areas of Focus

The CLIMIT Programme has two primary areas of focus: power generation with CO_2 capture and CO_2 storage. This involves the following activities:

The Norwegian authorities have great ambitions for the management of greenhouse gas emissions. The present Government has committed itself to achieving ambitious goals for CO_2 capture in conjunction with the gas-fired power plants at Kårstø and Mongstad.

In the short-term:

- Qualifying technology and reducing costs relating to CO_2 capture from gas-fired power plants
- Establishing methods for safe storage of CO_2 in geological formations

In the longer term:

- Improving or developing technologies with the potential to significantly enhance the efficiency and profitability of power generation with CO_2 capture
- Developing methods for safe storage of CO_2 that fulfil the requirements set out in international agreements for geological storage

Challenges

The main challenge lies in encouraging major industry players to invest sufficient resources in technology development as a basis for industrial development while at the same time enabling Norway to fulfil its environmental commitments. The key to promoting strong industry involvement is to create confidence that new markets for products and services will emerge on a scale large enough to justify such substantial investment on the part of industry. Another challenge is that Norway only has a few national technology suppliers capable of such investment, making cooperation with international industry essential. Gassnova SF and the Research Council will continue to work together at the national and international levels to create arenas for networking and cooperation, and to draw attention to the potential for industrial growth through technology leadership and development.

Table 1. The CLIMIT programme's strategy for power generation with CO_2 capture.

		Short term goal 2006-2010	Medium term 2010-2014	Long term > 2015
Post-combustion	Scale-up and regularity	Demonstration	Full scale Experience	
	Energy consumption	- 25 % *)	- 50 % *)	*) ref case 4000 kJ/t CO2
	Environment	Full understanding	Negligible effect	
Pre-combustion	Turbine development	Lab scale	Pilot scale	Realised
	Energy consumption		New technology lab scale	New technology demonstrated
Oxy-fuel	Energy consumption		Process integration	Membrane technology demo
	Turbine development		Pilot scale	Realised
Hybrid	New technology			Small pilot
Geological storage	Knowledge	Gap analyses	Improved	
	Methods	Development	Commercial	Implemented
	Build trust	Testing	Trust and acceptance	Demonstrated

GENDER IN NORWAY
E-mail: post@gender.no • Website: gender.no

Gender in Norway is an information service in English about gender equality, gender research, legislation and gender statistics in Norway. The website presents the gender equality work Norway is doing within the national and international arena. Relevant statistics and research contribute to provide a picture of the Norwegian society from a gender perspective.

Gender in Norway

The website gender.no gathers information on gender equality related strategies, laws and regulations, and policies and tools. *Gender in Norway* addresses itself to both a national and international audience, to anyone with an interest for or a curiosity of gender related matters. It includes gender statistics and gender research, pointing to facts, figures and reports as well as researchers, web resources and publications. The website has four categories where news and articles are organized into the categories gender equality, gender research, gender legislation and gender facts and figures. These are further divided in various topics.

Other content on the website includes:

- Dialogue, through invited bloggers
- Ask an expert-feature – visitors can get answers to their questions regarding gender and equality. Visitors' inquiries are directed to one of the partners behind this site with the best competence on each question
- A calendar of future events that gathers information about relevant conferences, seminars, etc., held in English

Information can be searched through various topics, such as:

- Population and migration
- Education and research
- Work, welfare and economy
- Families and relationships
- Power and decision-making
- Crime and violence
- Health and reproductive rights
- Peace and development
- Culture, religion and sports
- Human rights
- Media and technology

Collaboration between Public Authorities & Agencies

Gender in Norway is a collaboration between various public authorities and agencies in Norway, and is coordinated by KILDEN Information Centre for Gender Research. The website's partners include:

- Ministry of Children and Equality
- Ministry of Defence
- Ministry of Education and Research
- Ministry of Foreign Affairs
- Ministry of Local Government and Regional Development
- Ministry of Trade and Industry
- Committee for Mainstreaming – Women in Science in Norway
- Statistics Norway
- The Equality and Anti-Discrimination Ombud
- The Research Council of Norway
- KILDEN Information Centre for Gender Research in Norway

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GenØk – Centre for Biosafety is engaged in research, advisory services and capacity building related to biosafety. The centre focuses in particular on the environmental and health related consequences of the application of new bio- and nanotechnology (biosafety). GenØk was founded in 1998 and is a non-commercial and independent research institute located in the research environment at the University of Tromsø and the Science Park. GenØk is the national centre for biosafety in Norway and works closely with Norwegian regulative authorities on issues related to biosafety.

International Collaboration

The head office is based in Tromsø, Norway, but the centre is also represented in Trondheim, Norway, Christchurch, New Zealand, and Kuala Lumpur, Malaysia. GenØk is part of a national and international co-operative network, which encompasses recognized Norwegian and international research institutions and groups, as well as independent NGOs.

Research

GenØk's research projects focus on three potential impact areas related to development and use of new bio- and nanotechnology. These include:

- Human, as well as animal health and nutrition (e.g. vaccine, food and feed safety)
- The environment and natural resources (biodiversity, ecosystem integrity, agriculture, forestry and aquaculture)
- Sustainable innovations and outcomes (assessment of risk, uncertainty and other ethical aspects)

The research projects are based on cell culture, organismal and food-web models, employing strategies and methods from functional genomics, molecular biology, ecology, social sciences and bioethics.

Consultancy

As a national centre for biosafety, GenØk carries consultancy duties to, and offers advisory services for, national and international regulatory authorities, and other interested parties, on issues related to new bio- and nanotechnology. GenØk staff members are also frequently represented in national and international committees related to biosafety.

Capacity Building

The aim of the GenØk-initiated Gateways Institute Program is to establish a global network of genuinely independent research institutions serving as regional biosafety centres. GenØk is currently working with partners in China, Zambia and South Africa.

GenØk has been carrying out capacity building projects related to genetic engineering and genetically modified organisms in developing countries since 2003. These include:

- The centre organizes biosafety courses in Tromsø, as well as regional courses in developing countries
- In co-operation with the University of Tromsø an online course in biosafety is offered and plans for MSc and PhD programmes are being developed
- In 2007 the centre published a book called *Biosafety First – Holistic Approaches to Risk and Uncertainty in Genetic Engineering and Genetically Modified Organisms*
- Together with the Centre for Integrated Research on Biosafety in New Zealand GenØk has developed the BAT (The Biosafety Assessment Tool), a free Internet based service that provides forecasts, practical advice, checklists and access to literature on trends in development and products with biosafety implications

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Gjøvik University College concentrates its courses and R&D efforts within the areas of health, care services and technology. Gjøvik University College consists of three departments with a total of 1,800 students and 230 staff members.

The Norwegian Color Research Laboratory

The Norwegian Color Research Laboratory (colorlab.no) is a research group at Gjøvik University College. It was founded in the spring of 2001 to serve the rising needs for colour management solutions in the graphic arts industry. Since its foundation the scope of interest has grown to cover colour science, colour imaging, and image processing in a broader sense. The group employs a number of researchers with a broad competence basis, has an extensive network of national and international collaborators both from academia and industry and has well equipped laboratories and conference facilities. Currently the group is involved in a wide range of fundamental and applied research projects in areas such as print and image quality, colour management, cross-media colour reproduction, machine vision, film production, and display technology. In the fall of 2008 a new international master's programme on Color in Informatics and Media Technology will be initiated.

Norwegian Information Security Laboratory

The information security group (nislab.no) at Gjøvik University College conducts international competitive research in several areas of information security, supervises Ph.D. research projects in this field and teaches courses in information security at the master's and bachelor's levels. Activities related to information security at GUC were initiated in the spring of 2001 in reaction to a request by Telenor, the major Norwegian telecom company, through the demand of a large number of experts in the company with backgrounds in various areas of information security. In the course of a pilot study, great demands were also made by experts in other Norwegian companies. NISlab carries out research in many areas of information security including information security management, system security, cryptology, network security, privacy, attacks and forensics, information warfare and critical infrastructure protection, content protection and dependable computing.

The Center for Care Services Research

The Center for Care Services Research (omsorgsforskning.no) is a multidisciplinary research and competence centre that gathers, produces and spreads knowledge about care services and social work. The Center is a professional meeting point for researchers, teachers and students from different milieus and it will pass on new and already established knowledge about care services and social work to the research world, where it is applied, authoritative bodies and the rest of society.

The Center was established at Gjøvik University College in 2005. In November of 2006, the Ministry of Health and Care Services allocated the Center the function as the country's first regional R&D centre within care services research. It is to also act as a national coordinator for the other regional R&D centres which are planned to be set up.

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Green Business Norway aims to be an important catalyst for the development of Norwegian suppliers of environmental and energy technology solutions with the goal that they become profitable businesses on an international scale. Green Business Norway is a network representing 55 companies within the field of environmental and energy technology with a combined turnover of NOK 16.8 billion. The network collaborates closely with Nordic partners on common projects, and it has joint venture agreements with several customers in the international market.

Energy

Green Business Norway actively promotes renewable energy and energy efficiency in the following fields:

- Bio energy
- Solar energy
- Geothermal energy
- Energy efficiency
- Waste to energy solutions
- Engineering and construction
- Odour control solutions
- Wind power
- Zero emission technology (electric vehicles)

Waste

Waste-to-energy solutions are one of Green Business Norway's core activities, and it offers state of the art technology in the fields of:

- Sanitation technology
- Recycling and material recovery
- Biological and biochemical sewage plants
- Biogas Plants
- All waste-related services (transport/ equipment/reception facilities)
- Engineering and construction
- Odour control solutions

Management

Green Business Norway offers comprehensive clean technology consultancy services. Training is an important part of its activities in the following areas:

- Environmental assessment and management
- Environmental research in air, water, soil and biosciences
- Clean technology for the wood pulp and paper industry
- General consultancy services
- Risk management

Water

Green Business Norway offers comprehensive solutions for municipal and industrial drinking water and wastewater needs in the following fields:

- Water pollution monitoring – early warning systems
- Drinking water and fresh water
- Wastewater and sludge
- Water purification
- Water treatment
- Cleaning and reuse of production water
- Oil spill contamination
- Engineering and construction
- Odour control solutions

Monitoring

Monitoring and warning systems are another of Green Business Norway's core activities, with state of the art technology in the fields of:

- Air and water pollution monitoring
- Early warning systems for water/air pollution
- Real-time environmental monitoring
- Real-time weather forecasting
- Pollution forecasting
- Online odour measurements
- Instrumented safety systems for industrial applications

GTO SEDIMENT AS
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GTO Sediment is an innovative supplier providing sediment handling services to the world market. With its in-house developed technology, GTO can meet nearly all sediment challenges posed to the hydropower, irrigation and water supply industry. GTO technologies are developed to meet the numerous challenges caused by sediment transport in rivers. The company's has gained its experience through a number of projects in Nepal, Japan, Ethiopia, India, Costa Rica and Peru.

New Solutions to a Global Sediment Problem

GTO Sediment has developed and offers technologies and equipment for sediment removal from reservoirs and desilting basins. Enormous sediment loads that are carried by most rivers cause reservoirs to lose their storage capacity and destroy hydropower turbines. The revolutionary technologies allow efficient sediment removal with no movable parts and with a minimum of energy consumption.

The Sediment Problem

Sediments such as silt, sand and gravel are eroded from land and carried by most rivers. When the water meets a reservoir the velocity is reduced and sediments settle on the bottom; the sediment loads are so overwhelming that even big reservoirs fill up and lose their storage capacity within few years. On a global basis it is estimated that the annual storage loss is 35,000 to 70,000 million m^3, which is in the same order as the volume of all reservoirs in Norway combined. According to the World Bank, "Last century was used to build reservoirs, this one will be used to solve sediment problems."

Sediment Removal from Reservoirs

The recently developed GTO Reservoir dredge uses the water's potential energy to remove sediments from he reservoir. The dredge consists of a suction head, a flexible suction hose and an outlet pipe that goes through or over the dam wall. The secret of the technology is that no pumps are required and that a perfect mix between water and sediment is obtained without movable parts. Water consumption is kept at minimum, and there are hardly any limits either to depth or capacity.

Sediment Removal from Sand Traps

Open air desilting basins or sand traps in tunnels are required to remove abrasive sediment before the water passes the turbines. The Slotted Pipe Sediment Sluicer (SPSS) is a fixed structure that enables sediment removal with a minimum of water consumption, without interrupting water supply and without movable parts. Successful installations at Khimti in Nepal and Cuyamel have verified its reliability and efficiency.

Sediment Engineering

GTO Sediment has in-house hydropower expertise and benefits from close relations with SINTEF and NTNU in Trondheim. GTO can therefore offer sediment engineering in a broader perspective such as optimization of reservoirs and desilting basins and advice on overall layout to minimize the consequences of sediment transport.

1. Sediment removal at Malana Hydropower Plant in India – 30,000 tonnes of sediment is removed every month with manual labour and the energy of the water.

2. Cuyamel HPP in Honduras – the SPSS in the tunnel sand trap can remove 1,000 tonnes of sediment per hour without interrupting water supply and power production.

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Gusto Tradizionale AS was founded by Frode K.L. Ranhoff, a Norwegian management consultant who has a strong passion for and interest in traditional food products. The two Italian partners in the company, located in the Milan area in northern Italy, are Senior Consultant Paolo Pelizzari and Market Consultant Tiziana Bovenzi. Gusto Tradizionale was first organized as a project in Italy in 2003 and was established as a company in 2005.

Company Mission

Gusto Tradizionale's mission is to implement export strategies for Norwegian companies into the Italian market – and for Italian companies to come into Norway. One of the company's main collaborators is Innovation Norway.

High Standard of Quality

Gusto Tradizionale will promote well known traditional Norwegian products that can be appreciated by customers in the Italian market for their history and special characteristics. In general, the Italian food market has a high standard of quality and is always receptive to new tastes and products in order to improve variety. The company will, through knowledge and experience, be able to guide companies towards a level of unquestionable quality and skills that is necessary for Norwegian products to be introduced into Italy. It is prepared to help any company that wants to develop and implement an export strategy towards the Italian market, as well as helping Italian companies that want to be represented in the Norwegian market. Gusto Tradizionale collaborates with excellent chefs in both Italy and Norway.

Gusto Tradizionale's services include:

- Giving operative marketing support
- Providing a unique network of distributors and customers in the food and beverage industry in Italy that has been built up through the years

References

Gusto Tradizionale's projects from 2005 to 2008 include:

- The company has been representing Fjord Gourmet by Gilde Norge BA in the Italian market. It was active in the establishing of the product portfolio all the way from logistic needs and to end market consumers
- Two wine cellars from Franciacorta have introduced their wines in Norway with the help of Gusto Tradizionale
- Gusto Tradizionale has introduced an Italian coffee concept to the volume market in Norway and the rest of Scandinavia

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Benestad is a Norwegian-based development and manufacturing company, operating principally within the fields of oil & gas and defence. The core technology of the company is hermetic glass/ceramic-to-metal sealing. With 30,000 different combinations of glass/ceramics and a large range of high-grade metals at its disposal, Benestad is well equipped to find the best suited combination for each application.

Focus on Technology

The aim of the company is to develop and manufacture products where glass-to-metal sealing provides a competitive advantage. To achieve this aim, Benestad works beyond technological barriers in close cooperation with customers who rely on its products to provide optimum levels of operational stability and personal safety.

The company has supplied sophisticated glass-to-metal sealing since 1985 and throughout the years has continued to adhere to its philosophy of understanding, developing and employing innovative technology. Highly specialized proprietary processes are at the heart of its products and production.

As one of very few companies in the world capable of such advanced glass-to-metal sealing, Benestad offers many key functions, including in-house capabilities in the way of design, calculation, and core manufacturing processes and testing. Expanding its technology base with nanotechnology in 2003 was a natural step, considering the physical and chemical fundamentals of Benestad's sealing technology.

Focus on Quality

Strict quality control is of paramount importance, both to the company and its customers. Benestad's quality assurance system was implemented according to ISO 9001 and AQAP 110 in 1995, and the company now has ISO 9001:2000 and Module E in ATEX Directive Annex VII certifications.

Products

Penetrators for Subsea Electronic Enclosures have traditionally been the company's largest business area. Technological highlights applied in many of these penetrators are Glass-to-Titanium Sealing (GTTS) and extreme multi-pin glass geometrics, utilizing proprietary pressing and sintering techniques that are unique to the industry.

Benestad also delivers High Voltage penetrators, and during the period 1998–2001 it undertook further development projects with this product, partly funded by the Norwegian Regional Development Fund and the Research Council of Norway, resulting in material and process optimization. Today the products offer the following features:

- 7.2 kV to 24kV (phase-to-earth)
- Up to 600A current ratings

Benestad has also developed two specific capacitive sensor designs for subsea and topside applications. Both are protected by patents. The first one has been applied in pressurized leak detectors subsea, and the other is being applied in water fraction metering.

Institute for Energy Technology

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The Institute for Energy Technology (IFE), Norway's leading international energy research institute, carries out market- and technology-driven activities. Established in 1948, the Institute has a staff of 550, and an annual turnover of some USD 120 million. IFE has customers in more than 30 countries and collaborates with oil and energy companies worldwide.

Multiphase Flow & Flow Assurance Research

A main objective of IFE's research here is to contribute to the extension of safe and profitable use of multiphase transportation systems. Through nearly three decades of activity in this field the Institute has developed a range of multiphase flow models, including the OLGA system. A new model, Horizon, is now being developed to extend the possible transportation of untreated well flow.

Corrosion & Materials Research

Research in this field aims at developing corrosion mitigation methods for safe use of carbon steel in H_2S and CO_2 environments. Research on pH-stabilized glycol for corrosion control in gas condensate pipelines and scale control in MEG regeneration systems is an important part of the project portfolio.

Environmentally Friendly Tracers & Tracer Simulators

Through a series of R&D programmes over the past 15 years, IFE has developed a range of efficient, environmentally friendly tracers and tracer simulators for field applications. IFE provides a worldwide field service in this area.

E-Field Operation & Work Processes

IFE has more than 30 years of experience in human factors and control room research. Current R&D priorities are within e-field operation and work processes.

Solar Energy

Research and development of solar cell technology is important at IFE, both in the improvement of existing technology and the development of new solar cell technology. The Institute focuses primarily on silicon solar cells. A complete R&D silicon solar cell processing line combined with a characterization laboratory on solar cells make its laboratory unique in Scandinavia.

Environmental Technology

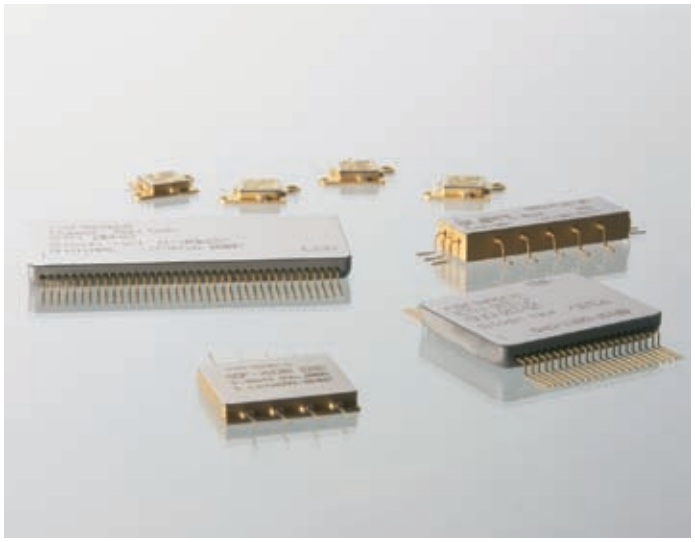
IFE does research in three main areas: climate technology, process understanding related to pollution control, and waste handling, including radioactive waste. Cost-efficient technologies for CO_2 handling and gas power stations with CO_2 capture are central R&D areas for IFE.

Hydrogen Research

IFE has since 1953 performed basic research on hydrogen storage materials (mental hydrates) and is an international leader in this field. Good access to neutrons from the JEEP II-reactor is crucial for this position.

The OECD Halden Reactor Project (HRP)

IFE is the operator of HRP, which is the largest international research project on nuclear safety in the world.



IMST
Institute for Microsystem Technology

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The Institute for Microsystem Technology (IMST) at Vestfold University College (VUC) carries out research, development and innovation activities in the field of micro- and nano technology and offers a graduate education programme in the same area. IMST develops and tests new technology for the building of microsystems, builds prototypes, finds new applications and supports industrial growth in the region.

Research

The institute's research programme is defined according to the needs for new technology and growth in the industry. Technology level research includes micro- and nanotechnology for micro-electro-mechanical systems (MEMS) and micro-sensors such as pressure sensors, flow sensors, inertial sensors and ultrasound transducers. Special focus is given to design, interconnection, assembly and packaging technology for microsystems. The innovation oriented project portfolio includes roles in development of ultrasound sensors for medical and maritime applications, high-frequency devices for space applications, sensors for aerospace and automotive applications, micro fluidic devices (lab-on-chip) for medical applications and new miniature energy sources and energy harvesting devices.

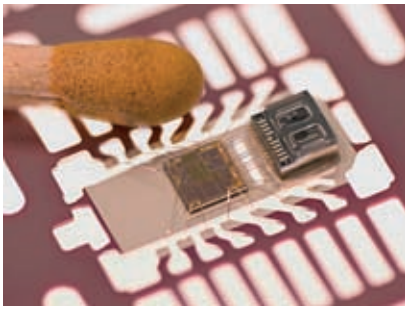
IMST has research laboratories and clean rooms equipped for the building and characterization of microsystems and for training of graduate students.

Education

IMST offers an application-oriented education programme that includes bachelor, master and doctoral (Ph.D.) level degree studies in the field. As one of the few such programmes in Europe, the institute offers an undergraduate program that provides training in microtechnology and the design of microsystems. The master's program has an international orientation, hereby attracting students from all over the world. Most of the students do their thesis work in close cooperation with the strong regional industry. The doctoral (Ph.D.) programme is focused on application-oriented research activities, defined in cooperation with the institute's world-leading industrial partners and universities in both Norway and abroad.

Industrial Sponsors & Partners

The research and education programme at IMST is carried out in close cooperation with world-leading regional microtechnology companies, including OSI Optoelectronics AS, Ignis Photonyx, poLight AS, Memscap AS, Microcomponent AS and Infineon Technologies SensoNor AS. Projects and education activities within the miniaturization of electronics also involve close cooperation with world-leading system level companies, such as Kongsberg Maritime, GE Vingmed Ultrasound and Jotron Electronics. IMST has a key role within the "Norwegian Centre of Expertise – Microsystems", an industry cluster that numbers more than 15 world-leading high-tech companies.



Microsystem for tire pressure monitoring systems from Infineon Technologies SensoNor AS.

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With a staff of almost 700, the Institute of Marine Research (IMR) is Norway's largest centre of marine science. The Institute is the main adviser for the Ministry of Fisheries and Coastal Affairs on marine ecosystems and aquaculture. IMR has an excellent infrastructure to support the research activities, including five research vessels, three research stations for experimental biology and aquaculture, and a wide range of biological and chemical laboratories.

Ecosystem Monitoring & Research

Traditional marine monitoring programmes have generally focused on individual elements of the ecosystem, such as a single fish species or a single environmental factor. IMR now is developing methods and procedures for monitoring and studying the whole marine ecosystem. Measuring all components of the ecosystem simultaneously offers new and improved prospects of understanding ecological relationships. IMR monitors and studies the ecosystems of the Barents Sea, the Norwegian Sea and the North Sea, as well as ecosystems in the coastal zone.

As part of the International Polar Year (2007-2009), IMR has engaged in studies of the ecosystem of the Antarctic. During a three month long international survey with the IMR research vessel *G.O. Sars*, various studies of the pelagic ecosystem and the marine environment are carried out in the Southern Ocean.

Aquaculture

The aquaculture programme at IMR is one of the largest and most comprehensive of its kind in Europe. Significant resources within the programme are allocated to the study and monitoring of potential environmental impacts from aquaculture. In recent years, animal welfare has also become a prioritized area of research. One result of this effort is the development of a new system for the continuous monitoring of sea-cages. The system visualizes environmental conditions throughout the water column, evaluates the status of the fish and transmits welfare advice to the fish farm operators via the Internet.

Photo: MAREANO.

1. The IMR research vessels are at sea for a total of 2,000 days a year.

2. IMR's ecosystem studies include mapping of bottom habitats such as cold-water coral reefs.

Ocean Climate

The IMR research group on oceanography aims to observe, understand and predict oceanographic variability and changes in ocean climate, and to understand and quantify the importance of these on production, distribution and behaviour of marine organisms. The group has three main research areas:

- Ocean climate: processes, variability and changes
- Impact on the marine ecosystem
- Operational oceanography

In cooperation with the Nansen Environmental and Remote Sensing Center and the Norwegian Meteorological Institute, IMR has developed one of the world's most advanced operational systems for the continual monitoring and forecasts of coastal water temperature, currents and salinity and levels of nutrients, chlorophyll, algae and oxygen (POMP).

3. A recently developed monitoring system gathers environmental and behavioural data from sea cages, transmits the data to a central expert system which analyses the situation and sends advice to the person in charge of the fish farm.

Acoustic Abundance Estimation

Using and developing advanced tools for the acoustic abundance estimation of fish and zooplankton has been a prioritized area of research at IMR for more than 60 years. Current research within this field includes technological challenges associated with species and size determination, post processing of acoustic data, stationary monitoring with full temporal resolution and acoustic density estimation in any direction of insonification (sonar applications). On the analytical side, IMR focuses on quantifying uncertainty in acoustic measures, as well as analytical tools and the development of observation – modelling approaches appropriate for the demands set by the ecosystem approach are priorities.

Advanced Research Vessel

The *G.O. Sars* represents a new generation of marine research vessels. It is extremely quiet – emitting 99% less noise under water than conventional research vessels – and has sufficient engine power to tow a large pelagic trawl at speeds as high as 5 or 6 knots. The G.O. Sars is equipped with advanced acoustic instruments, pelagic and bottom trawls, towed airguns and hydrophones for seismic studies, while its onboard laboratories enable a full range of environmental, plankton and fish analyses.

State-of-the-Art Research Station

The Matre Research Station started research on salmonid farming in 1971, ten years before salmon farming developed commercially in Norway. Many of the methods developed at this station are now in use worldwide. In 2006, the Research Station was totally modernized with new water supplies, experimental facilities and analytical laboratories. Fish welfare has become a key area of research, and the hypermodern facilities enable the station to accurately control water temperature, salt content and oxygen level and to register the reactions of the fish to changes in their environment. Experiments of this sort can also be used to study growth, sexual maturation and spawning under different conditions and to improve the understanding of these mechanisms in both wild and farmed fish.

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Dr.techn. Jens Jacob Jensen AS

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JJJ-Consult Dr.techn. Jens Jacob Jensen AS does technical advisory services, consulting services and R&D in the areas structural engineering, ICT and learning.

Products

- **Technical assistance within a limited sector of the subject of structural engineering** – For particular problems in the area of structural engineering, where specialist knowledge is required, JJJ Consult AS offers services such as research and calculations. This includes special assignments in the fields of vibrations, dynamics and accident prevention, with special reference to concrete structures such as industrial buildings, bridges, marine structures and fortifications. Services may be on the borderline between research and traditional consulting and may be relevant to builders and consulting engineers who do not have special competence in these areas.
- **Promotion and dissemination of research results for practical purposes –** JJJ Consult AS' main goal is to promote research results in order for them to be put into practical use more quickly. On the basis of current issues in industry the company identifies research results that can be utilized in practical dimensioning or for information purposes in developing practical tools like guides, spreadsheets, reference works, etc., to be distributed on digital media, e.g. CD-ROM.
- **Development of technical information and learning materials directed at children and adolescents –** The building industry presently suffers from a lack of recruitment. How can the building industry be more attractive to young people as they choose a profession? JJJ Consult AS is ready to take on assignments for the development of technical information and learning materials to be used in the recruitment of budding engineers who can play, think and create. Suppositions are made on the basis of the mind set of young people, with approaches ranging from kindergarten to high school and university. JJJ Consult has developed materials suitable for schools, museums and science centres that explain phenomena from physics, environment, art, society, etc. The focus is on opportunities and responsibility. Products include books, models, CD-ROMs or Internet applications.
- **ConTre – bridge model set system –** ConTre is a bridge model set system consisting of wooden rods, beams and slabs. It aims to stimulate young people to learn about the structural engineering profession and the design process using math, science and technology. With a complete set, delivered in a special wooden chest, a couple of persons can simultaneously build 8 different bridge types such as trusses, arch bridges, free cantilever bridges, floating bridges, suspension or cable stayed bridges. Single bridge sets for trusses and arch bridges are also available. Instrumentation and loading equipment for the material and structural testing of models have been developed. The equipment may be a part of a mini "structural test lab" for schools, recruiting young people for civil engineering research. CD-ROMs containing drawings, pictures and instructions are included.

KINGS BAY AS
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Situated at 78° 55' N, 11° 56' E in the core of a vast arctic wilderness with exquisite surroundings, Ny-Ålesund, Svalbard, is a sprawling research community and the northernmost permanent settlement in the world. Research at these latitudes is challenging, but since access is easy, the climate is relatively mild and the infrastructure is well developed, the village makes an ideal land-based entrance for many fields of science in the High North. Kings Bay AS is the owner of the village and the surrounding areas and provides infrastructure and services for visiting scientists.

Kings Bay AS

Working on behalf of the Norwegian Government, Kings Bay AS operates and maintains the settlement as its prioritized assignment. The Norwegian authorities express ambitious goals for Ny-Ålesund and have been investing considerable amounts in the development of the village. Kings Bay AS accordingly promotes research and research related activities and contributes in developing Ny-Ålesund as one of the paramount research stations in the Arctic.

Kings Bay AS thereby forms part of the busy international research community in Ny-Ålesund. The settlement is the permanent home to 35 people. Annually there are approximately 11,500 research days performed in Ny-Ålesund (2007), and an increasing number of cruise boats bring about 30,000 visitors per year (2007). The effect of local activities on the environment is presently limited, and a wide-ranging focus on preservation is established to maintain it like this.

Research in Ny-Ålesund

Kings Bay AS focuses on the researcher's demands and is able to provide a modern base for Arctic research and monitoring. This includes state of the art laboratories, including a large marine laboratory, diving facilities, offices, high speed data links, logistical support, a work boat equipped with scientific tools, transportation and full board and lodging.

Ten countries have established permanent research stations in Ny-Ålesund, and a total of approximately 20 nationalities use the premises each year. Currently climate change studies and monitoring form the core of the research activities. A wide range of disciplines are represented, notably marine science, aurora physics, biology, glaciology, geology, environmental science, geodetic studies, rocket probe studies and atmospheric physics. Cooperation amongst the research institutions is encouraged.

Kings Bay AS' Vision

The vision of Kings Bay AS is "to the best for Arctic research and monitoring". This implies that Kings Bay AS constantly focuses on developing and managing the village and the area for the benefit of the research community and keeps close contact with the institutions and researchers on site. By taking part in the dynamic exchanges and developments in the research community, Kings Bay AS is prepared to justify its ambition both today and in the future.

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Knutsen OAS Shipping AS is a fully integrated ship owning company located in Haugesund on the west coast of Norway. Within the course of 2008 the company will own and operate 40 ships and it has 11 ships under construction. Knutsen OAS Shipping is continuously seeking new areas of expansion to secure and strengthen its position in a very competitive market. To meet future requirements and provide customers with first-class services, the company has focused on advanced technology and innovative and environmentally friendly solutions. This has resulted in new technology products designed for implementation in response to an increasingly demanding market.

Innovation & Technology Focus

At present, Knutsen OAS Shipping is operating within the tanker segment with involvement in the following areas:

- Offshore loading and crude oil transport
- Products
- Chemicals
- Liquefied natural gas (LNG)

Since the mid-1980s Knutsen OAS Shipping AS has evolved into one of the leading shipowning companies within offshore oil loading. The company has lifted more than 4,000 cargos from offshore loading fields, giving Knutsen OAS Shipping important experience in the performance of sophisticated operations using advanced ships. All of the offshore loading shuttle tankers have a dynamic positioning system, which has given the company experienced crew with special skills to handle advanced operations. This experience has been used to improve operations with focus on safety and using the latest technology in the market.

The transport of natural gas is another focus area for the company. From 2004 to 2007, 5 LNG ships were delivered. Additional LNG ships will be delivered in 2010 in a segment where the company has ambitions for further expansion. LNG experience, combined with long-term experience in offshore loading, products and ice operations, are areas of expertise which the company will develop to provide high-standard marine transport services – as shipping expands into new sectors where issues of environmental significance represent increasingly greater challenges and opportunities.

Technology, Safety & Environment

Knutsen OAS Shipping aims to be a front-runner in tanker operations. The company has therefore stringent requirements with respect to quality, safety and the environment. In order to fulfil these ambitions and meet charterers' requirements for advanced shipping services, a focus on technology has been given high priority.

This priority has resulted in new innovative technology for handling volatile organic compounds (KVOC®), ballast water treatment and a new innovative method for marine transport of pressurized natural gas (PNG®).

Knutsen VOC Technology – KVOC®

KVOC® is a new cost-efficient method to limit VOC emissions during loading and transport of volatile cargoes such as crude oil. The system has so far been installed on several of the company's offshore loading vessels and has proved to limit the VOC emissions between 60 to 80% during loading and transport. Besides reducing air emissions, the KVOC® installation also reduces H_2S release from the cargo – which has become an increasing challenge, representing a hazard to the environment, the ship itself and to human health. KVOC® is commercially available to other operators.

Ballast Water Technology

Within the next few years ballast water treatment will become more and more important, and strict requirements are now imposed to minimize the transfer of harmful aquatic organisms and pathogens. Knutsen OAS Shipping has ambitions to implement its own ballast water treatment technology.

PNG® – New & Innovative Natural Gas Transport

PNG® (Pressurized Natural Gas) is a new transport solution for marine transport of natural gas. The technology has been developed by Knutsen OAS Shipping in close cooperation with German pipe manufacturer Europipe GMBH and Det Norske Veritas. The technology has passed all the qualification requirements stipulated by the classification society and is now approved as ready for implementation.

PNG® will open for new transport alternatives and is particularly suitable for offshore loading for direct transport to the market. A PNG® solution will provide the gas industry with new opportunities beyond conventional pipeline transport and LNG.

The gas is stored onboard the ships in specially designed cargo cylinders at a pressure of 250 barg. Compared to LNG marine transport, the gas treatment is minimal and similar to the treatment required for pipeline transport, making this alternative very attractive and flexible in use.

The PNG® technology will make it possible to capture gas from marginal oil and gas fields. With the present demand for energy, it is only a matter of time before the technology is implemented. Knutsen OAS Shipping's ambition is to become a world leader in technology for the marine transport of pressurized natural gas and to perform direct offshore loading of natural gas from offshore fields.

1

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The development department within the Kitron group is one of Scandinavia's leading product development companies. With more than 90 engineers working in the fields of electronics design, mechanical design, industrial design and software, the company delivers development projects to a number of leading Scandinavian companies. As part of a major Scandinavian electronics manufacturing service provider, all products developed by Kitron provide competitive advantages for Kitron's customers.

Areas of Expertise

Kitron offers a unique solution to its customers through its development department.

Areas of expertise include:

- Electronics design
- ASIC/FPGA design
- Software design
- Driver development under Windows XP/CE
- Mechanical design
- Industrial design
- RF and high-frequency design
- Micro material and production technology
- Component technology

Services

An organization focused 100% on project management and product development is available to Kitron's customers. This includes also consultancy services, product upgrades and cost reduction projects.

Kirtron's project organization is specialized for:

- Medical technology
- Telecommunication
- Industry
- Defence technology

Product Development

With experience from product development since the 1970s, Kitron's development projects focus on quality, development time and product cost as its primary goals. The development process is based on quality systems such as ISO9001:2000, along with elements from PROPS.

2

3

1. Industrial and mechanical designs of transponder for a road toll system for Kapsch.

2. Industrial and mechanical designs of a hand hold Paint Teach Pendant Unit for ABB.

3. OCAS, Obstracle Collision Avoidance System. Complete mechanical design and SW/HW design delivered by Kitron Development. Kitron Arendal is responsible for the production and delivery of the finalized system.

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Light Structures AS contributes to safer and more cost-effective operations of structures through the acquisition and analysis of load data. The company provides turnkey structural health monitoring systems for the maritime sector, as well as customized systems for other applications.

History

The company is a SME based in Oslo, Norway. It was established in 2001 by researchers in fibre optic sensor technology, and has since then maintained its focus on developing and manufacturing fibre optic sensor systems.

Light Structures AS has grown to be the leading supplier of fibre optic structural health monitoring systems for maritime applications. The company's main activities are located in Oslo and South Korea.

Structural Health Monitoring

Structural health monitoring is made possible by recent advances in sensor technology and materials science. Sensors are constantly measuring the load a structure is subjected to. The measurements are continuously compared to the maximal permissible loads. Ships countering heavy waves, wind turbines in a storm, or bridges experiencing the combined loads of wind and traffic, are all examples of structures that may be operated at their optimum when the forces acting on them are known.

Monitoring systems also identify the conditions that have an adverse effect on structural lifetime. When advised, the operator may take actions to reduce the loads, which in turn prolongs service life, reduces maintenance cost, and improves safety.

Fibre Optic Sensor Technology

The core in Light Structures AS's monitoring systems is its fibre optic sensor technology. These sensors have several advantages compared to the conventional electrical ones. They include:

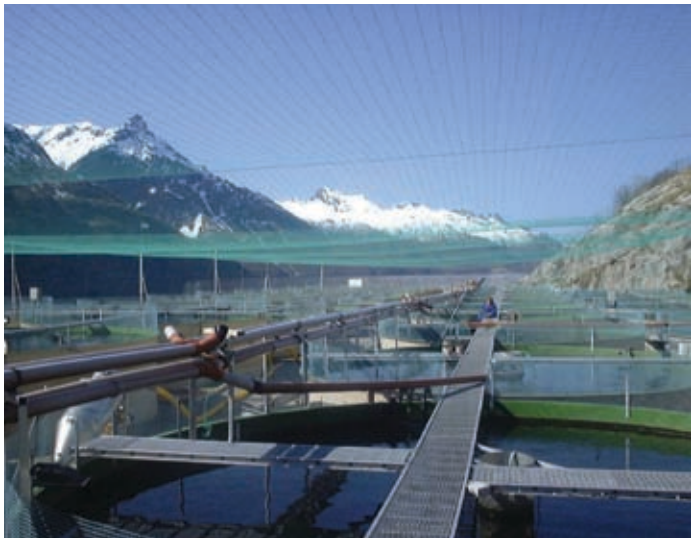
- Immunity to electromagnetic noise and no emissions. The sensors may be operated close to high voltage cables without signal deterioration
- Explosion safety
- Waterproof – no short circuits
- Measurement at long distances
- Long-term stability

The company combines fibre optic sensors with its analysis and presentation software to build complete structural health monitoring systems.

R&D Activities

Light Structures AS engages in R&D activities to adapt its technology to meet a customer's special needs. Results in recent years include:

- Explosion safe, fast response, pressure sensor for use in extremely cold environments (-200C°)
- Ultra-fast sensing equipment for the detection of pressure waves from explosions
- Small sensors for measurement of load distributions on the human skeleton
- Systems for the measurement of weather induced loads on high voltage power distribution lines
- Systems for ice load monitoring on icebreakers
- Custom software for analysis and presentation



MARINE HARVEST NORWAY AS
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Marine Harvest ASA is the world's largest aquaculture company with a harvest volume of 340,000 tonnes gw of salmon and trout products in 2007. The company, listed on the Oslo Stock Exchange, has 9,000 employees worldwide, and its head office is in Oslo. Marine Harvest Norway AS (MHN) is a leading industry actor regarding R&D activities within Norwegian Aquaculture.

Locations & Personnel

In addition to filet production and further processing in Norway, Scotland, Ireland, Chile and Canada, the company has extensive VAP (value added products) activities in the USA, France, Belgium, Poland and the Netherlands. Marine Harvest Norway's (MHN) main office is in Bergen, which houses a central technical team covering areas like fish health, nutrition and feeding, fish quality, slaughtering and R&D.

Olav Breck, Dr. scient, Cand. med. vet., is the head of a small R&D department, which also conducts biological benchmarking, i.e. the utilization of biological data to improve performance, fish health and quality and identify key R&D areas. MHN also has several veterinarians, biologists and other technical personnel within the organization.

MHN has a continuous focus on ensuring the best possible welfare for fish, based on an ethical standpoint, and it recognizes that good fish welfare is a key criterion for good performance and quality.

Projects

MHN has a portfolio of some 20 larger projects. The main emphasis for 2008 to 2010 is put on major viral diseases such as IPN, HSMI and PD, or diseases of unknown aetiology, e.g. CMS. Within the quality segment, flesh colour and texture receive much attention. In addition, activities related to further improving killing techniques and adapting to new EU-legislation also have priority. Another topic of importance is the development of technical systems for the on-site slaughtering of salmon, with potential major benefits related to improved fish quality and welfare, as well as reducing the risk of disease spread through avoiding the transport of live salmon in open well boats. Finally, a recently started project focuses on the impact of increased temperatures andsub optimal oxygen saturation on fish health and performance.

R&D Sites

MHN has ownership in two R&D sites; one is a small cage site at Helgeland in northern Norway (Fjord Research Station), and one is a large scale semi-commercial site at Hjelmeland in southern Norway. For the latter, the Centre for Aquaculture Competence (CAC), led by Trine Danielsen, MHN has the operational responsibility and, together with co-owners Skretting and AquaGroup, determines which R&D areas to focus on. Currently, sustainability related to feed raw ingredients is a key area due to continued growth of the salmon industry totally depending on alternative oil and protein sources instead of marine ones. The main objective of the current project is, through replacement of marine with vegetable raw materials, to become a net marine protein producer, without compromising fish health and welfare.

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Mericon AS is a CRO established in 1990. The company offers assistance within research and development to clinical studies and regulatory affairs. Mericon's scientific staff are all educated at Norwegian universities and have experience in research and lecturing from universities in Norway and abroad. The company has several years of experience from research and development within the chemical and pharmaceutical industry, and has also acted as consultants for governmental authorities.

Clients

Mericon AS offers services to:

- The pharmaceutical industry – specialized in registration and clinical testing of new medicinal products with respect to efficacy and safety. Preparation of registration documentation, planning, monitoring and reporting clinical studies on human and veterinary medicines
- Governmental authorities – assistance within evaluation and reviewing of documentation
- Universities – giving lectures and courses/ seminars within the company's disciplines

Clinical Studies

Mericon AS offers personalized service from a small team. This is adaptable to client requirements and focuses on quality according to international and national requirements.
Clinical research services include:

- Product development planning
- Protocol design
- Preparation for regulatory authority and ethics committee notifications
- Case Report Form (CRF) design
- Monitoring
- Report writing

Quality Assurance

Mericon AS has experience within quality assurance in connection with the manufacturing of active pharmaceutical ingredients (APIs) according to GMP.
Quality assurance services include:

- Evaluation of suppliers
- Materials management
- Specifications
- Product documentation
- Packaging materials and labelling
- Technical contracts
- Distribution

Regulatory Affairs

Mericon AS has many years of experience in assisting the pharmaceutical industry in regulatory affairs management.
Regulatory affairs services include:

- Assist in contact with The Norwegian Medicines Agency (NoMA)
- Provide guidance according to national procedures and requirements
- Translate Summary of Product Characteristics (SPC)
- Translate Patient Information Leaflet (PIL) and labelling
- Translate other relevant documents related to marketing authorization
- Readability testing of package leaflets to NoMA
- Assist regarding submission of variations to NoMA
- Prepare and update product information in The Norwegian Pharmaceutical Product Compendium (Felleskatalogen)
- Ensure health and public marketing information is provided according to Norwegian law

Readability Testing

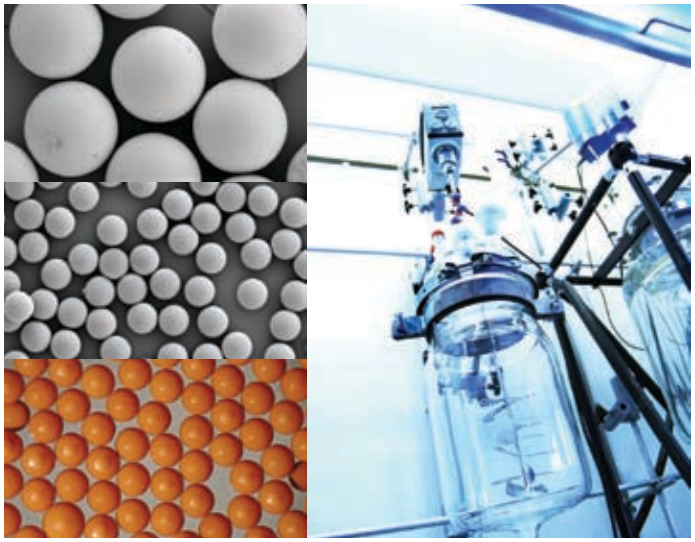
Mericon AS performs readability testing (user testing) of package leaflets.
Readability testing services include:

- Preparing the package leaflet, if necessary
- Preparing the test protocol
- Preparing the questionnaire
- Performing pilot tests
- Performing the interviews and if necessary adjust the package leaflet during the process
- Evaluating the results
- Writing the Summary Outcome Report

Statistics & Data Management

Mericon AS has a solid foundation of knowledge in medical science and statistics, as well as extensive practical experience in clinical studies.
Statistical services include:

- Sample size estimation
- Statistical analysis plan
- Randomization
- Data management
- Statistical analysis and reports
- Pharmacokinetic calculations



MICROBEADS®

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Microbeads AS develops, manufactures and sells monosized polymer particles for industrial applications on a large scale, based on a unique patented technology.

Company & Product Development

In 1976 the late Professor John Ugelstad invented a process for the manufacture of polymer particles of an identical size and perfect spherical shape. The patented technology was licensed to Dyno Particles in 1980 to develop products for biomagnetic separation. Microbeads was established in 2002 to develop and manufacture monosized polymer particles on an industrial scale. The patented technology in Microbeads, based on the Ugelstad invention, is licensed from Dynal Invitrogen for use within industrial applications. Microbeads also has its own patent portfolio to produce monosized beads more efficiently. Licensed technology from LEN (Leiv Eiriksson Nyskaping) enables monosized polymer particles production based on step polymerisation.

Products

The monosized polymer particles are manufactured in Microbeads' plant in Norway with a production capacity of several hundreds tonnes per year. The polymer particles are produced in the particle size range of between 0.5 to 500 microns. Because of this unique technology, perfect monosized and spherical shaped particles with a uniform particle size can be prepared with a controllable molecular weight and cross-linking degree. The polymer spheres can be made compact or porous with a controllable pore size distribution. Monosized polymer beads made by Microbeads are mainly composed of polystyrene, polyacrylic or resorcinol-formaldehyde polymers.

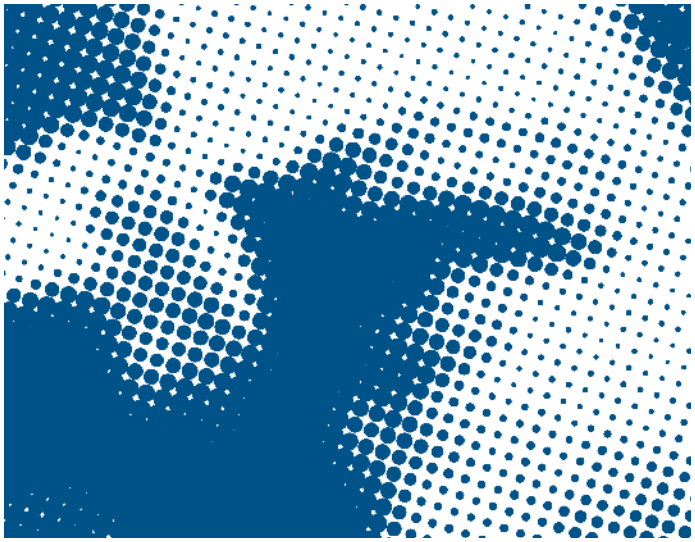
Application Areas

Monosized polymer beads have a wide variety of application areas where they are used as an additive to give special properties. Application areas include:

- Decorative coating (paint)
- Industrial coating
- Plastics processing
- Calibration
- Purification of ^{137}Cs in radioactive waste
- Cosmetics

Spheromers® CA/TS and Calibre® CA as additives in coatings and paints have opened up for a new generation of products with new, improved performance. In addition to the commercially available products, the patented technology makes it possible to offer large or small-scale custom production, where polymer composition, degree of cross-linking, porosity and particle sizes can be custom-designed.

For the purification of radioactive waste, monosized polymer particles based on resorcinol formaldehyde can be used to remove the radioactive ^{137}Cs isotope from alkaline radioactive waste by ion exchange. These monosized beads show excellent chemical and hydraulic properties.



NAMMO AS
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The Nammo Group is a world leading supplier of ammunition, missile products and demilitarization services. The Group has 1,600 employees in 6 countries (Finland, Germany, Norway, Sweden, Switzerland and the USA) and a turnover of NOK 2.8 billion. The shareholders are the Norwegian Ministry of Trade and Industry (50%) and the Finnish Defense and Aerospace Group, Patria Oyj (50%).

Ammunition

Nammo designs, develops and produces a wide range of high quality ammunition products. The ammunition products include more and more innovative technologies with an increased focus on reducing collateral damage.

- The implementation of radio frequency programmable fuses demonstrated by Nammo has triggered its customers to come up with new concepts not possible earlier without this technology
- Small arms ammunition with a virtually invisible tracer is a qualified product from Nammo
- Advanced hydro ballistic calculations and simulations have made it possible to design a projectile that could take out targets both on the surface, in the air and also into the sea

Demilitarization

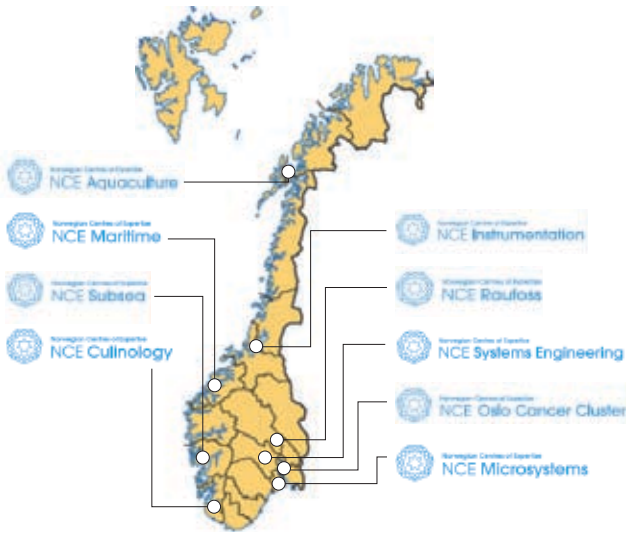
- Nammo's demilitarization business comprises leading expertise and know-how related to environmentally friendly recycling and effective disposal processes for all conventional ammunition and explosive products
- The Group assists other nations in their need for safe disposal by installing and operating locally build factories based on a whole set of unique Nammo-based technologies comprising recycling up to 95% of the waste
- Nammo has developed both extreme blasting technology and end user products, for both the mining and construction industry

Rocket & Space

- With regards to missile and space propulsion, Nammo possesses leading technology in rocket booster and thrust vector control. In recent years the focus has been on advanced propellants, thrust management systems including advanced materials, insensitive munitions solutions, and hypervelocity propulsion as well as hybrid propulsion technology
- The launch of a complete hybrid rocket build by Nammo demonstrates the group's potential to achieve technological progress
- Within the Space business, Nammo has been a partner to the European Space Programme "Ariane 5" for over a decade.

NCE Raufoss

- Nammo is part of the Norwegian Center of Expertise at Raufoss
- The industrial cluster at Raufoss, including neighboring industrial enterprises, local R&D establishments and educational institutions, was appointed a Norwegian Centre of Expertise for Advanced Lightweight Materials and Automated Manufacturing in 2006
- The Norwegian Centre of Expertise at Raufoss is currently regarded as the strongest industrial cluster of goods manufacturing companies in Norway.



NCE Norwegian Centres of Expertise

NORWEGIAN CENTRES OF EXPERTISE (NCE)
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Innovation Norway · SIVA · The Research Council of Norway

The Norwegian Centres of Expertise Programme (NCE) is established to enhance innovation and internationalization processes in the most dynamic and growth-oriented Norwegian clusters. The programme supports long-term development processes in the clusters based on collaboration between industry, R&D and the public sector. Nine clusters have so far been selected and given status as an NCE project.

The NCE Programme is jointly owned and implemented by the three main Norwegian innovation agencies: Innovation Norway, the Research Council of Norway and SIVA, with Innovation Norway having the main responsibility. The programme was launched in 2006, and is funded by two ministries: the Ministry of Trade and Industry and the Ministry of Local Government and Regional Development.

Clusters Drive Innovation & Growth

Clusters are regional concentrations of specialized companies and institutions, with multiple linkages and mutual interests for collaboration. Dynamic clusters are key drivers of innovation and growth, for regions and for nations. Building unique strengths out of the specialized capabilities of the clusters will strengthen competitiveness in an open and global economy.

Projects Represent Dynamic & Ambitious Clusters

NCE projects are selected through open calls for proposals. Applications are evaluated by expert panels and based on well-defined and strict criterias: The cluster's resource base, collaboration and commitment, innovation capabilities, international orientation, growth potential and the project's ability to accelerate the processes. The competition to be qualified and selected as a NCE project has been hard. The 9 NCE projects accepted so far represent the most dynamic and ambitious clusters in Norway.

Financial & Professional Support

The NCE programme offers financial and professional support to the clusters for up to 10 years. The support is aimed at strengthening the linkages between the companies and institutions within the cluster as well as between the cluster and the world outside. A strategy for long-term development and renewal, building on the partner's joint interests and commitment forms up the platform for the joint actions. This strategy can include a number of approaches and objectives as in, for example, facilitating collaborative innovation processes, improving regional and national education to better meet the demands from the cluster, attracting new firms and talents and branding of the cluster.

The programme has established a network among the NCE clusters, aiming at creating linkages between the clusters, sharing experiences and supporting the development processes with models and tools. Special attention is given to the highly important objective of creating stronger linkages between Norwegian clusters and international business and knowledge environments. Developing trans-national cooperation between clusters is one of the important ambitions in the NCE programme.

Each and one of the 9 NCE-supported clusters are presented in the following pages.

The following website gives additional information on the programme and the projects, as well as contact information: www.nce.no

Norwegian Centres of Expertise
NCE Aquaculture

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INNOVATION NORWAY · SIVA · The Research Council of Norway

NCE Aquaculture focuses on value creation and innovation associated with commercial production of farmed fish and seafood for the global market. The cluster consists of companies involved in the production of fry and edible fish, processing, feed production, technology, health and environment, finance, research and training. These are key actors who by virtue of their competence and resource base will play a decisive role in the further development of Norwegian aquaculture.

Background

Since the 1970s the aquaculture cluster along the coast of the Nordland region has been involved in the creation of one of Norway's most important export industries. The Norwegian aquaculture industry provides NOK 19 billion (2006) in export revenue, ensures settlement along the coast and upholds many important values in society. The cluster has been built up through the development of salmon as a breeding species, and has contributed to the development of companies and competence in breeding, technology and equipment, feed and nutrition, sales and export, R&D and funding.

There is a great potential for the further development of the breeding of salmon, cod and other species such as wolffish, halibut, shellfish and sea urchins. Aquaculture operators and companies related to aquaculture in Nordland have worked together closely for many years and have established an efficient cluster. The companies' width and professional weight ensures unique access to skills.

The NCE Aquaculture partnership is formalized through business agreements between the following companies: Aker Seafoods ASA, Bodø Science Park, AKVA Group ASA, Lofitorsk AS, Arctic Seafood Holding AS, Nordlandsbanken, BioMar AS, Nova Sea AS, Cod Farmers ASA, Helgelandstorsk AS, Plastsveis AS, Skretting AS, Fjord Marin Holding ASA, Rapp Marine AS, Bodø University College, Tysfjord Marine Holding, the Norwegian Institute of Fisheries and Aquaculture Research and Gildeskål Research Station AS (GIFAS).

Initiatives & Projects

Activities within NCE Aquaculture are organized around seven prioritized working areas. The core of this is innovative cooperation in practice, and the further development of the relations and cluster dynamic that have been developed. The seven strategies are:

- Innovation strategy
- Marketing and customer strategy
- Industrialization strategy
- Technological strategy
- Environmental strategy
- Skills and internationalization strategy
- Cluster strategy

Strategy & Objectives

NCE Aquaculture`s objective is to become a locomotive in the further development of Norwegian aquaculture and related activities. The further development of existing activities and the development of the breeding of new species are to lay the foundation for the cluster's companies to increase total value creation by NOK 5 billion, and to create 600 new jobs in the region by 2017.

The cluster has competitive advantages in both geographical surroundings and competence. One objective is for the venture to develop cod breeding as a new and important activity within the cluster. Through NCE Aquaculture, the cluster is to establish a common and nationally coordinated R&D strategy.

Norwegian Centres of Expertise
NCE Culinology

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Innovation Norway · SIVA · The Research Council of Norway

The main objective in creating NCE Culinology is to strengthen the knowledge platform and capacity for innovation in the field of gastronomy and culinary differentiation for the benefit of Norwegian food production. The food cluster in Rogaland has deep historic roots in the production of agricultural-based food and seafood. In addition to a strong production side, the district has an acknowledged culinary environment and a well-established network in which industry, R&D institutions and the public authorities are working in close collaboration to develop the industry.

Background

The development of market and framework conditions reveals two clear lines of development in the food market. Firstly, Norwegian food producers and suppliers are exposed to increasingly tough international competition both in Norway and abroad as far as pricing, quality and character are concerned. Secondly, the quality requirements for raw materials, traceability, ingredients, product characteristics, production conditions, profiling and market orientation are becoming increasingly demanding. This not only applies to skills within the typical culinary market segments, but also within the more volume-oriented grocery trade. It is becoming increasingly clear that the culinary dimension and the need to differentiate products are critical success factors at corporate level.

The vision for NCE Culinology is to raise the production environment in Rogaland and Norwegian food production to the top level in the European food quality markets in the next 10 to 15 years. The partnership behind NCE Culinology consists of: Bioforsk, Biomarin Vekst, EWOS Innovation, Fatland, the Norwegian Agricultural Purchasing and Marketing Co-Op for Rogaland and Agder, Finny Sirevaag, Fiskå Mølle, Fjordkjøkken, the County Governor in Rogaland, the County Agriculture and Forestry Office, the Culinary Institute of Norway, Holmens, Marine Harvest Norway, Norconserv, the Norwegian School of Veterinary Science, section for small livestock research, Nortura, Prima Jæren, Rogaland Farmers' Union, Rogaland County Council, Rogaland Science Park, Greater Stavanger Economic Development, Skretting, Sparebank 1 SR-bank, TINE, the University of Stavanger. The Professional Forum for Food and Beverage is a contractual partner.

Initiatives & Projects

The guiding principle throughout the entire project period will be clarity in the building up and dissemination of knowledge. This will be achieved by means of four main activities:

- Basic knowledge
- Coordination – innovation-oriented R&D projects
- Innovation practice
- Other cluster-strategic common activities

Strategy & Objective

NCE Culinology will function as a professional catalyst and will be measured on its ability to increase the level of innovation and upgrade the professional and market-oriented skills within and between operators in the food and meal industry cluster. The objective is to further develop the quality of raw material production, specialize processing and increase value creation per investment factor.

Norwegian Centres of Expertise
NCE Instrumentation

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Innovation Norway · SIVA · The Research Council of Norway

Situated in Trøndelag, NCE Instrumentation represents cutting-edge expertise in the field of instrumentation. Based in the dynamic R&D community in Trondheim, represented by the Norwegian University of Science and Technology (NTNU) and the SINTEF research group, the cluster has developed over a 20-year period, serving challenging national customers within the areas of maritime and offshore applications. As a result, a globally competitive business cluster, with a current direct and indirect turnover of NOK 4 billion in some 100 companies, has emerged.

Background

Originating within the R&D community in Trondheim, many of the companies have developed on the basis of R&D findings or with personnel recruited from this cluster of expertise. From the total of 250 spin-offs from regional R&D activity over the past 20 years, roughly one-third is instrumentation businesses. One of its objectives is to create a foundation for growth for newly established technology companies within the NCE Instrumentation area.

Core companies in NCE Instrumentation include Kongsberg Maritime, Roxar, Fugro-OCEANOR, Q-Free, Kongsberg Seatex, Sicom, Norbit, Cavotec/Micro-Control, Noca, and StatoilHydro. In addition there are three associated members: HIST (Sør-Trøndelag University College), NTNU and SINTEF.

Initiatives & Projects

The projects carried out by NCE Instrumentation aim to further develop the companies' global competitiveness and to increase company growth. This will be achieved through a strategic development of new cooperative processes and by establishing new arenas for cooperation, such as:

- Arena for Industrialization
- Arena for Innovation
- Arena for KnowHow
- Arena for Communication and Marketing

Strategy & Objective

The cluster has considerable growth potential within its existing market. High-level regional customers, such as StatoilHydro at Stjørdal, various utility companies, as well as regional, high cutting edge technology companies (including StatoilHydro-R&D in Trondheim) provide the foundation for significant market expansion, products expansion, and increased competitiveness for the cluster, both regionally and globally.

During the initial three-year project period NCE Instrumentation will establish new arenas for cooperation in order to achieve the following objectives:

- Establish five joint projects in the areas of development and production of traditional instrumentation products in which each project will gain an annual efficiency of NOK 5 million
- Establish two large-scale development projects in which several companies develop new custom-made instrumentation solutions for an integrated and complex process
- Establish a new product segment in which cooperation between companies and the ability to appear in the market as a consortium is essential for meeting customers' product specifications
- Through cooperation with the SINTEF research group and NTNU the NCE Instrumentation must play an active part in at least three R&D projects as part of the EU's 7th Framework Programme
- Serve as a mentor through active sponsorship for five relevant new companies generated from the R&D community

Norwegian Centre of Expertise
MARITIME

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The maritime cluster on the northwest coast of Norway consists of 14 design companies, 14 ship owning companies, 12 shipyards and 139 equipment suppliers. These companies have 18,000 dedicated employees and a turnover of NOK 31 billion in 2006. The cluster is complete and covers all the elements of the value chain – within a small geographical area.

World Leading Position

The maritime industry on the west coast of Norway is a world leader in designing, building, supplying and operating the largest and most advanced vessels for the oil industry. The above headline is no exaggeration. Today the cluster's position is unchallenged.

Behind this incredible statement are 18,000 people in the region working for companies with a turnover of NOK 31 billion in 2006.

But, above all, they works for companies, which today have a world leading position in the development and operation of advanced maritime technology.

These businesses are creating maritime solutions for tomorrow.

How did the Cluster Get There?

There are many explanations. One is that they have learnt to live from and with the sea. Another, is that demanding challenges, in Norway's tough climate, have forced the industry to constantly develop more advanced vessels. This has been done through, first of all, innovative vessels for the fishing fleet, and then, step by step, larger and more technologically advanced vessels for the oil industry.

Other explanations are the geographical proximity, good collaboration and communication between all links of the value chain – between ship owners, design companies, supply of equipment and shipyards. In addition Norway's harsh climate and challenging nature have built people with stamina, courage, the will to take risks and an instinct for competition.

The result is the world's leading maritime industry.

Breaking Waves

"Breaking Waves indicates the act of doing something for the first time. Being a pioneer."

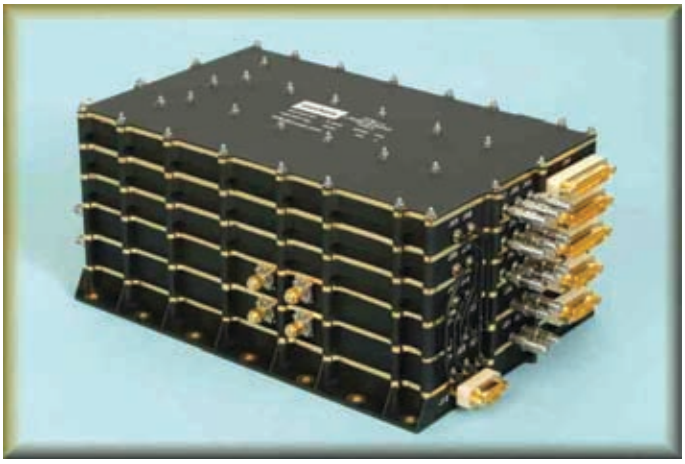
–Tara McCluskey.

All of these explanations can be summed up in two words: Breaking Waves. For the maritime industry, Breaking Waves means creating a breakthrough within this industry. It is about taking the offensive, getting results and being in the lead. Breaking Waves has its roots in the industry's history and in the geography. Proximity to the elements and the tough climate has gradually forced the maritime industry to develop better solutions. Through generations it has refined its expertise.

Breaking Waves is about strength, courage, teamwork, experience and knowledge. Breaking Waves is also a daily reminder of the industry's goals – and how to achieve them.

A maritime adventure.

NCE Norwegian Centres of Expertise



Norwegian Centres of Expertise
NCE Microsystems

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NCE Microsystems is the result of a long-term commitment to microtechnology in the region of Vestfold. The companies in the cluster comprise the most important commercial arena for microsystems technology in Norway, and play a leading role in the Norwegian electronics and ICT fields. Most of the companies in the cluster are international leaders in their product areas – marketing and selling their products to major, demanding international customers.

Background

Miniaturization in electronics is a key trend throughout the ICT sector and continues to develop at a rapid pace. To increase packing density and performance, research is being conducted internationally in several new technology areas related to integration and interconnection in three dimensions. This will require completely new technologies for use in product development, construction and assembly. The anticipated impact of this trend may be so vast that, in the long run, it could threaten the very basis of electronics production in Norway. If the Norwegian electronics industry is to keep pace with these developments, efforts to enhance expertise in this area must be implemented. It is essential to establish laboratories that are adequately equipped to conduct experiments and produce test products and prototypes.

With new technology comes the potential to establish new companies. These companies will need to be internationally-oriented as they will not have a domestic market. Developing a new technology company takes time, typically requiring a minimum of ten years. Achieving profitable turnover on a new product usually takes at least five years. This means that all activities must be planned in a long-term perspective. Newly established companies will benefit greatly from the cluster's wide-ranging international experience.

Initiatives & Projects

The projects carried out by NCE Microsystems are grouped around the following main areas of activity:

- Further develop the existing network
- Increase product development as a basis for commercialization
- Increase technology activities and R&D within cluster companies
- Implement trend analyses and strategic processes
- Establish new study programmes, a research centre and infrastructure

Strategy & Objective

The overall objective of NCE Microsystems is to promote the growth and renewal of the companies within the cluster and to establish new companies with international potential. A dynamic MNT community will be cultivated so that internationally leading companies with international ownership will choose this region in which to develop and grow. A viable, well-coordinated regional innovation system will also be developed to ensure commercialization and future value creation that will continue after the NCE project has been concluded.

Microtechnology companies in the cluster will benefit from increased sales and better utilisation of new solutions in miniaturization and the application of Microsystems technology. NCE Microsystems seeks to promote the development of new start-up companies and create more jobs within the cluster. Efforts will also be made to obtain funding for various projects from the EU, the Research Council of Norway, Innovation Norway, the European Space Agency and other funding sources.

Oslo Cancer Cluster

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Innovation Norway · SIVA · The Research Council of Norway

Oslo Cancer Cluster is a Norwegian Centre of Expertise (NCE), comprising an industrial cluster of biotech companies focusing on the development of cancer therapy and cancer diagnostics. Oslo Cancer Cluster's vision is to transform world class cancer research into new cancer diagnostics and treatment, and thereby improve the lives of cancer patients. Oslo Cancer Cluster aspire to be regarded as the most innovative cluster in Europe for cancer diagnostics and treatment.

The purpose of Oslo Cancer Cluster is to support and accelerate translational research, and give patients access to better cancer diagnostics and therapies. It wants to be instrumental in moving scientific progress from the world-class research performed inside the cluster companies and supporting university hospitals and out into the world market.

Oslo Cancer Cluster

Oslo Cancer Cluster is a natural regional cluster, where the interaction between members in the Oslo region provides ideal conditions for major synergy effects. The cluster was established in 2006 as a result of more than 20 years of excellent cancer-related activities in the region, and in June 2007 Oslo Cancer Cluster was awarded NCE (Norwegian Centres of Expertise) status by the Norwegian Government. It adapts the comprehensive cancer cluster network model of the highly successful MD Anderson Cancer Centre and Memorial-Sloan Kettering Cancer Centre in the USA.

Oslo Cancer Cluster comprises about 40 members, including industrial companies, academic research institutions, health initiatives and support groups in the field of biotechnology – all with their main focus on cancer. Two Technology Transfer Offices and R&D facilitators in the Oslo region are also listed as members. Together these institutions represent more than 70% of the human resources in cancer research in Norway.

Initiatives & Projects

Oslo Cancer Cluster has an impressive 63 projects in the pipeline. It aims to convert research into innovative cancer treatment by:

- Completing development projects between university/hospital/business
- Removing obstacles to cooperation, developing a common R&D platform and ensuring the optimal use of R&D resources within the cluster
- Supporting the development of ideas into new products and commercial enterprises
- Promoting research and innovation in the cluster both nationally and internationally
- Strengthening the training, education, specialization and availability of competent personnel in science, life sciences, medicine and biotechnology

Future Dynamics

A dynamic Oslo Cancer Cluster will be characterized in the next 5 years by three distinct dynamics:

- A local dynamism, and increased productivity and competitiveness among the member companies
- The global attractiveness of the research performed inside the cluster
- A global market reach for the diagnostics, therapies and products developed inside the cluster

Oslo Cancer Cluster is facilitated by The Norwegian Radium Hospital Research Foundation (www.radforsk.no)

NCE Norwegian Centres of Expertise

Norwegian Centres of Expertise
NCE Raufoss

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INNOVATION NORWAY · SIVA · The Research Council of Norway

More than one hundred years of experience with international industrial development forms the background for the Raufoss industrial cluster, an outgrowth of Raufoss ASA. The cluster's core area of activity is the manufacturing of products in lightweight materials by automated production, and its goal is to develop a national resource centre. The industrial cluster at Raufoss currently consists of over 40 companies with more than 3,000 employees. The group's total turnover amounts to roughly NOK 4.5 billion, of which exports comprise some 85%.

Background

With expertise originating in Raufoss ASA, the Raufoss cluster serves an extensive, global network of customers. Several of the companies are owned by international interests. The group's most important markets are the international automobile and defence industries. NCE Raufoss currently has the following participants: Raufoss Technology & Industrial Management AS, Nammo Raufoss AS, Hydro Aluminium Structures Raufoss AS, Hydro Aluminium Profiler AS, Raufoss Technology AS, Kongsberg Automotive Raufoss AS, Steertec Raufoss AS, Plastal AS, Hexagon Composites ASA, Raufoss Water and Gas AS, Raufoss Metall AS, Raufoss Industrial Tools AS, Mustad Longline AS, TotAl-gruppen (a network of small and medium-sized companies) and Raufoss Næringspark ANS.

Initiatives & Projects

The projects at Raufoss are grouped into five main areas of activity:

- Development of the cluster and its networks
- New activity
- Technology and infrastructure
- Linking education and practice
- Commercialization of R&D findings

Strategy & Objective

The core areas of activity to be developed are lightweight materials and automated production. These also comprise the core areas of expertise for all the companies in the cluster, as well as the area in which the cluster is on the international cutting edge. NCE Raufoss seeks to become a national resource centre in these areas. One objective is for the cooperating companies to maintain and strengthen their current market positions. Specifically, this will involve the re-creation of 150 jobs annually in existing companies. In addition, new companies employing 250 persons with a total turnover of NOK 1 billion per year will be established and developed during this period.

By collaborating on targeted R&D projects, the companies will maintain and strengthen their market positions. Cooperation with educational institutions and expert circles at the regional, national and international levels will be crucial. As one example of this, the group has signed agreements with Gjøvik University College and the Norwegian University of Science and Technology (NTNU).

Raufoss Technology & Industrial Management (RTIM) heads NCE Raufoss. RTIM is a joint R&D company, acting as a resource centre and development partner for companies in the group. RTIM will also play the role of integrator through its well-established networks both inside and outside the cluster.

Norwegian Centres of Expertise
NCE Subsea

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Innovation Norway · SIVA · The Research Council of Norway

Since the early eighties the subsea industry in the Bergen area, Norway, has grown to become one of the world's most complete environments for subsea technology. The regional cluster consists of some hundred companies and organizations with subsea as their only or main business area.
NCE Subsea is an initiative by the subsea industry in the Bergen area for the strengthening and internationalization of business, R&D and education.

The cluster

NCE Subsea was established in order to contribute to the further development of one of the world's most complete subsea environments – the subsea industry in the Bergen area.

The cluster's main focus is on maintenance, modification and operation of subsea installations. The environment includes a great number of suppliers of services and high-tech products. Over time a close collaboration has been established among industrial actors, R&D institutions, schools and authorities in the region.

Focus on technology

The subsea industry is technology intensive. As the operating time of the installations is prolonged, the distance to shore increases and operations take place on deeper and deeper water, the demands for maintenance, modifications and operations change. NCE Subsea initiates and organizes joint industry projects and services.

Facilitator

The facilitator organisation NCE Subsea aims to contribute to research, innovation, competence development and international business development with emphasis on stimulating collaboration and experience sharing within the cluster, and with national and international collaborators. NCE Subsea has five main target areas;

- cluster development
- technology and environment
- education and competence
- internationalization
- innovation

Internationalization

Development of the international subsea market is promising, and it will offer great technological and competence demanding challenges for a long time ahead. Most participants in NCE Subsea supply goods and services in the international market. Many of them are established in the most central markets with their own companies or through agents. An internal survey shows great willingness to emphasise international market opportunities, even in new geographical areas. The desire to cooperate with international actors is extensive. NCE Subsea contributes to the companies' internationalisation processes, among other things by initiating and executing joint marketing measures.

Competence

The key to continued development is the competence that the organizations possess in the shape of staff and network. NCE Subsea initiates and arranges courses, education and projects on subsea technology, collaboration and innovation. NCE Subsea works to improve the access to a qualified workforce for members of the cluster. National and international information work will help attracting experts from the entire world to the region. Challenging jobs in combination with a rich cultural life, magnificent nature and a Scandinavian working environment makes more and more people choose to move to and settle in the Bergen area.

The subsea industry in the Bergen area will for a long time offer exciting, challenging and internationally focused jobs for qualified and motivated people.

Photo: Bjørn-Owe Holmberg

Norwegian Centres of Expertise
NCE Systems Engineering
Kongsberg

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The Kongsberg cluster comprises knowledge-based companies, several of which are world leading in demanding industries like subsea, maritime, automotive, aircraft, defence and aerospace industries. Many of the core companies grew out of civilian divisions of Kongsberg Våpenfabrikk (defence industry). The cluster has generated new industries and value creation using brainpower, expertise and collaborative solutions. The cluster leads Norway in industrializing major technological innovations and has achieved a key position in global markets.

Background

During the past 20 years, the companies in the Kongsberg cluster have increased their number of employees from around 4,500 to 18,000, of which approximately 6,000 work in the Kongsberg region. In the same period, turnover has increased sevenfold, totalling approximately NOK 25 billion in 2007, of which exports comprise approximately 70% (2007).

R&D investment in Kongsberg totals approximately NOK 1.4 billion (2006), corresponding to 10% of all R&D investment in Norwegian industry. The cluster has industrialized a range of technologies developed by the Norwegian University of Science and Technology (NTNU), the SINTEF Research Group, the Norwegian Defence Research Establishment (FFI) and other R&D institutions. Cluster companies include Kongsberg Gruppen, Kongsberg Automotive, FMC Technologies, Volvo Aero Norge, Dresser-Rand, Esko Graphics, Kongsberg Devotek, Kongsberg Safety Systems, Argos Control and several more. The companies have both national and international owners, and are represented in more than 40 countries.

Facts about the Kongsberg Industry

- Aircraft engines – Approximately 70% of all Boeing and Airbus aircraft have vital engine parts made by Volvo Aero Norge. These parts are produced exclusively in Kongsberg
- Automotive – Roughly 50% of the world's car manufacturers have products from Kongsberg Automotive
- Subsea – FMC Technologies in Kongsberg is world leading in the delivery of underwater production systems for the oil and gas industry
- Defence – Kongsberg Defence & Aerospace has developed the world's most advanced naval strike missile. It is developed and produced in Kongsberg
- Space – Kongsberg Defence & Aerospace is Norway's largest space company
- Maritime – Kongsberg Maritime has a leading global position in the market for dynamic positioning systems and is the world's largest in the field of marine automation
- Offshore – Gas turbines and compressors from Dresser-Rand in Kongsberg ensure 70% of the production of the Norwegian oil and gas industry

Core Competence is Systems Engineering

The core competence for the companies within the Kongsberg cluster is systems engineering. Systems engineering is an interdisciplinary approach and aims to enable the successful realization of complex systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, subsequently proceeding with design synthesis and system validation while considering the complete problem for the system's entire lifetime.

Unique Master Degree programme in Systems Engineering

The Kongsberg cluster companies have initiated a Master Degree programme in Systems Engineering (MSSE). The programme is established at Buskerud University College in Kongsberg in cooperation with Stevens Institute of Technology in New Jersey, USA, and the Kongsberg industry. This programme is the first MSSE in the Nordic countries.

NARVIK UNIVERSITY COLLEGE

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Narvik University College (NUC) has been and will continue to be a leading knowledge centre for development in the north. For more than 50 years, engineering students have received their education at NUC. As northern Norway's technological university college, NUC plays an important role with regard to competency raising and social development.

Programmes of Study

Narvik University College offers a range of different study programmes, at both the bachelor's and master's level. In addition to a master's degree in technology and bachelor's in engineering studies, science teacher training, nursing, and economics and administration, study programmes are offered. NUC also offers a wide range of post-qualifying and further education programmes.

International Student Body

NUC has approximately 1,300 students and 160 employees. The students come from 20 different countries. Slightly less than 10% of the students have an international background. The greater majority come from institutions of higher learning in China and Russia with whom NUC has special agreements.

Doctoral Degree Programme

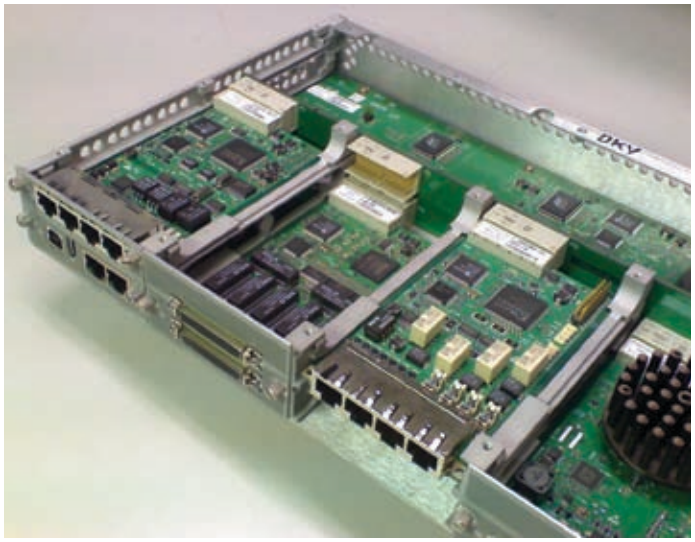
Narvik University College offers three and four-year doctoral degree programmes in collaboration with NTNU, the University of Tromsø and Luleå University of Technology (LTU) in Sweden. Doctoral work will normally be within the main research and development areas at NUC. NUC currently has 16 fellows/PhD students.

Research & Development

Narvik University College has research and development activities ongoing in a range of fields, from simulations, homogenization theory, industrial technology, electromechanical systems and energy technology.

Cold Climate Research Centre at NUC

The cold climate research at NUC is represented by participants from several of the existing R&D groups. In this way, a close cooperation between numerical modelling, numerical analysis, simulation, visualization and instrumentation is ensured in all projects.



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Nera Networks AS is an independent company with strong positions in individual niches in the global microwave transmission market. Using proprietary technology, as well as third party products and solutions competence, Nera Networks aims to become a centre of excellence in the field of wireless microwave transmission.

The Company

Nera Networks has designed, developed, manufactured and deployed transmission solutions since its inception in 1947. The company, with some 700 employees worldwide, has its headquarters in Bergen, Norway, and regional offices in the Americas, the Middle East, Africa and Asia. Nera Networks generates revenues through sales in more than 100 countries. More than 90% of its sales are to customers outside of Norway.

Nera Networks has more than 30 sales and customer support offices and 140 engineers in research and development. The company's main R&D centre is located at the headquarters in Bergen, Norway with some 120 engineers, the majority of them with an education at the MSc level and more than 10 of them hold a PhD.

Nera Networks' areas of expertise include:

- Radio transmission techniques
- Telecom networks
- Microwave technology
- Signal processing
- ASIC/FPGA development
- Software

Nera Networks is involved in university research programmes and has staff holding positions at universities.

Markets

Nera Networks provides wireless transmission solutions to communication network owners in most market segments including:

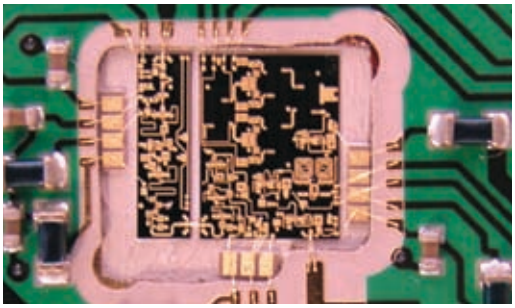
- Mobile
- Broadcast
- Enterprise
- Internet service providers
- Government and educational institutes
- Defence
- Offshore and utilities

Nera Networks provides network solutions that link businesses and communities, large and small, worldwide. In short, the company's business is bridging societies.
Nera Networks makes a continual effort to understand networks better than anybody else. In this way, the company helps its customers to stay at the forefront of technological developments – and ahead of the competition.

Products & Services

Nera Networks provides a unique portfolio of microwave radio solutions for all types of networks and market segments. These include:

- Turnkey solutions of more than 20,000 kilometres of microwave networks in Africa for mobile operators and governments
- Design and installation of a national carrier backbone in Latin America that was implemented in 6 months
- Large national digital broadcast networks in Australia and Europe for broadcast operators
- Wireless broadband turnkey solutions in Europe and Latin America for ISPs and enterprises
- Design and installation of the longest radio hop of 160 kilometres in Kyrgysiztan
- The most powerful communication solution for mobile offshore drill ships at 110 kilometres out in the Norwegian Sea



Monolithic Microwave Integrated Circuit, actual size 5x5 mm.

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The Norwegian School of Economics and Business Administration (NHH) is a research-led institution that is recognized internationally for ground-breaking work in a number of different fields. The NHH group is the largest and most prestigious centre for research and education within the fields of economics, business administration and leadership development in Norway, with over 470 employees and combined revenues of more than EUR 50 million.

Dynamic Research Environment

The NHH group comprises the Norwegian School of Economics and Business Administration (NHH – *Norges Handelshøyskole*) and its affiliated organizations the Institute for Research in Economics and Business Administration (*Samfunns- og næringslivsforskning* – SNF) and the Administrative Research Institute (*Administrativt forskningsfond* – AFF).

Research activity has a very high status among faculty members, and NHH has been closely associated with some of the most significant developments in the fields of finance and economics. The list of internationally renowned alumni and faculty members includes Karl Borch, co-founder of modern risk theory, Jan Mossin, one of the fathers of the Capital Asset Pricing Model (CAPM) and Finn E. Kydland, winner of the Nobel Prize for Economics in 2004.

Broad & Specified Research Focus

A dynamic network of formal and informal research groups brings together researchers from a range of fields to focus on specific issues of vital importance to both the Norwegian and global economies. These groups partner with international research networks, businesses and organizations to expand the frontiers of knowledge and to promote value creation and progress.

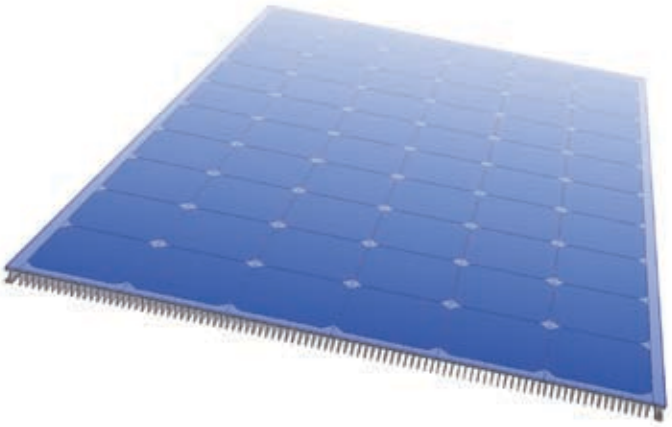
The FIBE conference, held at NHH in January each year, is the largest academic gathering in Norway within the field of business administration.

Faculty resources are organized into five academic departments: Finance and Management Science; Accounting, Auditing and Law; Economics; Strategy and Management; and Professional and Intercultural Communication.

Cross-disciplinary research centres focus on: Advanced Studies in Economics, Economic Policy, Financial Economics, Fisheries Economics, Strategy and Management, and Ethics and Economy. In addition, AFF carries out applied research in the areas of leadership and organizational development.

Publishing & Presenting at the Highest International Level

NHH group faculty publish in the leading international journals, and present their research at major international conferences. In addition to a busy programme of seminars and guest lectures from some of the foremost researchers and practitioners in their fields, the school hosts major national and international academic conferences.



NORSK SOLKRAFT AS
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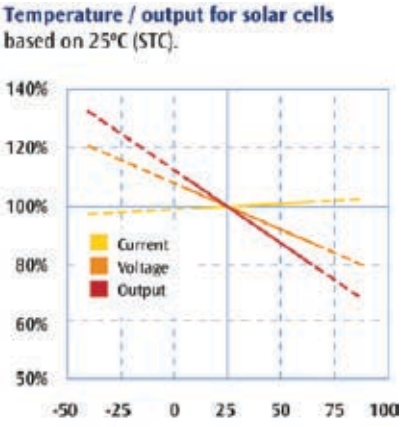
The Solkraft Cool Module is a new generation of solar cell module. Its features include increased efficiency, more power per unit area, longer product lifetime and reduced operating cell temperature. These are all factors that have a large positive contribution to system performance and economic bottom line.

Heat Losses

As the sun heats up an ordinary silicon cell module during the day, the cell voltage drops and the power output is dramatically reduced. Research shows an average "temperature coefficient loss" in the power output of -0.5%/°C for all modules with silicon cells. To solve this heat-loss-problem, Solkraft Innovation has developed a passive cooling system that significantly reduces the cell temperature.

Passive Cooling Technology

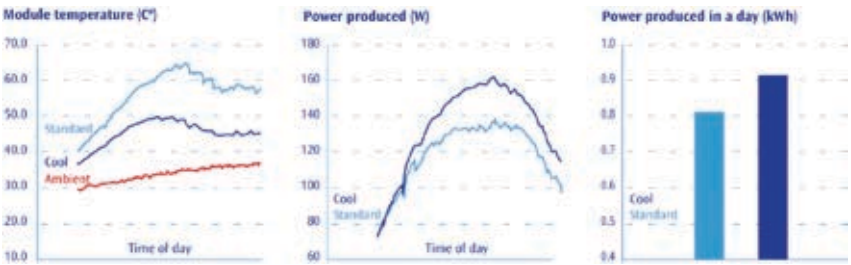
The unique design of the patent pending Solkraft Cool Module SCM230 transports heat from the cells to the module backside where the heat is dispersed through radiation and convective air flow. Local air movements will further enhance the heat dissipation from the module. This passive cooling counteracts the voltage reduction caused by rising temperature and increases the power output with 10% to 15% in warm climates.



The graphs show results from field tests with data from various days with changing weather performed by the accredited independent PV testing laboratory at Arizona State University. The testing was done in parallel on standard solar cell modules and Cool Modules with identical cells. The nominal operating cell temperature (NOCT) was measured to be 45.2°C for standard modules and 34.2°C for the Cool Modules. Any reduction in temperature fluctuation range will significantly reduce the stresses in the module, thus prolonging the module lifetime.

Norsk Solkraft AS

Norsk Solkraft AS (Norwegian Solar Energy Corporation) is an international company with its headquarter in Oslo, Norway, and subsidiaries in Italy, Spain and Greece. The company builds and operates large scale solar PV power plants, and produces and markets innovative solar equipment like mounting structures in aluminium and high efficiency solar cell panels.



Graph A.) Average temperatures in the modules during the day.
Graph B.) Power produced in the modules throughout the day.
Graph C.) The accumulated total power produced in the modules during a day.

1

NORTHERN RESEARCH INSTITUTE (NORUT)
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Northern Research Institute Tromsø
Northern Research Institute Narvik
Northern Research Institute Alta – Áltá

Northern Research Institute (Norut) is a national research group located in northern Norway. Norut has research activities within technology and social science research and carries out research commissions for industry, business and the public sector. The Institute has a special focus on the High North, and has 110 employees.

Leading Research Community

The Northern Research Institute is a leading research community that delivers high quality services with good applicability for its principals. The Institute is characterized by its interdisciplinary scope, which ranges from societal development to technology, and it has special High North competence.

Norut participates in large research programmes and strong international research networks. Norut's regional expertise is applicable to regions elsewhere in the world.

Broad Research Expertise

Norut's expertise spans from basic research, through commissioned research, to the commercialization of research ideas. The Institute's ambition is for research activities to provide practical and applicable results, with a commercial potential where this is relevant.

Norut carries out research commissions for industry, business and the public sector in Norway and internationally. Research challenges are often solved by interdisciplinary teams. Approximately 90% of the activity is financed by research commissions.

1. Norut centrally placed on the circumpolar map.

Group Facts & Figures

Norut is located in Tromsø, Narvik and Alta in northern Norway. The company in Tromsø has responsibility for the group. The Institute is majority-owned by the University of Tromsø.

Norut's history goes back to 1984. Today the Institute has 110 highly qualified employees within the fields of technology, social science and innovation.

1

norut
NORTHERN RESEARCH INSTITUTE

Northern Research Institute (Norut) has a high level of technological competency and participates in a number of international research programmes, some of which are under the direction of the EU. In addition to relevant data platforms and analysis tools, Norut has laboratory facilities, technical measurement tools and unmanned aerial vehicles.

Information Technology

Special skills within distributed data systems are essentially related to:

- Geographic information technology and environmental informatics
- Peer-to-peer technology and flexible data communication
- Net-based game technology and e-learning
- Personal e-health technology and services
- Distributed multimedia systems and advanced Internet and web technology

Earth Observation

Special skills within signal analysis and image processing, particularly related to:

- Detection of wind and waves in ocean areas
- Snow and ice mapping
- Vegetation mapping
- Environmental and resource mapping
- Climate and time studies
- Oil/gas – related electromagnetic modelling
- Modelling of electromagnetic waves in different mediums

Construction Technique, Material & Cold Climate Technology

- Concrete technology, erosion and repair of concrete constructions
- Corrosion protection and surface treatment
- Composite materials and sandwich constructions
- Metallurgy and welding
- Construction technique, modelling, product development
- Ice mechanics and ice load on constructions
- Machine construction with fatigue, fracture mechanics and tribology
- Low temperature laboratory, testing of materials, constructions and equipment
- Frost strain and phase transition in materials
- Snow and ice loads on constructions
- Thermal strain and tension in constructions

Environmental Technology & Renewable Energy

- Solel and solar heat, silicon based solar cells
- Surface treatment and fracture mechanics
- Passivation techniques for solar cells
- Optical measurements, analyses and simulation of energy systems
- Purification of polluted grounds and water
- Separation technology
- Bioenergy
- Waste treatment and recycling
- Infrastil hydraulic power

1. Sørstraumen Bridge, repair of a concrete construction.

2. One of Norut's unmanned aerial vehicles.

2

norut
NORTHERN RESEARCH INSTITUTE

Northern Research Institute (Norut) has an interdisciplinary approach to research. The staff has a diverse background from political science, sociology, planning, social anthropology, history, human geography, economics, business and statistics. Norut provides analyses, social impact assessments, economic impact studies, cost/benefit evaluations, trailing research and evaluations.

Culture & Society

The research done in this field seeks to contribute to an increased understanding of current social change processes through studies of social and political inclusion and exclusion mechanisms, cultural encounters and trust. Research in this area includes:

- Cultural encounters
- Transboundary collaboration
- Health
- Welfare
- Indigenous peoples
- ICT and society

Industry & Innovation

Norut's research is important for understanding and supporting regional development processes, and for managing natural resources of national and international importance. The research in this area is focused on the following themes:

- Industrial clusters and regional innovation systems
- Environmental and natural resource management
- Regional planning
- Tourism

Regional Development & Policy

The research done through Norut provides new knowledge about political processes and fundamental social development in northern regions. The research is also relevant for other comparable regions. Research is done in the following areas:

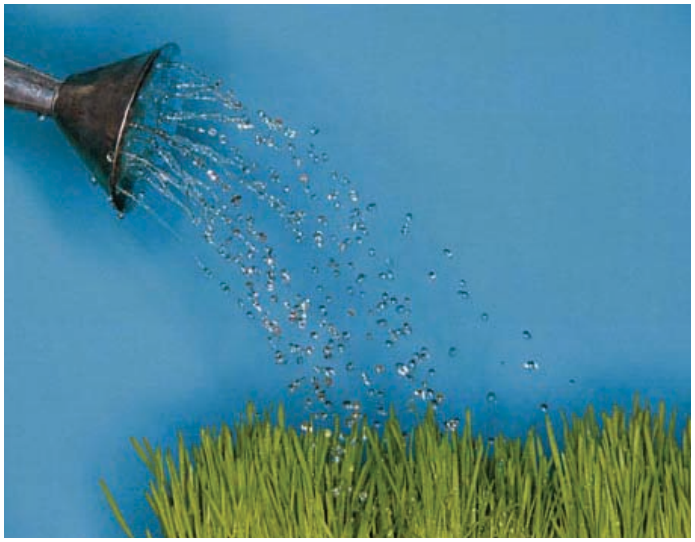
- Planning
- Analysis
- Evaluation
- Policy instruments
- Industrial development

1

1. Saami children inside of a reindeer pen. Can you see my calf?

2

2. Wireless communication in a flexible office landscape.



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Norinnova is an innovation company with the main objective of commercializing new business ideas based on research activities and new technologies. Its business areas are innovation, equity capital investment and innovative environments. Norinnova contributes in business development either by assisting entrepreneurs, as co-partners in new enterprises, or by selling or licensing intellectual property rights to going concerns. Norinnova is a subsidiary of Northern Research Institute.

Business Areas

Norinnova has activities within the following business areas:

- **Innovation** – Protection of intellectual property rights, and development of business concepts based on research and new technologies
- **Equity capital investments** – Equity capital investments at an early stage in new enterprises, supported by an active commitment in business development. NorInnova has a seed capital fund of NOK 60 million
- **Innovative environments** – Arranges and develops innovative meeting points and sessions between R&D communities, entrepreneurs, companies and public business authorities

Innovation

The core business of Norinnova is to commercialize new business ideas based on research activities and new technologies. Business innovation is often seen as the development of new products or processes, the application of new technologies, or as modified ways of combining input factors giving a higher degree of benefit or efficiency. Norinnova deals with so-called radical innovations based on new knowledge and research primarily from universities and research institutes. These represent only a small part of the total amount of innovations in business, but have a higher success and growth potential.

At Norinnova, ideas are gathered from R&D sources, and prepared for commercialization in a partnership between entrepreneurs and the company. The commercialization may emerge either as the establishment of a new enterprise, or through protection of intellectual property rights which thereafter may be licensed to a commercial partner.

NORWEGIAN ASSOCIATION OF PHARMACEUTICAL MANUFACTURERS (LMI)
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The Norwegian Association of Pharmaceutical Manufacturers, Legemiddelindustriforeningen, (LMI), is an industry organization for Norwegian and international pharmaceutical companies which develops, produces and/or markets pharmaceuticals in Norway.

Objectives

LMI's objectives are:

- To be a competent partner with the Norwegian health care system
- To give patients quick access to appropriate medicine
- To contribute to a good and predictable framework for the pharmaceutical industry in Norway
- To develop more research and production of pharmaceuticals in Norway

Activities & Membership

LMI works towards having the Norwegian authorities improve the framework for the industry and the image and reputation of the industry. LMI also provides services for the member companies, as well as making case assessments and statistical reports concerning the pharmaceutical market in Norway. The Association organizes courses and training activities, for, amongst others, sales representatives and clinical trials monitors. LMI actively participates in international industry associations for the manufacturers of pharmaceutical products.

As of 1 January 2008 there are 44 member companies in LMI, of which six companies manufacture pharmaceuticals in Norway. Member companies have almost 4,300 employees in Norway. They represented more than 80 percent of the total medicines sales in Norway in 2007.

Life Science

LMI's member companies spent just under NOK 1 billion (about EUR 125 million) on R&D in Norway during 2006. A report by Boston Consulting Group (BCG), commissioned by LMI in 2007, showed that Norway has a great R&D potential in life science/biopharma. LMI therefore wants to focus on these exciting growth opportunities in 2008.

The biopharmaceutical market has several unique characteristics which separate it from other areas. There is a direct connection between research quality and commercial access. High quality of research is necessary, but let alone it is not enough. The ability to commercialize, or the ability to turn research into innovation is vital for value creation. International pharmaceutical companies increasingly use biopharma companies as innovation engines. Norway, however, lacks a strong environment for the commercialization of projects.

Cancer is one of the areas in which Norwegian life science research has gained a head start. Large parts of this research environment have organized itself in a trade cluster connected to the main university-hospital in the southern part of Norway. Through connecting cancer researchers in the hospital with researchers from various sized life science companies, the objective of developing diagnostic methods and new pharmaceuticals for cancer patients is approached more quickly.

Potential

The potential for life science becoming a considerable industrial sector in Norway is present. To what degree it is possible to bring out this potential, depends on whether or not there will be a prepared strategy, covering short-term and long-term perspectives. LMI challenge the authorities, research environments at hospitals and universities and the companies which are working with life science to join forces and work for a common goal.

LMI's director general Pål Christian Roland.

Photo: Morten Brakestad

NST | Norwegian Centre for Telemedicine
UNIVERSITY HOSPITAL OF NORTH NORWAY
WHO Collaborating Centre for Telemedicine

NORWEGIAN CENTRE FOR TELEMEDICINE (NST)
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The Norwegian Centre for Telemedicine (NST) is located in the city of Tromsø in the north of Norway. The Centre's mission is to produce and provide knowledge about telemedicine and e-health, both nationally and internationally. Its goal is to ensure the integration of telemedicine services into health care. NST is renowned internationally and has been a World Health Organization (WHO) Collaborating Centre for Telemedicine since 2002.

Strong Research Focus

One of NST's strengths is applied research related to developing practical telemedicine solutions. Out of NST's staff of around 100 people, more than half are engaged with research within technology, organizations, pedagogics, social sciences and clinical studies. At present, the Centre has some 15 PhD students making groundbreaking research within telemedicine.

NST's projects range from needs assessment to the entire process of developing, implementing and evaluating telemedicine and e-health solutions. The Centre's mission is to provide ideas and advice about equipment and organizational forms in order to help healthcare providers use telemedicine services effectively. NST provides guidance and advice for those who want to implement services like teledialysis, teleradiology, telepathology, video conferencing and more.

International Cooperation

As part of its work as a WHO Collaborating Centre for Telemedicine, NST seeks to engage in international cooperation. Over the years, the Centre has done telemedicine feasibility studies and initiated collaborative efforts in countries such as Botswana, South Africa, Sri Lanka, Nepal, Cuba, Afghanistan, Russia, Cambodia and Palestine.

Presently, NST is implementing a telemedicine network in Palestine, connecting the rehabilitation centres in Jerusalem, Bethlehem and the West Bank by video conference equipment. This project will improve the health services offered to the handicapped by allowing patient information to be sent from one centre to the other when the patients themselves are not able to travel between centres.

Tromsø Telemedicine Laboratory

NST is also the host and leading partner in a newly established research institute named Tromsø Telemedicine Laboratory (TTL). At TTL, NST and nine other research partners will develop new technologies to ease the increasing burdens placed on the health care system, which are due to an aging population and more chronic diseases. This is sponsored by the Norwegian Research Council (NFR).

NECON
Norwegian Engineering & Consulting AS

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Norwegian Engineering & Consulting AS (NECON) was established at Kokstad in Bergen, Norway, in 2004 as a supplier of competence services to the oil and gas industry and other industry segments. The Board of Directors has various backgrounds in engineering and many years of industry experience. After its establishment, NECON has opened branch offices in Oslo, Trondheim, and Stavanger, as well as a subsidiary company in Mumbai, India. The company has strategic plans for further growth and establishments. The market has a demand for NECON's services, and the company experienced the best growth in the market for 2006. NECON consists of 260 engineers and co-workers.

Norwegian Engineering & Consulting AS (NECON) provides engineering and project administrative services through contracting, consulting and recruitment. NECON has as its goal to become one of the leaders in executive consulting services directed towards oil, gas, energy and consulting engineering enterprises nationally, as well as having a long-term perspective towards the international market.

Employee Philosophy

NECON is a company that is comprised of engineers who have exhibited particularly good abilities within their respective professions. It provides project administrative and multidisciplinary engineering services.

The company profile will be that of the consultancy coalition posing the most demanding requirements of its employees. NECON will ensure good quality of the employees through verification of competence and high employee motivation. "Stricter requirements for competence in conjunction with a diversity of relevant work assignment experiences shall make our consultants the most attractive employees for needs for temporary and flexible competency," says Aslak Gundersen, Assistant Managing Director in NECON.

NECON has a clear goal of thinking long-term with its employees. This involves the company having a clear employer responsibility through continuous further development of its resources and always seeing to it that its employees have competitive terms and conditions. Continual competency building via attractive projects and internal and external courses are a necessity in order to create satisfied employees.

200 Engineers for Further Growth

NECON shall be the company of opportunities. Visibility and the company's administration's communication of the possibilities it has must be promoted actively via a focus on the subjective choices of the individual person.

The possibilities of the employees to make choices must be a strength in order to create belonging and create motivation and inspiration for the employees. "Continuous individual focus on every single one of our employees in order to create individual successes creates a successful company. We will succeed through our employees. Our employees shall at all times feel themselves to be significant and valued. In 2008 we have 260 engineers, and during the next two years we will employ 200 new engineers," says Aslak Gundersen.

NORWEGIAN POLAR INSTITUTE
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With a staff of 120, the Norwegian Polar Institute (NPI) is Norway's principle organization for research, environmental monitoring and mapping in the polar regions. The Institute advises Norwegian authorities on matters concerning polar environmental management and runs research stations in Svalbard in the Arctic and Dronning Maud Land, Antarctica.

Research Programmes

The ***Polar Climate Programme*** excels in research that involves both modern processes and long time-series. The studies encompass topics such as ocean fluxes of heat, mass and salt; atmosphere/sea-ice/ocean interactions; paleoclimatic archives (marine sediment and ice cores); and radiation, glacier mass balance and snow distribution. The programme contributes to the global understanding of climate change.

The ***Biodiversity Programme*** conducts research on questions related to the population biology and ecology of Arctic and Antarctic wildlife. There is a strong emphasis on birds and mammals because these are good system indicators and are the subject of exploitation and management (hunting, tourism, etc.). The potential impact of climate change in polar regions is currently a focal point for the research team.

The ***Ecotoxicology Programme*** gathers knowledge that improves understanding of contaminants, their sources and their biological effects in the European Arctic. It focuses on persistent organic pollutants (POPs) and heavy metals.

The ***Geological Mapping Programme*** generates maps with detailed area descriptions for Svalbard and the Norwegian claims in Antarctica.

Research scientists working within these programmes are involved in extensive field expeditions. They aim at close interdisciplinary collaboration; for example, the investigation of how factors such as sea-ice distribution affect animals and their prey.

Research scientist Eva Fuglei with an Arctic fox in Svalbard.

Environmental Management

The NPI is a directorate under Norway's Ministry of the Environment and advises the Ministry and other governmental bodies. The NPI represents Norway in several committees and processes, such as the Integrated Management Plan for the Norwegian Sector of the Barents Sea. It is the competent authority responsible for implementing and overseeing the Norwegian Antarctic environmental legislation.

Maps & Information Services

The Institute publishes reports and handbooks aimed at both the scientific community and the general public. Its international journal, *Polar Research*, presents articles concerning research in the northern and southern polar regions. As the mapping authority for Norwegian claims and territories in the Arctic and Antarctica, the Institute publishes maps in both digital and printed formats. The library has a substantial collection of polar literature, and the picture library contains about 80,000 contemporary and historical photographs.

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Norsk Romsenter
NORWEGIAN SPACE CENTRE

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The Norwegian Space Centre (NSC) is a governmental administrative agency under the Norwegian Ministry of Trade and Industry. NSC promotes the development, coordination and evaluation of national space activities, and supports Norwegian interests in the European Space Agency (ESA).

The vision of the Norwegian Space Centre is that Norway in 2015 shall be the country in the world to benefit most from space activities. Research and development are vital instruments in implementing the vision, and user-value is the key word.

Societal Benefits

Norway is sparsely populated and surrounded by vast areas of water. The development of satellite communications, navigation and Earth observation are all required for efficient utilization and governance of these areas. All activities supported by NSC are fundamental tools in the management of natural, economic and environmental resources.

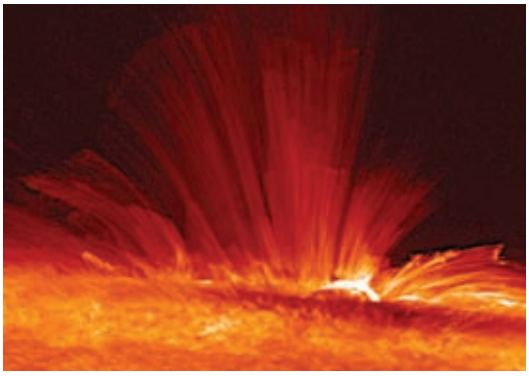
The extreme latitude of northern Norway and the Svalbard archipelago is a clear asset. Andøya is an ideal location for launching rockets designated to help study the Aurora, and the ground station at Svalbard is the world's most favourable site for downloading data from all satellites in polar orbit. NSC aims to strengthen these activities as they enhance the public utility of space.

Industry

Norwegian companies are world leaders in several niches of satellite communications due to a continuous commitment to development that started as early as in the 1960s. NSC is the main coordinator of publicly funded research and development in the Norwegian space industry. A principal aim is to develop further high-tech industrial ventures within the framework of ESA cooperation, but also in collaboration with other international partners.

Space Research

Norway's long-standing involvement in selected areas of space research, such as solar physics and Sun-Earth interaction, has attained international prominence. NSC supports research in these areas, as well as in space-related disciplines where Norwegian scientists are likely to excel.



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© Petter Hannes

THE NORWEGIAN UNIVERSITY OF LIFE SCIENCES

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The Norwegian University of Life Sciences (UMB) aims to be a major player in the areas of biology, food science, environmental science, land-use and natural resource management, and all of the aesthetic and technological subjects associated with these areas. The university's vision is to secure the basis of existence for present and future generations.

A Research University

UMB is a research university, with research making up half of the university's activities.

Food

UMB focuses on plants, animals and fish, and covers the whole value chain from food production to raw material quality and the processing of food products.

Environment

Environmental research at UMB focuses on sustainable use and management of land and water resources, and the use of the local environment to enhance the life quality of humans and animals.

Biotechnology

Biotechnology research is interdiciplinary and linked to the areas of animals, plants and microorganisms. UMB has some of the most comprehensive biotechnology research in microbiology, molecular biology and biochemistry in Norway. UMB is a joint owner of the Centre for Integrative Genetics (CIGENE).

Aquaculture

Since the 1960s, when UMB started using fish as laboratory animals for breeding experiments, UMB has contributed worldwide in developing the platform for breeding and feeding within the aquaculture industry. UMB is a joint owner of the research centres AKVAFORSK, Aquaculture Protein Centre and Centre for Feed Technology.

Health

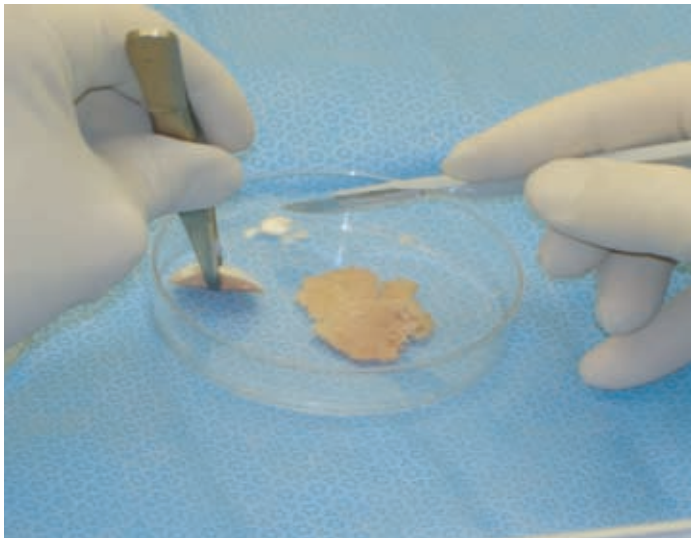
UMB has long-standing traditions in food and environmental research, and has always focused on human health. Through an innovative approach to health issues, the university plans on being a bridge builder for the various health research areas, where UMB has a focus on preventive and rehabilitative health care.

Knowledge Transfer

UMB has more than 100 years of experience in carrying out applied research for industry and contributing to the development of agriculture, aquaculture and other bioindustries in Norway. The University is obliged, according to Norwegian law, to transfer knowledge and technology to industry and society at large. UMB will strengthen its links with relevant industries and continue to supply Norwegian and foreign companies with knowledge, technology and scientific results vital for growth and innovation in the industrial sector.

Teaching

At UMB there is a strong connection between research and teaching activities. There are approximately 2,800 students at UMB, of which some 150 are international students. UMB has an extensive collaboration with foreign universities, and 30% of its students choose to carry out a study period abroad. UMB offers 12 bachelor's and 30 master's programmes, and seven master's programmes are taught in English. UMB's post-qualifying and further education programmes offer tailor-made courses for different sectors of the industrial and public markets.



ORTHOGENICS
MOLECULAR DIAGNOSTICS™

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Orthogenics is an innovative biotech company located in Tromsø, Norway. The company's breakthrough findings could revolutionize the understanding of the pathophysiology of osteoarthritis (OA), hereby providing hope for millions of people, with a promise of great commercial possibilities within the diagnostics and treatment of one of the most common diseases in the Western world today.

Privately Held Company

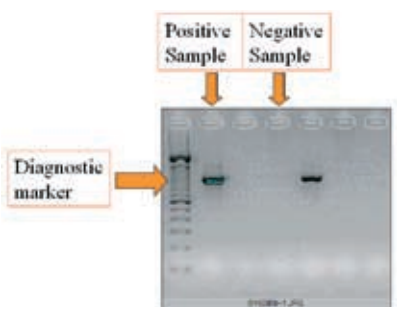
Orthogenics was founded in 1999 and today has ten employees, including some of its founders. The company conducts several R&D projects. It has been able to show breakthrough results, which have been verified by scientific partners in Europe and the United States. The company has patents pending. The development project will lead to a commercialized test for early diagnosis of OA, followed by a treatment principle for OA.

Business Idea

Orthogenics aims to provide easy-to-use diagnostics for early detection of OA, and subsequently therapeutic solutions, based on the company's in-house technology and patented discoveries.

Medical Need

Osteoarthritis is a chronic joint disease that affects the cartilage. OA is a disease with a high incidence rate (currently 25 million in the United States), and is the most common type of arthritis. Currently, no single test can diagnose OA, and no treatment is available that prevents, reverses or blocks progression of the disease. Clinicians use a combination of clinical history, physical examination, X-ray, MRI and arthroscopy to diagnose OA and rule out other conditions. However, current methods have limitations: X-rays do not reveal OA damage in early stages, and the cost is high. Improved diagnostic methods will secure treatment and improve quality of life for OA patients. Orthogenics aims to be the first company to develop simpler, cheaper and more reliable tests and kits for OA diagnosis.



PCR test.

Technology

Orthogenics studies have been done using PCR detection of specific DNA sequences. Orthogenics is currently developing diagnostic tests and kits based both on PCR and ELISA technology.

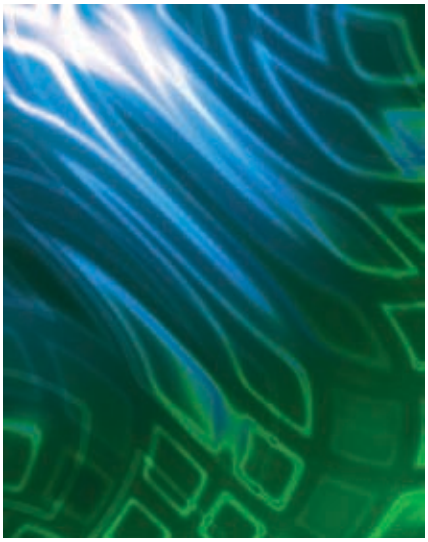
Business Model

Collaboration with partners is a key in Orthogenics' strategy to fulfil the following goals:

1. Develop specific and sensitive diagnostic tests and kits that are easy to use in diagnostic laboratories and hospitals using standard equipment
2. Co-finance projects through collaborations and public financing
3. Conduct clinical development, and perform marketing, sales and distribution through partners
4. Cooperate in partner development of theranostics within OA
5. Issue the project either through trade sale or stock listing in Europe/the United States

Partner Opportunities

Please contact Orthogenics to discuss partner opportunities.



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Polytec has its head office in Haugesund, the regional centre of one of Norway's principal oil and gas regions. In addition to its main objective of conducting research in the area of gas technology and environment, the institute also performs research on the improvement of energy efficiency. Polytec is active in several international arenas. The overall mission of Polytec is to provide added value to the regional community on a non-profit basis, and to be a local centre of expertise within a number of competence areas.

Areas of Competence

- Single and multiphase pipeline flow
- Infrastructure development
- Field and pipeline design and operation
- Gas process and chemistry
- Technical environmental protection
- Environmental data and numerical simulation
- Energy optimization
- Combustion technology
- Computer modelling (Fluid dynamics, CFD)
- Instrumentation and metering

Gas Transport & Field Development

Gassco and StatoilHydro are Polytec's most important collaborating partners. Polytec is involved in infrastructure development on the Norwegian Continental Shelf utilizing its competence in numerical modelling and optimization of gas transport, as well as current and field development for dry gas and multiphase, process and chemical engineering and instrumentation and metering. Gassco is responsible for the coordination of maintenance and operational preparations for new platforms that will be connected to the pipeline system on the Norwegian shelf. Polytec also contributes to ensure that the IKT systems run satisfactorily, operational procedures work out and all operators of equipment are trained.

The largest projects with StatoilHydro, a state-run energy company, involve the development of multiphase systems and security against over-pressurization in connection with the extraction of oil and gas from the Norwegian shelf.

Energy Efficiency

Polytec has had a number of energy efficiency assignments from both ENOVA and other industrial actors. Cogeneration is a main focal point. In this area the institute works closely with Cogen Europe and a professional network of countries in middle and southern Europe. The institute also arranges an annual Cogen conference together with the Norwegian Gas Centre.

Handling of CO_2

A central field of activity for Polytec's staff is the capture, transport and value-added considerations in connection with the handling of CO_2. During recent years the company has become a part of a growing professional network and is working actively in projects aimed at reduction of climate gas.

Business Development

The petro-maritime industry is a dominant part of the local industry in the Haugesund-region. Polytec will contribute to the further growth in this and related industries by facilitating research, development and innovation partly funded by Innovation Norway and the Research Council of Norway. Single companies can claim Polytec's competence in industrial-wide surveys and analysis as well as consultancy on innovation and development to meet specific business needs.

PGS Petroleum Geo-Services

PETROLEUM GEO-SERVICES (PGS)
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Website: www.pgs.com

Petroleum Geo-Services (PGS) is a leading technology focused geophysical company. PGS offers an extensive range of seismic services and products for the petroleum industry, including data acquisition, processing, reservoir analysis and interpretation. PGS also provides Multi-Transient Electro-Magnetic (MTEM) acquisition and processing services. PGS has its headquarters in Lysaker, Norway, offices in more than 28 countries and a permanent staff of over 2,500 employees. Its revenues in 2006 were approximately USD 1.3 billion.

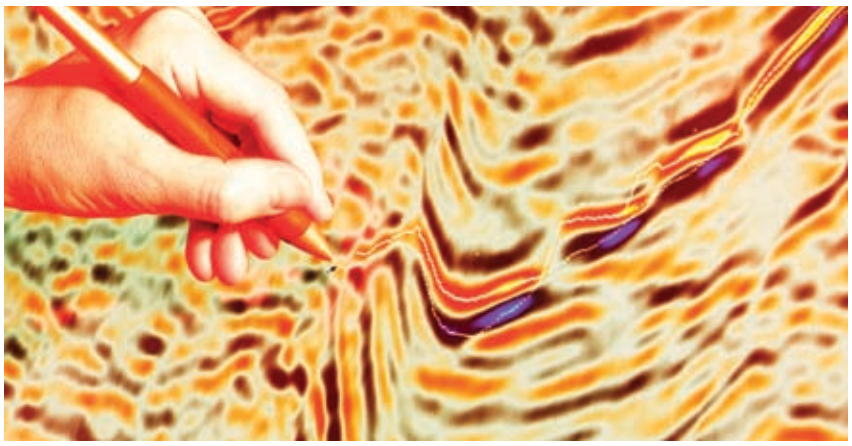
Core Services

PGS' core services consist of the acquisition and processing of geophysical data. Geophysical data are used by oil and gas companies to explore for hydrocarbon accumulations, to develop new oil and gas fields and to manage those fields in production. PGS operates a marine fleet of highly advanced 3D seismic vessels and land crews with high channel count equipment, supported by a global data processing network. PGS strives for efficient, safe operations with minimum impact upon the environment.

PGS' main competitive advantages are a strong technology base, a comprehensive knowledge base and a culture for innovation and new ideas.

R&D

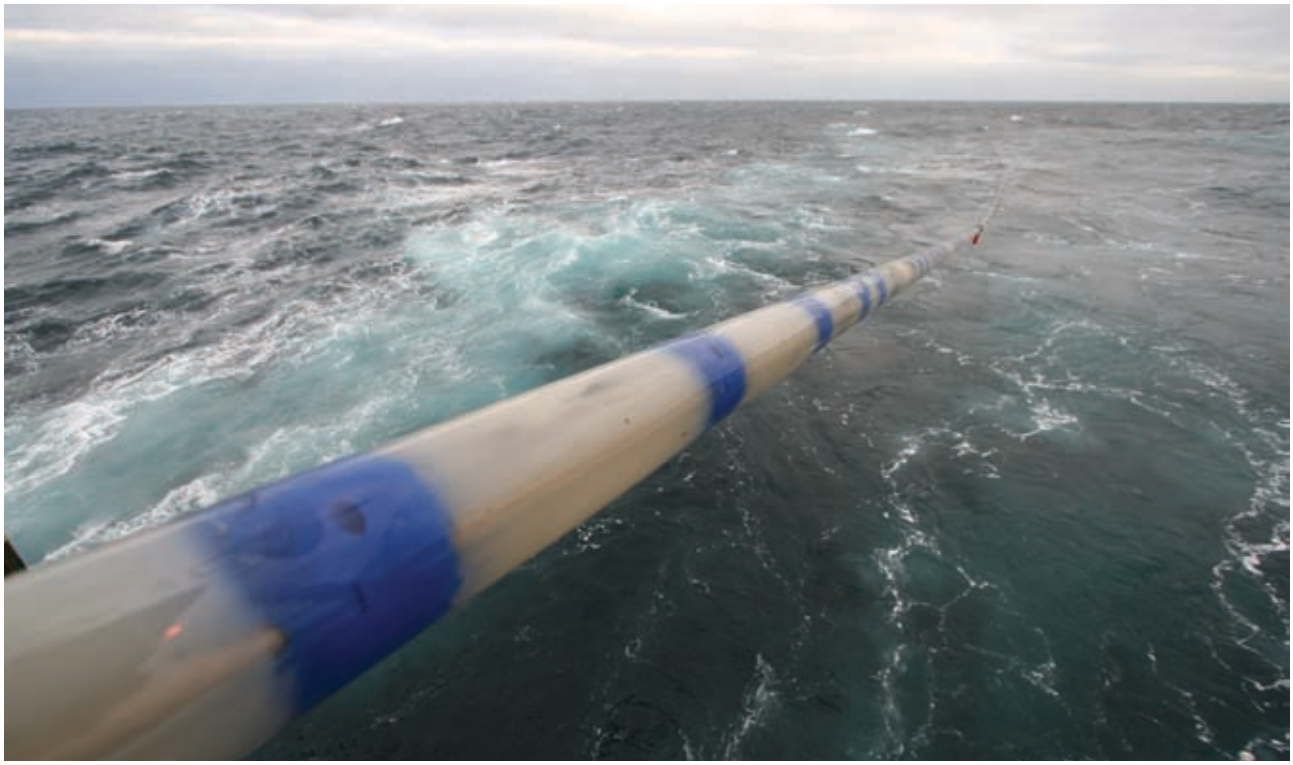
PGS' R&D is focused on marine seismic acquisition and data processing as well as cable-based electromagnetic (EM) technology. PGS has larger R&D departments in the USA, UK, Norway and Australia. Additional R&D groups have recently been established in The Netherlands, Sweden and Singapore.



The aim of R&D in PGS is to develop technology and services that can provide its clients with the clearest possible image of the sub-surface in a safe and economical way. The company has a twofold objective: to improve the efficiency of its operations and increase the quality of the geophysical data it delivers.

Modelling & Visualization

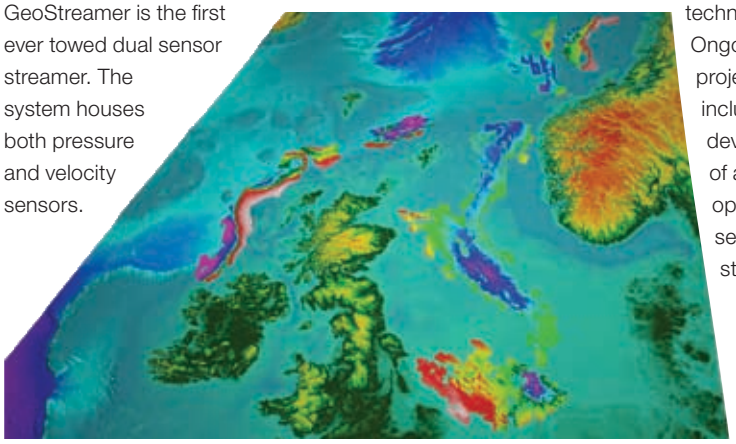
Careful planning is a requirement for conducting a successful seismic survey. Cost and quality requirements have to be balanced. PGS has developed one of the best and most comprehensive survey planning software packages in the world – Nucleus. This module-based package is widely distributed in the oil and gas industry. It can simulate the result of a seismic survey with different source and receiver configurations through sophisticated seismic modelling. Through the recent release of Nucleus+ user efficiency has been increased significantly. The re-shaped software can be used in an interactive way or in a workflow-based manner. Currently the scope of Nucleus is being extended towards electromagnetic modelling methods.



3D visualization has become a vital part of a geophysicist's work. PGS has designed holoSeis to inspect and evaluate seismic data in a fast and innovative manner. holoSeis is a part of the workflow from the quality control of seismic data during acquisition and to building complex velocity models for pre-stack depth migration and to visualize the end product for customers. holoSeis handles record breaking large volumes of 3D seismic data. Essentially, seismic images from the entire North Sea can be visualized at once.

Marine Acquisition Technology

PGS has developed and commercialized a completely new seismic streamer; the GeoStreamer is the first ever towed dual sensor streamer. The system houses both pressure and velocity sensors.



Compared to a conventional streamer with pressure recording only, the GeoStreamer delivers enhanced resolution and deeper penetration. The GeoStreamer builds on the solid streamer technology that PGS developed together with Teledyne in the past. Solid streamers have proven to work safely and efficiently.

PGS has designed several generations of fibre optic seismic sensor prototypes. This includes the successfully tested OptoSeis 4C cable system, which is made for permanent seismic monitoring of producing oil and gas fields. Company efforts are now focused on the commercialization of these new technologies. Ongoing projects include the development of a towed optical seismic streamer.

Another key focus area of R&D in PGS is electromagnetic technology. Multi-Transient Electro-Magnetic (MTEM) is a proven remote sensing method for direct hydrocarbon detection and delineation. The development of a towed EM system is ongoing and promises acquisition efficiency similar to towed seismic streamer acquisition.

Processing Technology

PGS is dedicated to address the needs of its customers to obtain clear 3D images of oil and gas fields. The company's R&D teams support a worldwide network of data processing centres with leading edge technology. PGS has developed a high-fidelity suite of Kirchhoff, Wave Equation and Reverse Time Migration (RTM) algorithms to create images of the sub surface. In addition, advanced interpolation and regularization schemes and powerful noise and multiple suppression methods have been developed in order to optimally reveal the geological structures. Current R&D topics include model building and sophisticated multi-azimuth illumination techniques.

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Pronova BioPharma is a world leader within the field of omega-3-derived pharmaceutical refining production. The company's history goes all the way back to 1838, when JC Martens in Bergen began refining oil products from fish.

The Company

Pronova BioPharma's key product is the first omega-3 product to be approved as a pharmaceutical drug. The product is branded as Omacor worldwide, except in the United States where it is marked as Lovaza. Omacor and Lovaza is approved in the United States and in Europe for the treatment of elevated levels of triglycerides in humans, a condition known as hypertriglyceridemia, or HTG. HTG is a form of dyslipidemia, a disorder of lipid metabolism. It is also approved in Europe as secondary prevention after myocardial infarction – in the period following the initial survival of a heart attack, the post myocardial infarction period. Approximately 600,000 patients, in 40 countries, use the drug as a part of their therapy.

The production of Omacor begins with fish oil from South America. At the factory in Sandefjord, the fish oil is concentrated in an eight-step patented production process. The result is an active pharmaceutical ingredient (API) containing more than 90% omega-3 fatty acids and devoid of environmental toxins. Pronova BioPharma exports 99% of its products, primarily to Europe and the United States.

R&D

Pronova BioPharma has a strong research and development programme and has close collaborations with academic communities in Norway and abroad. Studies are carried out under the direction of Pronova BioPharma in collaboration with pharmaceutical partners and independent research communities. The objective is to achieve new indications for today's product and to develop new pharmaceuticals. Clinical studies in more than 60,000 patients are completed or ongoing. Pronova BioPharma makes use of the Norwegian public support scheme SkatteFUNN and participates in a number of public research programmes.

The activities in which Pronova BioPharma is involved impose great demands on the expertise and experience of its staff. The company operates within a highly specialized sector and employs a large number of staff with a MSc or PhD in the pharmaceutical and biomedical field. The business concept and affiliated expertise are, along with the necessary technology, crucial to the success of the commercialization of pharmaceutical substances on a global scale.

Market Situation

In 2004 Pronova BioPharma received approval for Omacor in the United States, and has, during the period following the launch of the medicine in 2005, seen a very positive development in sales. The medicine is also well established in Europe, where there is a continued growing demand. Pronova BioPharma distributes the medicine through partners who are responsible for sales and marketing in their respective territories.

In 2005 Pronova BioPharma signed an agreement with the Japanese pharmaceutical company Takeda. Although the medicine will be subjected to new clinical trials and must be approved by the Japanese authorities before it is launched in the market, this is a market with a great potential.

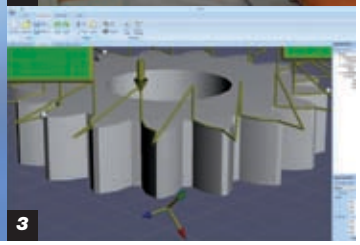
In order to meet an increased market need worldwide Pronova BioPharma started in October 2007 the construction work of a new production plant in Kalundborg, Denmark which will double the API production capacity, an investment of NOK 1.45 to 1.70 billion.

The Future

The future prospects for Pronova BioPharma are very good and further expansion of its working staff, both at the head office in Lysaker, within R&D, at the factory in Sandefjord, and for the new plant in Denmark, is anticipated.

Pronova BioPharma Facts

- Product – Omega-3-derived medicine Omacor / Lovaza
- Ownership – Ferd Private Equity Fund bought the company from Hydro in 2004–2005. Since October 2007 Pronova BioPharma is listed at the Oslo Stock Exchange (ticker PRON)
- Finances and staff – The revenues for 2007 were NOK 1,014 million, with an operating result before depreciation and amortisation (EBITDA) of NOK 503 million. The company employs about 185 people.



PPM AS
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PPM AS is an international robot system integrator and software house providing solutions for industrial robots. PPM has a high level of competence in advanced industrial robot systems within different types of applications providing robotization that is simple, highly flexible and efficient. A great deal of focus on research and development through strategic cooperation with European universities, ensures the most recent and cost efficient technology in PPM's robot installations.

A New Level of Flexibility in Robot Applications

Imaging a fully robotized production line built up by standard industrial robots. Some of its characteristics would be that it was productive and cost efficient, but also, unfortunately, time consuming to reconfigure. Imagine that all the products are customized, only a few of each type are made, and then new products are introduced according to customers' inquiries.

Traditionally this had been a typical non-robot task due to the lack of flexibility of industrial robots. However, PPM has taken this challenge, introduced new technology and successfully implemented such robot installations in the international industry. With the company's "programming-on-the-fly" concept, new, dedicated robot programmes are developed instantaneously when new products appears in the robot cell. The only requirement is that there are available CAD models.

This has opened completely new opportunities for profitable robotization in even small- and medium-sized enterprises. In combination with PPM's sensor systems, even products with unstructured properties can be safely and efficiently handled.

Simplified Programming Of Robots – SPORT

PPM has taken on the challenge and developed software to turn standard robots dedicated to serial production into modern, highly flexible robots for one-of-a kind production. SPORT is the PC software that enhances user friendliness and data security of standard industrial robots. SPORT provides structured disaster recovery even of different types of robots. In addition, robot programmes can easily be made off-line using either text editor or a modern graphical interface.

1. Gear deburring in the aearospace industry.

2. "One-of-a-kind" production by programming the grinding robot "on-the-fly".

3. Graphical robot programming using PPM's software SPORT.

4. Professor Trygve Thomessen – Managing Director of PPM AS.

PPM AS – Turning Innovation into Flexible Automation

PPM has a highly qualified staff located in Trondheim and in Budapest, Hungary. Through the Hungarian – Norwegian joint robot laboratory, ITM, PPM is provided a highly competent pool of human resources in addition to access to state of the art technology being developed through international R&D projects. This includes high speed real time sensor control, advanced simulation, intuitive robot programming and cognitive process control.

By having access to multiple robots in PPM's Application Development Center, new solutions can be developed for the company's customers fast and cost effectively. This is frequently utilized when running feasibility studies or other type of consultancy for PPM's customers.

The idea behind this is always to provide the best and most cost efficient solutions for its customers by *turning innovation into flexible automation.*

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RAGASCO AS is the world's leading manufacturer of composite cylinders for the LP Gas industry. RAGASCO developed and now manufactures the unique 3-layer Complet range of composite LPG cylinders, which are exported to more than 30 countries. RAGASCO was established in 1998, and in 2000 the company delivered the first Complet LPG cylinders to Statoil. Since then the company has grown steadily and now supplies Complet LPG cylinders to major industry companies including BP, Totalgaz, AGA, Vitogaz, Primagaz and Exxon and a number of small and medium-sized distributors.

LPG Cylinders – Distinctive Design

The Complet range of composite LPG cylinders has a distinctive 3-layer design:

- 1st Layer: The seamless blow moulded liner forms the inner gas barrier. This is made of a tough, chemical resistant High Density Polyethylene (HDPE) with the boss integrated
- 2nd Layer: This composite load carrying material is filament wound fibreglass and resin, which has a great capacity to withstand pressure. An advanced curing process ensures the see-through feature
- 3rd Layer: The distinctively designed, injection moulded outer casing protects the pressure vessel and valve. The ergonomic handles allow for easy lifting and are built for stacking

Special additives are included in the materials to ensure UV stability and chemical resistance to prevent degrading over time from changing weather conditions. All processes are carefully monitored and supervised at RAGASCO's state of the art production facility.

Product Advantages

The exceptional design of the Complet LPG cylinder provides a number of advantages for the LPG distributor and end-user. These advantages include:

- The material qualities and technology prevent corrosion and thereby avert the risk of leaks and the need for cosmetic maintenance of the cylinders
- The cylinders do not explode in the event of a fire due to their fail-safe design. The heatproof, fibreglass mesh controls any escape of gas in extreme temperatures to prevent explosion
- The award winning design has proved to be attractive to end-users both for outdoor appliances as well as for indoor usage where allowed. Only non-corrosive materials are used

Export Markets

Complet LPG cylinders are exported to most EU countries as well as Switzerland, the USA, Canada, Mexico, South Africa and Malaysia. A large number of additional countries are in the process of starting import.

Complet LPG cylinders are approved according to the European road transportation directive ADR/RID as well as SVTI (Switzerland), DOT (USA), TC (Canada) and a number of other national authorities.

AAKREHAMN TECHNOLOGY CENTER

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RTS AS

RTS AS is a supplier of engineering solutions, equipment rental, product sales and personnel supply. The company is based in Karmøy in the south western part of Norway, close to the central oil bases. RTS offers complete rental solutions to the subsea industry. The RTS inventory of rental equipment covers:

- Positioning
- Environmental
- Hydro graphic
- Sensor Logging
- PC and video products.

RTS is the parent company for subsidiaries IWS, Membran Teknologi AS.

IWS

IWS (Industrial Weighing Services) offers a unique, offshore proven and cost effective weighing system for heavy objects with restricted access.

- Decommissioning of offshore platforms
- General industrial weighing
- All weighing system is manhandled
- Capasity to more than 25.000Te
- PC controlled with online weight/COG presentation/logging
- Easy adaptable to each individual project

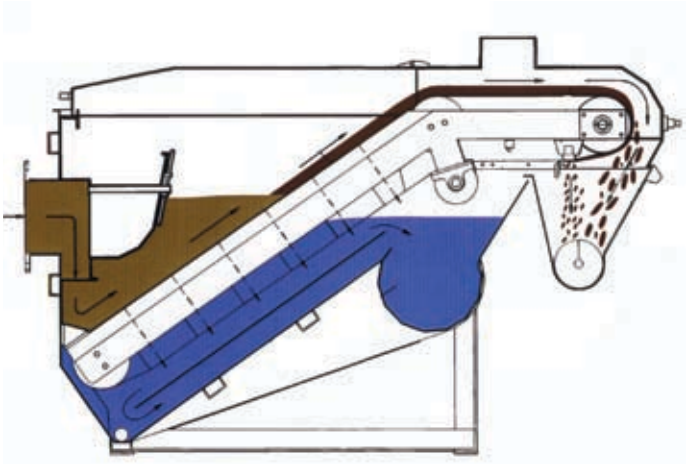
Other IWS services include:

- Consultancy in offshore/subsea Engineering/operations
- Client representative offshore/subsea operations (More than 20 years experience in offshore/subsea operations)

Membran Teknologi AS

Membran Teknologi AS' main product is the Power Jack. The Power Jack is the world's most powerful tool of its kind. The concept behind the Power Jack technology is incredibly simple, and has many applications. The Power Jack can be made in all shapes and sizes depending on requirement, and it is patented internationally.

The Power Jack was originally developed to remove concrete on subsea pipelines. It has later been adopted for several applications, like the dividing of large stone blocks and cracking of valves-trees and flanges. From the same idea other products like membrane plugs and pipe connection (PD Connector) have been developed.



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Website: www.salsnes-filter.no

Salsnes Filter AS has established a cost effective wastewater treatment process that meets the specifications of the European Commission for reduction of waste water effluent pollution (primary treatment). Salsnes is proven by the Norwegian Environmental Protection Agency (SFT) as the most effective product for solid separation within municipal wastewater treatment.

The Company

The company was established in 1991 and runs its operation from Namsos in Norway. Activities within the Norwegian and international market are co-ordinated from here along with the operation of domestic projects including total delivery with training and service. Salsnes Filter serves the foreign market through cooperative partners with classified distribution agent contracts. The company currently has contacts over the whole world and formalized agreements in Africa, South America, Mexico, USA/Canada, Australia/New Zealand, Asia and large parts of Europe. With the exception of South Africa, which has a licence for production, production and product development is in Namsos.

Products

Salsnes Filter's patented filter technology for wastewater treatment and effluent treatment is leading the Norwegian market in municipal primary treatment. The food industry, pulp and paper industry, fish farming and the cruise industry use the fully-automated treatment technology to treat effluent, secure good quality of incoming water or to improve utilization of raw materials. Salsnes Filter is also a competitive alternative to a primary settling stage for a traditional chemical/ biological treatment facility or preventing MBR fouling.

Salsnes Filter does not just fulfil the primary requirements; it also has the technology to provide the necessary continuity and stable operation. Salsnes Filter has endless wire mesh screen and filter mat design and many control options that are important to secure the treatment results, in a cost effective way.

Industrial Benefits

Since industry is now required to carry out wastewater treatment, it makes sense to examine the results and benefits generated by the investments. Hunton Fiber AS from Gjøvik had to reduce effluent, but the additional benefits produced payback in less than 12 months. Salsnes Filter also provides important solutions to the fibre and paper industry, as well as the fish, meat and vegetables industries, brewing, the wine trade, cruise/ shipping industry, the tanning industry, fishing net cleaning, agricultural fertilisers and other wet organic waste treatment.

R&D

Salsnes Filter's product quality is the result of several years of targeted concentration on product development and quality assurance based on participation and contributions from customers and competence environments. The cooperation with research organizations like SINTEF and NTNU has been vital to the results. In this way Salsnes Filter AS has contributed to creating a new understanding of mechanical treatment in the international market. Through active research and development work, the company shall strengthen its position within the national and international treatment market.

1

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SeaBed Geophysical AS is a service company that provides expertise and services to the global oil industry in all aspects of the marine multi-component seismic sector. The company provides feasibility studies, modelling, survey planning and acquisition, processing and the interpretation of seismic data. SeaBed is a Norwegian contractor that is fully owned by SeaBird Exploration.

Company Objective

SeaBed's objective is to provide first-class services to the oil industry in order to reduce the economic risks involved in the exploration phase and to reduce uncertainties related to reservoir description, fluid flow and reservoir management.

CASE System

SeaBed's seismic acquisition method is based entirely on its own autonomous node system called the CASE system. This system is the result of many years of research, development and prototyping. The system is scalable, flexible and has the capability to work in very congested areas with the company's proven industry leading data quality and vector fidelity.

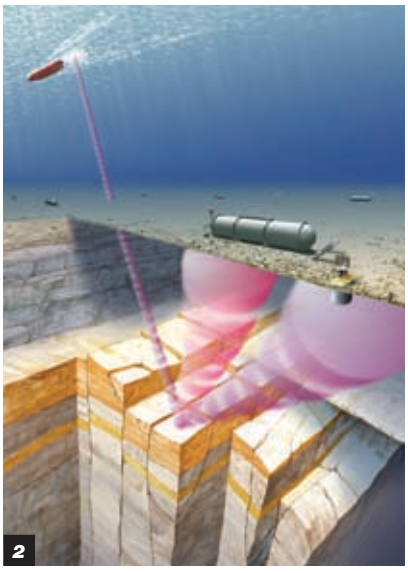
The system's capabilities, both in terms of operational efficiency and high-quality data, were proven during a survey that was done offshore off Mexico for PEMEX in 2003 and 2004. This was the world's largest 4C-3D ever performed (approximately 230 square kilometres). The acquisition was done on the Cantarell Field, which is the world's largest offshore producing field. To be able to cover the requested area, SeaBed utilized 250 CASE units, which were deployed in seven patches totaling approximately 1,500 Node positions. The Cantarell Field has a great deal of infrastructure. Here, the benefits of using a node system without cables were distinctive.

New CASE Units

As the multi-component seismic market is moving towards greater water depths, SeaBed has developed new CASE units, called CASE Abyss, which are applicable down to a depth of 3,000 metres. The company has already performed a successful small pilot at 2,300 metres using six prototype CASE Abyss units for BP in the Gulf of Mexico in 2004. 500 units are scheduled to be ready for operation in ultra-deep applications by the end of 2007.

Dedicated Node Vessel

A dedicated vessel (Hugin Explorer) is currently being rigged for Node handling and source system enabling a single vessel operation. The Hugin Explorer will be equipped with state-of-the-art navigation systems, automated Node handling and storage systems (facilitating both CASE Abyss Nodes and the original CASE Nodes) and a work class ROV. The Hugin Explorer is scheduled to be ready for operation in the second quarter of 2008.



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3

1. The new CASE Abyss Node.

2. Illustration showing the principle of Node 4C-3D technology.

3. The Hugin Explorer.

Seut Industrier as

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Seut Industrier AS, established in 1916, produces blind flange valves and containers. Much of the company's production is tailor made for industrial companies, the offshore industry, defence, governmental authorities and entrepreneurs. Seut Industrier, located in Fredrikstad, is a subsidiary of BNS Consent Norge AS.

Secure against Accidental Discharge

Seut valves placed in drain/outlet pipes from tanks/reservoirs prohibit any accidental discharges of toxic/forbidden chemicals to the environment. A seal in the top bolt/nut ensures that the valve is foolproof in regards to an incorrect opening of it and makes it so that it passes the standards set by environmental authorities and insurance companies.

Seut Blind Flange Valves

This product is based on quality, efficiency, simplicity. It is easy to operate and reliable.
It is suitable for:

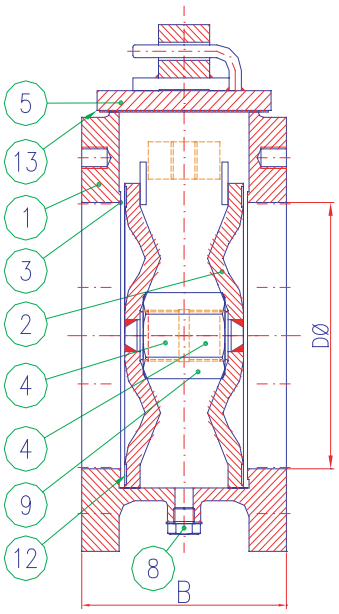
- Ships
- Rigs and platforms
- Refineries
- Terminals
- The chemical and petrochemical industries

It can be used wherever security is required when blinding:

- Liquids
- Oils
- Solvents
- Chemicals
- Gasses
- Steam and water

As shown on the drawing, the valves establish a "double barrier" closing. This makes the valve able to blind off lines with all known liquids and gases. Also, in regards to bleeding and taking samples out of the pipeline the valve can be used together with pressure and volume measures.

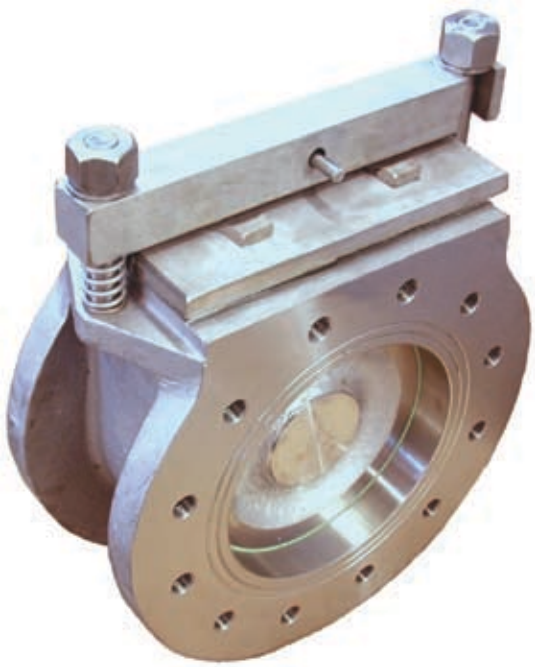
This valve can be delivered in carbon steel, ST.52.3, in stainless steel, AISI 317L, and in Duplex material.



Approval

The valves are approved by the following:

- Det Norske Veritas
- Bureau Veritas
- Lloyd's Register of Shipping
- US Coast Guard
- American Bureau of Shipping
- Rina Italy
- Germanisher Lloyd
- USSR Register of Shipping



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The SINTEF Group is the largest independent research organization in Scandinavia. SINTEF generates new knowledge and solutions for its customers, based on research and development in technology, the natural sciences, medicine and the social sciences.

Services

Contracts for industry and the private sector account for more than 90% of SINTEF'S turnover, while just seven percent comes in the form of basic grants from the Research Council of Norway. SINTEF's vision is: "Technology for a better society". Its ambition is to contribute to the creation of value and to the sound and sustainable development of society.

SINTEF solves customers' problems through research contracts in the following fields: health, information and communications technology, marine and maritime activities, materials science and applied chemistry, petroleum and energy, technology management and building/ construction.

Locations

SINTEF has approximately 2,000 employees, 1,500 of whom work in Trondheim and 400 in Oslo. It has offices in Bergen, Stavanger, Ålesund, Houston and Rio de Janeiro, and a laboratory in Hirtshals (Denmark). SINTEF's head office is in Trondheim.

Partners in Cooperation

SINTEF cooperates closely with the Norwegian University of Science and Technology (NTNU) and the University of Oslo. NTNU personnel work on SINTEF projects, while many SINTEF staff members teach at NTNU. Collaboration involves the widespread joint use of laboratories and equipment. SINTEF has established a similar pattern of collaboration with the University of Oslo, and cooperates with other national and international universities and R&D institutes.

International Activity

About twelve percent of SINTEF's turnover comes from international contracts, around one third of which is derived from EU research programmes. The rest comes from standard contract research projects for overseas companies.

Commercial Spin-Offs

SINTEF also acts as an incubator for new industrial companies. This process brings highly desirable knowledge-based industry to Norway. However, the most important innovation takes place by developing existing industry. Every year, SINTEF contributes to the further development of more than 2,000 companies through its research and development activities.

Cod Farming

The world will need more and more farmed fish in the future, and scientists at SINTEF Fisheries and Aquaculture Research are developing new aquaculture species. One of the challenges of cod farming has been that of finding suitable food for the newly hatched cod larvae. While baby salmon are born with a large inbuilt "lunch-box" and develop a functional digestive system relatively quickly, cod larvae need specially developed live plankton – 100% research-based! For sensitive baby fish it is particularly important that they should enjoy stable conditions for growth during their earliest stages of life. The plastic tanks full of tiny swimming creatures are small but carefully balanced ecosystems. Inside each tank, plant plankton, animal plankton, and fish larvae live in harmony, with the water current, temperature and lighting all carefully regulated. The heart of the system is a biofilter that provides an optimal bacterial flora for the baby cod and supplies the tanks with mature, recycled water.

The North's New Nervous System

SINTEF scientists are working on an underwater wireless network of communication nodes to which sensors can be connected. In a few years, the pilot scheme could be ready to monitor the Barents Sea. The project "A New Nervous System for the Arctic", has a budget of NOK 21 million. Kongsberg Maritime, Fugro Oceanor, StatoilHydro, Western Geco, the Institute of Marine Research in Bergen and NTNU/SINTEF want to monitor the ocean in the same way that the surface of the Earth and the atmosphere are being monitored today. Environmental monitoring, biomass monitoring and greater certainty regarding petroleum pipelines and offshore installations are among the benefits envisioned. The Barents Sea is huge and it would be impossible to cover it completely with a wireless network. However, the scientists have a vision of placing sensors and a monitoring system along the line of the continental slope north of Tromsø, for example, where the seabed makes a sudden jump from deep to shallow.

A Sensor Is Born

The Microsystems and Nanotechnology Laboratory (MiNaLab), which belongs to SINTEF and the University of Oslo, has two clean rooms of 800 m² and 600 m². SINTEF operates a complete silicon processing line for the development and small-scale production of solid-state radiation detectors and micro-electromechanical systems (MEMS).The laboratory is designed for a throughput of 10,000 4-layer wafers per year, and the scientists perform single- and double-sided wafer processing of 100 and 150 mm wafers. Sensor manufacture involves a photolithographic process (see image). With the aid of a powerful imaging light, in a few seconds the process engineer etches delicate patterns of circuit connections from a mask onto silicon wafers covered with a light-sensitive film. The pattern on the mask is on a scale of micrometres. To avoid the film becoming damaged by ordinary white light, the process must be carried out under yellow lighting.

Illustration: Bjarne Stenberg

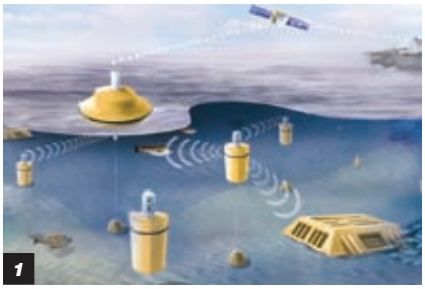

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Photo: Thor Nielsen

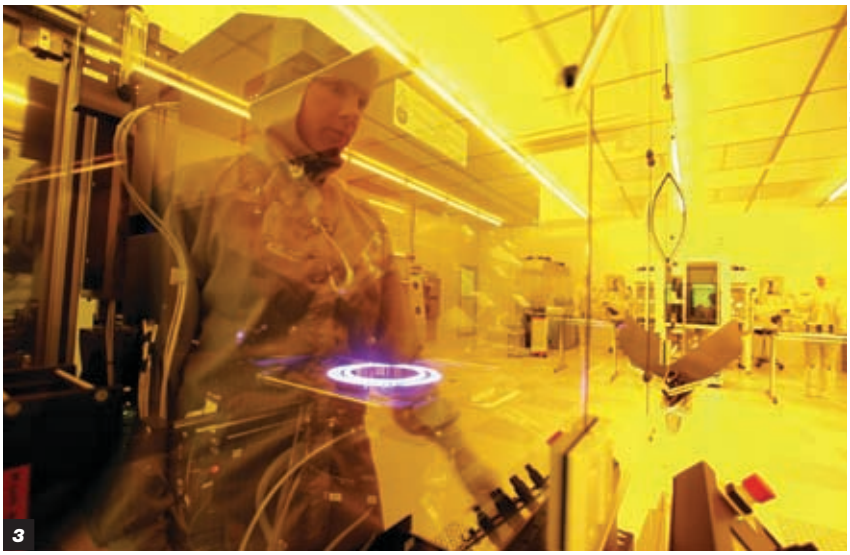

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Photo: Thor Nielsen

SINTEF

1. SINTEF is preparing an Arctic network of sensor nodes that can be used for environmental and biomass monitoring.

2. Research scientist Trina Galloway ensures that living conditions are perfect for farmed cod larvae.

3. An advanced sensor is born in one of SINTEF's clean rooms.

CO_2 Handling

CO_2 handling is employed as a concept for capturing CO_2 from industrial processes and energy production, and transporting it to and storing it in geological formations. SINTEF is one of a small number of R&D institutions capable of addressing all the links in the CO_2 chain. Pioneering projects in this field were carried out as early as 1987–88.

The Norwegian Government has provided good general conditions for research on CO_2 handling, and NTNU and SINTEF are playing central roles in such research. SINTEF's efforts with regard to the EU's research programmes have led to a doubling of its project portfolio in CO_2 research in three years, with a current annual turnover of around NOK 40 million. SINTEF leads Europe's largest R&D project related to energy production in this area.

The Strongest Material in the World

Scientists at SINTEF are among the first in the world to develop a process for large-scale production of carbon nanotubes. Production of the strongest material in the world takes place in a high-temperature reactor designed in Trondheim, which was officially opened in 2005. Carbon nanotubes are a completely new material with special properties that are in great demand. The material has turned out to have unsuspected electrical and chemical properties in addition to its high strength and extremely low weight. This means that super-strong plastics, uncrushable boat hulls and super-light aircraft could become a reality.

Floating Production in the World of Gulliver

During the past few years floating production systems have appeared in offshore petroleum fields. New fields are currently more likely to be developed using production vessels and floating platforms. Many of these come to MARINTEK, a member of the SINTEF Group, in highly miniaturized versions before they are built, for testing in one of the largest ocean basins in the world. Here MARINTEK has tested models of some of the world's largest floating objects.

Photo: Thor Nielsen

This pilot plant in Trondheim plays an important role in SINTEF's research on CO_2 capture from coal- and gas-fired power stations.

Vital Data Straight to the Ear

SINTEF has been working for a long time on a rather special earplug. Its underlying concept is that it makes it possible to listen to sounds, such as a neighbour's voice, while sorting out and eliminating injurious noise. The idea has resulted in a start-up company called Nacre AS. In combination with a radio, the earplug makes up a complete communications terminal for noisy environments. The Swedish and Norwegian armed forces have actively supported the development and testing of the earplug. Nacre envisages a wide market for its earplug. The company believes that, besides military applications, there will be applications for the earplug in noisy industries, aviation, the police and fire services.

Cold Gas Gave Life to the Snøhvit Field

SINTEF has a share in the first offshore development in the Barents Sea. Designed without surface installations, the Snøhvit project involves bringing huge volumes of natural gas ashore for liquefaction and export from the first plant of its kind in Europe, and the world's northernmost liquefied natural gas (LNG) facility. A cooperative research programme involving SINTEF, NTNU and StatoilHydro generated new LNG technology that made it possible to develop Snøhvit. NTNU, SINTEF and the Institute for Energy Technology (IFE) also played central roles in developing the multi-phase flow technology that enables the gas to be brought ashore without a platform.

Brain Damage from Shaking

Every year, between ten and fifteen Norwegian babies are subjected to forceful shaking by their carers; perhaps a third of them die, while another third survive, but are left with serious long-term injuries. It can be difficult to deal with such cases through the court system because of lack of evidence and witnesses. This leads to innocent people becoming suspects, while the ones who are guilty may go unpunished and then the children who have been mistreated are handed back to their assailants. The Department of Forensic Medicine at the University of Oslo has launched a project on "shaken baby syndrome" and the relationship between shaking and brain damage, and has brought SINTEF ICT into it. A baby mannequin, originally designed for car collision tests, acts as the guinea pig for forensic scientists studying brain damage. SINTEF ICT has placed accelerometers in the doll's head in order to measure the forces produced by shaking and impacts with hard surfaces. The measurements are stored on a computer for later analysis.

SINTEF

Photo: Ole Sæther/Appollon

Arne Stray-Pedersen from the University of Oslo, and SINTEF research scientists Frode Strisland and Olav Storstrøm use a baby mannequin, originally designed for car collision tests, in their research on "shaken baby syndrome".


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Research endeavours and technological development are key pillars of StatoilHydro's long-range commitment. Research activities are directed from the Research Centre in Trondheim. StatoilHydro devotes approximately USD 400 billion to research activities annually, and has research centres in Norway (Trondheim, Bergen, Porsgrunn) and Canada (Calgary).

R&D in StatoilHydro

StatoilHydro is committed to research, technology development and expertise to achieve its ambition of becoming a stronger, internationally competitive company. Establishing and executing the R&D project portfolio shall reflect the corporate technology strategy and is carried out through different R&D programmes.

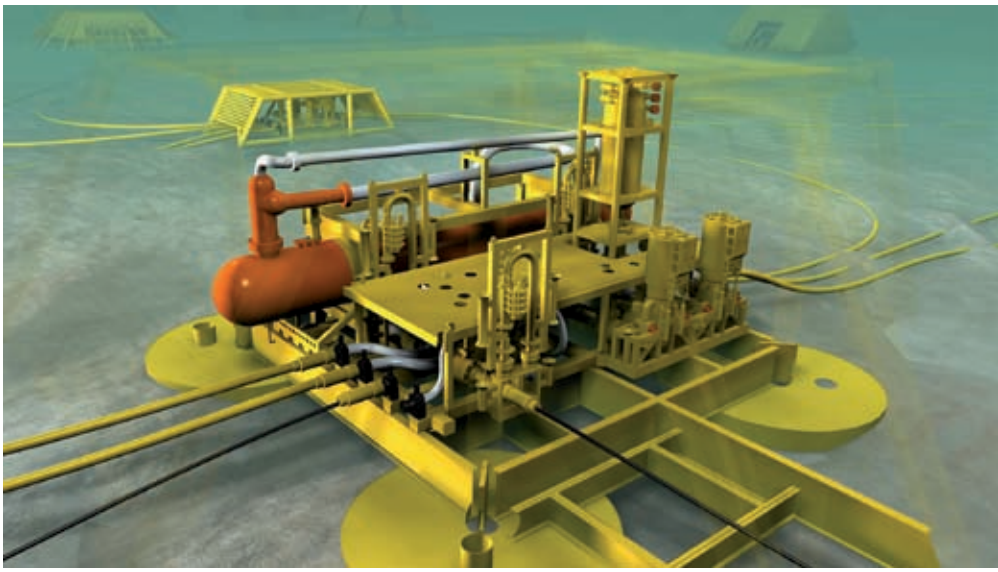
"Our main task is to develop technology and expertise for increased energy supply to the world while meeting the environmental challenges," says Morten Loktu, Senior Vice President for Research & Development in the company. "In order to succeed, the researchers must be innovative and help invent new technological solutions. We have already identified several technological challenges that must be solved to reach StatoilHydro's business goals. By combining our forces in the new company, we have an excellent foundation for developing technology that will allow us to face these challenges."

Exploration

StatoilHydro has a R&D programme named "Explore" who includes seven projects. Four projects focus on developing new tools and technology and three other projects concentrate on the most actual basins, plays and prospects in StatoilHydro's portfolio. The projects maintain a balance between short-term needs for the exploration community in StatoilHydro, and a longer term need to look at future concepts.

Increased Oil Recovery

The Increased Oil Recovery (IOR) programme is established to supply StatoilHydro's assets with critical technology and work-processes in order to achieve a world class recovery factor (RF) from all relevant areas. Based on the applicable business challenges, the program has identified three main challenges, which will act as the basis for the R&D efforts within the IOR programme. These are to identify remaining oil, efficient drainage of reservoirs and integrate people, processes and technology (IO).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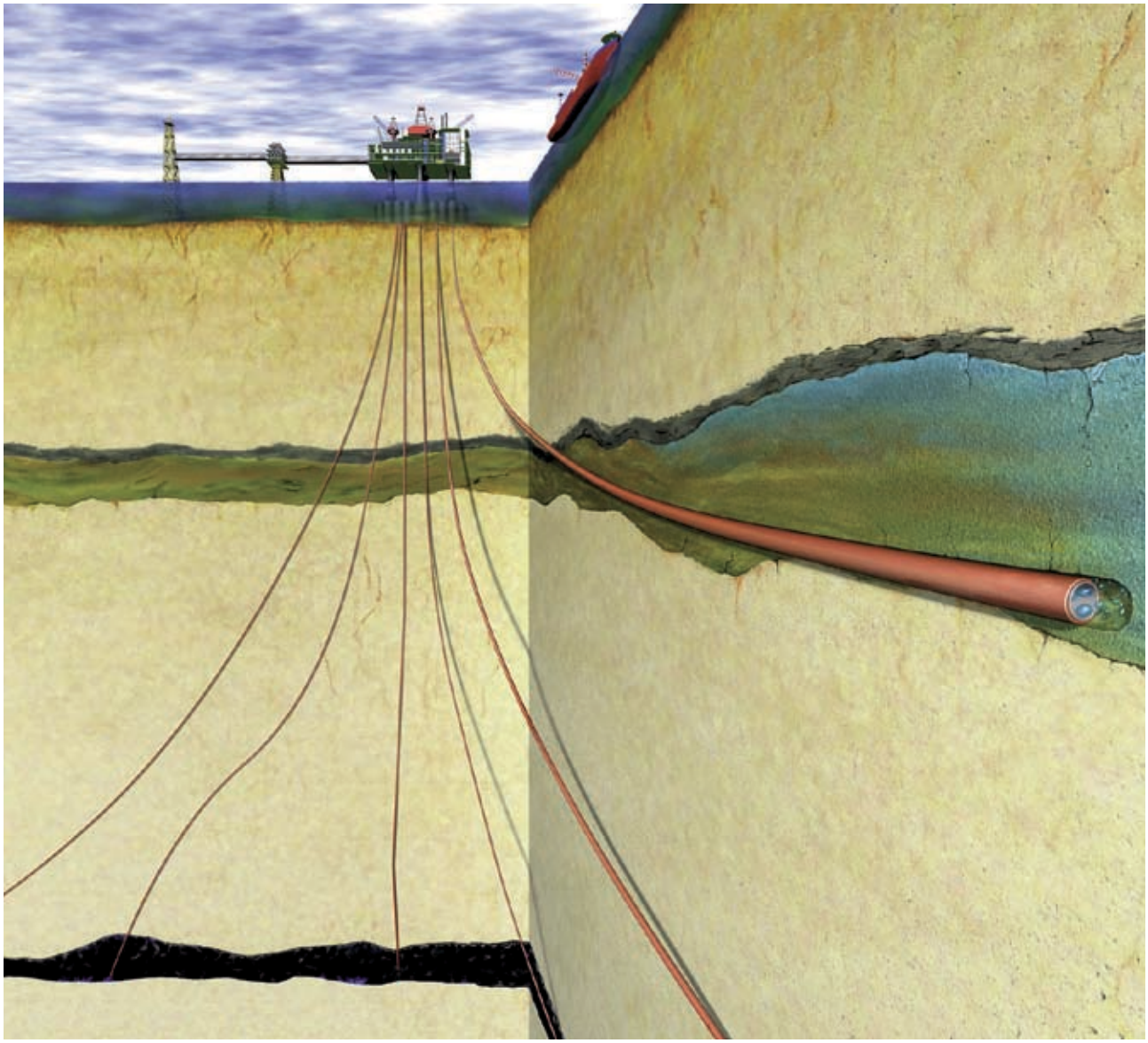

Adding Value to Oil & Gas Resources

The R&D Oil and Gas Value Chain (OGV) programme has been established to develop competence and technologies that enable StatoilHydro to take strong global positions in new gas and oil value chains, and/or add value to the gas and oil resources through production, processing, transportation, trading and marketing. The programme has identified three main challenges, which will act as a basis for the R&D effort within the OGV programme. These challenges are heavy oil, gas value chain and support to manufacturing and marketing facilities.

New Development Solutions

The programme New Development Solutions (NDS) shall brand StatoilHydro as the leading technology company within challenging field developments. The NDS programme shall develop technology that address business challenges related to increased oil recovery, integrated operations, deep water, offshore heavy oil and arctic areas.

New Energy & New Ideas

“Licence to operate” is a prerequisite for doing business. To StatoilHydro this means complying with its goal of “zero harm” and responding to the increased awareness of climate change by being a part of the solution. The R&D programme New Energy and New Ideas (NENI) has identified areas where technology can make a difference.

[simula . research laboratory]

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Managing Director: Professor Aslak Tveito

Simula Research Laboratory AS has three objectives: research at an international level, education in partnership with Norwegian universities and innovation based on the research results. Simula conducts research in three areas: networks and distributed systems, scientific computing and software engineering.

Basic Research

Simula engages in oriented basic research. By identifying a few fundamental issues and working on them over a long period of time, constraints are imposed on the individual freedom more typical in a university, while increasing opportunities to concentrate resources on a small number of demanding issues. The research at Simula is organized in long-term, focused research projects (see example), and is devoted to topics with a high potential for ground-breaking research results and benefits for society. The projects comprise close collaborations with companies, public organizations and internationally renowned researchers to achieve these goals.

Research Education

Simula School of Research and Innovation AS was founded May 8th 2007. Its main goal is to both strengthen the quality of the graduate education at Simula and to increase the number of candidates produced. The school's ambition is to create an important arena for cooperation between the worlds of academia and industry in which we educate PhD candidates. The teaching is done in close collaboration with industry partners and Norwegian universities.

Research Application

The third objective of Simula is to apply the results from the conducted research to create businesses and commercial value. This objective is handled by the two fully owned subsidiaries Simula Innovation AS and Kalkulo AS. The core objective of Simula Innovation is to assist the research departments at Simula in their efforts to realise their insights in terms of real-world applications. Kalkulo delivers technical software based on mathematics, geometry and visualization.

Project Example

At the Department for Scientific Computing there is a project dedicated to the simulation of the heart. Although this organ has been studied for centuries there are still many unresolved questions, especially related to how the heart behaves and adapts during different pathological conditions. Simula cooperates with groups in the medical community to answer some of these questions, using a combination of simulations and physical experiments. The models used to describe the heart are formulated as differential equations, and solving them is a huge computational challenge, requiring both sophisticated software and powerful computers. The goal of the project is to offer accurate simulations of heart activity, which may assist in predicting and treating heart-related diseases.

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Telenor Research and Innovation (R&I) is one of Norway's largest research organizations within ICT and usage. The department contributes to the long-term global competitive strength of Telenor, by facilitating innovation and providing input to strategic development. Telenor R&I collaborates extensively with industrial partners and academia both nationally and internationally.

Converging Markets

Customer demands, technologies, business models and players in the telecom markets and converging industries are changing rapidly. Telenor meets the new opportunities and challenges with a strengthened focus on innovation.

Expertise Across Disciplines

Telenor R&I has 245 employees, located at Fornebu/Oslo, in Trondheim, Tromsø (Norway), and in Kuala Lumpur (Malaysia). The staff comprises 20 nationalities and represents a variety of backgrounds, spanning from experts in financial and regulatory issues to technology, the social sciences, customer insight and commercialization skills. The focus of the work is on the implementation of interdisciplinary projects.

Competence Resource Centre

R&I is a competence resource centre for all of Telenor, offering expertise and advice, and challenging management on existing strategies and mindsets. Based on R&I's own activities and external cooperation, R&I offers world-class research in defined areas of value to Telenor. The work comprises business models, user studies and future communication networks as well as new service concepts and applications in various markets. The activities include experimentation, testing and demonstration facilities.

New Business

R&I is an innovation hub for Telenor and external partners. On the basis of R&I research competence and commercialization skills, Telenor is able to realize new options in a variety of ways, either through the Telenor market units, in new business areas or as independent spin-outs from R&I, alone or in collaboration with third parties. This enables great flexibility and agile management of new initiatives.

R&I Centre in Malaysia

Telenor Research and Innovation Centre Asia Pacific (TRICAP) was established in May 2006 and has now (primo 2008) 20 employees. TRICAP works closely with Telenor's Asian operators in order to create new concepts and increased usage of mobile services. TRICAP mainly works within three focus areas: social media, growing markets and new business opportunities for mobile operators. Their results and findings are shared with all operators in the Telenor Group.

Høgskolen i Telemark

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Telemark University College is the fourth largest state university college in Norway, with a student body of 5,500. It is located in the county of Telemark in the southeast part of Norway. The university college has 160 different study programmes, including 11 master's programmes. Telemark University College is in the process of establishing PhD programmes within the fields of gas and energy systems, cultural studies and ecology. It otherwise has extensive research collaborations and exchanges with a number of educational institutions throughout the world. Telemark University College has ambitions of becoming a university within 2013 – either alone or by combining resources with other educational institutions.

Research in Gas & Energy Systems

One of the main goals for Telemark University College is to contribute to future-oriented research and education in gas and energy processes and within good energy and resource management. There is an active emphasis on research-based innovation and entrepreneurship. Telemark University College has close collaborations with regional and national industry, and with local research centres in connection with PhD projects and agreements with other universities internationally. The Master of technology is taught in English.

Cultural Understanding, Policy & Production

Telemark University College offers a unique opportunity to research and study within art subjects, education, traditional arts, social science, history, linguistics and literature studies, interdisciplinary cultural studies and sport, physical education and outdoor life studies. These particular subject and research areas derive benefits from the Telemark region's well-known cultural traditions. Research includes cultural policy topics, such as access to cultural programmes. Culture production studies focus on an understanding of art's distinctive character, and the production and interpretation of artistic objects and works, such as literature, text, visual art and design.

Research & Education in Nature, Health & Environmental Studies

Environmental research, and in particular issues pertaining to biological diversity, meet with both increasingly greater challenges and new interdisciplinary research requirements. There is also a great need for the production of new knowledge on natural science conditions for good ecologically based management. This is also one of the prioritised research and education areas for Telemark University College. An objective is to strengthen the knowledge base for environmental protection policy and environmental awareness in general.

Research on Sport, Physical Education & Outdoor Life

Telemark University College has one of the nation's largest professional communities within the subject areas of sports policy, sport facilities, outdoor life studies and the social organization of sports and physical education. Both bachelor's and master's programmes are offered within this field.

TietoEnator

Building the Information Society

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With its unique Energy Components (EC) software, TietoEnator provides a product that form an integrated and flexible system for data acquisition, production monitoring and reporting, management of oil and gas terminals, shipments, accounting and sales of hydrocarbons. The software is a best-practice solutions for the management of oil and gas production, transport, sales and revenue. The software has been adopted by several of the leading oil and gas companies in the world as their global standards, and is used for management on all types of fields, terminals and pipelines, and are currently being deployed globally.

The Company

- Annual net sales exceeding EUR 1.6 billion
- More than 16,000 employees in 27 countries
- Global operation
- Strong oil and gas commitment and experiences

A World Leader within the Oil & Gas Hydrocarbon Accounting

- Provides an Energy Components product suite
- Leading position in the global market recently confirmed by independent analyst survey/assessment
- Selected as global best practices by oil and gas majors, for example, ExxonMobil, Shell, BP, Chevron and ConocoPhillips
- Wide acceptance throughout the oil and gas industry in general with more than 200 installations worldwide

EC Hydrocarbon Accounting

- EC Production
- EC Transport
- EC Sales
- EC Revenue

EC Operational Support

- EC Personnel Logistics
- EC Safety & Security
- Operational Support Services

1

TINE BA (TINE R&D CENTRE)
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The TINE Group is the largest food enterprise in Norway and employs 5,540 people. TINE BA's R&D Centre is Norway's largest industrial research group dedicated to food and nutrition. In addition to the dairy product companies within the group, other TINE BA subsidiaries are strong players in a variety of food categories. Fellesjuice AS is a supplier of premium juices in the domestic market, whereas Diplom-Is AS produces and markets premium ice cream in Norway, Sweden and Denmark. The group also consists of a cheese import company (Ostecompagniet AS), marine omega-3 supplier Maritex AS and Salmon Brands, which develops and markets fresh salmon. In addition, ready-meals company Fjordland, belongs to the food group. TINE's international subsidiaries, Norseland, Inc. in the United States and TINE UK Ltd. are responsible for licence production, sales and marketing of Jarlsberg® cheese in North America and the EU, respectively. In August 2007, TINE acquired Wernerssons Ost AB, one of Sweden's largest distributors of specialty cheeses. The group's annual turnover in 2007 was nearly USD 3 billion. TINE BA is managed under a cooperative system owned by 16,300 Norwegian milk farmers.

TINE R&D Activities

Approximately 100 scientists, product developers, engineers, laboratory and support staff serve the group's innovation and development activities. Research and development collaborates closely with production and marketing, as well as with feed and health advisory teams who serve the dairy farmers.

Research and development activities have two main objectives:

- Quality, efficiency and cost minimizing in the entire value chain from dairy farming and raw material supply, via development and processing through to marketplace and consumer
- Innovative concepts and products supporting TINE's aim to be market leader and front runner in offering new products and solutions in food and nutrition

A broad spectrum of milk related topics constitute key R&D activities. Food safety, animal welfare and animal health, feed, nutrition, raw material, processing and packaging are all highly important fields of research for the company. Further research fields include:

- Health and nutrition
- Environment
- Fermentation
- Ingredients
- Marine innovation

R&D Behind International Success

One of the world's best-known cheese types, the semi-soft Jarlsberg®, was created 50 years ago. Jarlsberg®, which is both a type of cheese and an international

1. TINE researchers in dairy pilot plant.

2. SALMA – Setting a new standard for freshness and quality in the way salmon is offered to the consumer and professional food market.

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brand, originated the category. Jarlsberg® holds a premium position in the United States, Canada, Australia and New Zealand, and is developing a strong following throughout the EU and Russia.

The Jarl S. Berg Innovation Factory

Taking its name from TINE's international cheese success Jarlsberg®, TINE's in-house innovation cell is a core research group for the exploration of new ideas. The Innovation Factory frequently hosts visits from other companies or individual researchers.

TINE's state-of-the-art research laboratory and development facilities also include an in-house bakery, cheese and milk production pilot plants, meat processing, a fully equipped restaurant kitchen and sensory labs.

Research Supporting Long-Term Business Strategy

An important role for the TINE R&D centre is long-term research to support and build business activities, the main research areas being:

- **Milk and dairy** – TINE has a unique and comprehensive databank containing health, yield, fertility and other data on the Norwegian cow population. Recent research projects have resulted in the development of specialized feeding regimes for milk cows, which is the foundation for development of tailor-made raw materials and end products
- **Health and well-being** – Latest in the series of the company's healthy nutrition lines, TINE recently introduced the brand EPADHA omega-3. The EPADHA omega-3 range comprises marine oils and patented emulsion, all suitable for application in a number of foods, particularly dairy products and juices. Efficacy research studies support the health claims linked to the brand. Several other research projects address the area of "healthy nutrition". In addition to antioxidant beverage series MANA, and probiotic Biola drinks and yoghurts, TINE has launched the low fat/low sugar SANS range, extending to yoghurts, fresh cheese, ice cream and other dairy products
- **Innovative marine products** – In collaboration with strategic industry and research partners, TINE has carried out groundbreaking research and development work in order to create a new standard in salmon products. World renowned chefs have praised the SALMA salmon loins which are based on a patented process for the raw material handling.

External Collaboration

In order to be at the forefront of research in key areas, TINE collaborates frequently with external research groups in commercial institutes and universities, and with its suppliers. Some research projects are carried out together with other industry partners, in Norway and abroad, creating stimulating and challenging networks where the flow of ideas can generate new opportunities for all participants. TINE welcomes inquiries for R&D cooperation from all parts of industry and research.

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3. Jarlsberg® cheese pioneered a new cheese category when it was introduced on the international market more than 50 years ago. It is today one of the world's best-known cheese brands.

4. EPADHA Omega 3 emulsion from TINE for use in a variety of food products, developed by application specialists.

5. Testing TINE Optifôr, a computerized feed design system based on NorFor – Nordic Feed Evaluation.

5

UNIVERSITY OF OSLO

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The University of Oslo (UiO) is Norway's leading institution of research and higher education. Founded in 1811, it is Norway's oldest and largest university, offering a world-class research and learning experience in one of Scandinavia's most vibrant cities. The University has always had, and continues to play, an important role in the development of both the Norwegian national identity and the modern Norwegian state. The University of Oslo's overall strategic goal is to strengthen its position as a research university of high international standard.

The university comprises eight faculties and various specialized Centres, Museums and Research Schools, and has been awarded almost half (8) of Norway's 21 recently established Centres of Excellence as well as two Nordic Centres of Excellence. The UiO has 4 Nobel Prize winners. Today the university has approximately 28,000 students and 5,400 employees.

A Research University

The University of Oslo is actively working to cultivate excellence within all areas of research in the traditional disciplines as well as in interdisciplinary areas. The University's focus on vital and dynamic cooperation between researchers is reflected in the establishment of several multi-disciplinary research programmes.

Centres of Excellences

The UiO has 8 of the 21 National Centres of Excellence:

- Centre of Mathematics for Application (CMA)
- Centre for Physics of Geological Processes (PGP)
- Centre for Molecular Biology and Neuroscience (CMBN)
- Centre for the Study of Mind in Nature (CSMN)
- Centre for Ecological and Evolutionary Synthesis (CEES)
- Centre for Cancer Biomedicine (CCB)
- Centre for Immune Regulation (CIR)
- Centre for Equality, Social Organization and Performance (ESOP)

The UiO has in addition one Centre of Researchbased Innovation: the Centre of Innovative Natural Gas Processes and Products (inGAP)

The UiO has two Nordic Centres of Excellence:

- Centre for Ecological and Evolutionary Synthesis (CEES)
- Centre for Research in Water Imbalanced Related Disorders (CRWIRD)

UiO: an Outstanding Technology University

The UiO is the leading actor in R&D in Norway in three prioritized technology areas: biotechnology, information and communication technology and nanotechnology. Within molecular life sciences the University, together with the University Hospitals in the Oslo area, makes up the largest research cluster in Norway in this field. UiO hosts the Norwegian participation in Nordic EMBL-Partnership (European Molecular Biology Laboratories) in Molecular Medicine via Centre for Molecular Medicine Norway

Innovation

- Three areas with a high potential for radical innovations: medicine, material science and pharmacology
- On a level with international universities TTOs when it comes to success rate: 45%

UiO: Strongest in Culture & Language Studies & the Social Sciences

The UiO has some of its major strengths within Language and Areas Studies, with research and teaching in almost 30 languages from all over the world as well as interdisciplinary area studies effectively covering every corner of the world. The UiO is the leading actor in the Social Sciences e.g. in the field of Economics, where we have been awarded two Nobel Prizes in Economics and a Centre of Excellence (ESOP).

International Cooperation

The University of Oslo, with 115 successful projects, has the largest EU portfolio of any Norwegian university under the Sixth Framework Programme. Success rate for the Sixth Framework Programme: UiO 31%, Norwegian average 26%, European average 19%. The University's EU participation involves a large academic diversity where the natural sciences and medicine are most heavily represented; nevertheless, 15% of all projects are within social sciences and humanities.

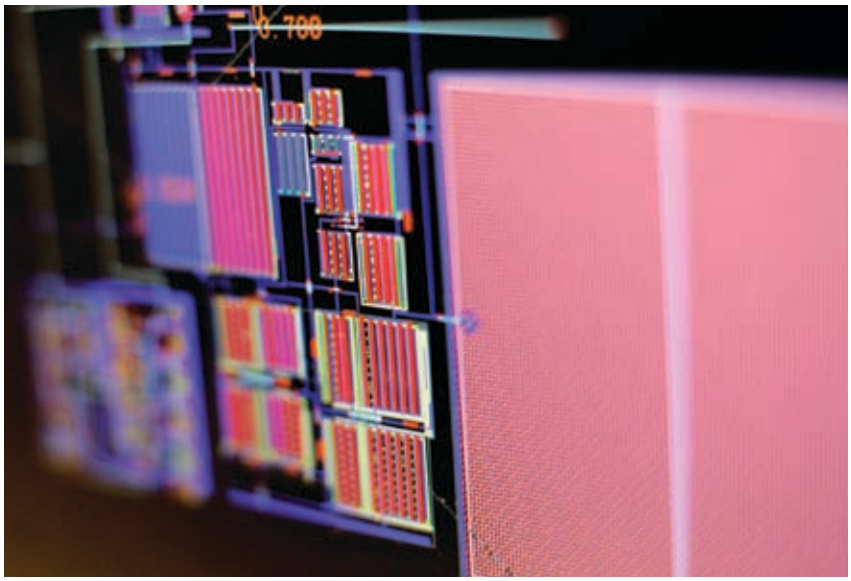
The UiO cooperates internationally bilaterally with a wide range of top universities, including e.g. in the US with Yale, Harvard, Berkeley, MIT and Stanford, and NASA; in the UK with Oxford and Cambridge; with most of the top universities in China, Japan and India; as well as in Mexico, Brazil, Argentina and Chile. The UiO also cooperates in research and higher education with several institutions in Africa and Asia within areas dealing with important global issues such as health, education, development and the environment.

Ranking Score

According to the Shanghai Jiao Tong-ranking 2007 (Academic Ranking of World Universities), the University of Oslo is ranked as:

- Nr. 1 in Norway
- Nr. 19 in Europe
- Nr. 69 in the World

The UiO also ranks high in other international evaluation systems.



UNIVERSITY OF AGDER

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The University of Agder (UiA) is the fourth largest university in Norway, offering 150 areas of study to 8,300 students. The following presentation contains a selection of the university's many fields of research at the faculty of Engineering and Science.

Renewable Energy

The Renewable Energy Team performs multi-disciplinary research and development in hydrogen technology and materials science, biocrops, photovoltaics, electrical engineering for renewables, thermal energy, waves and wind. The team has a newly started bachelor of engineering programme in renewable energy.

Functional Ecology

Within the framework of Functional Ecology, chemical compounds used by organisms for all types of interactions in the aquatic environment are studied, involving research within behaviour, physiology, immunology, toxicology and molecular chemistry. Fish and amphibians use specialized compounds for migration, reproduction and defence. Detecting these compounds is important for sustainable nature management, and provides possibilities within aquaculture development and bioprospecting.

Load Bearing Structures & Engineering Materials

The objective of the group is research and development in the field of strength analysis and material technology. Ongoing projects include Advanced Finite Element Methods, Applied Fracture Mechanics, Optimisation of Concrete Microstructure and Uncertainty Modelling. The areas of application are within civil engineering and the oil and gas offshore industry.

Mechatronics

The Mechatronics Group at the University of Agder admits about 90 bachelor students and 30 master students each year and runs the oldest mechatronics study programme in the Nordic region. The Mechatronics Group is actively involved in R&D towards the local oil and gas and process industries. The focus areas of the study programme and R&D are product development, modelling, simulation and control of mechatronic systems with large actuator forces and moments.

Future Mobile Systems

Together with industry, UiA is participating in the definition and design of new mobile applications and device reference models that integrate ubiquitous and long-range wireless communications. These are important components of an updated, overall architecture with new mobile services, communication protocols, and applications.

Wireless Mesh Networks for Broadband Internet Access

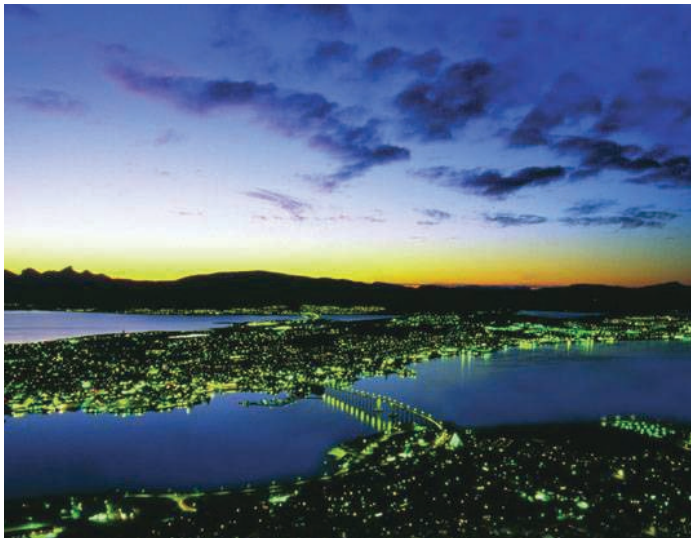
While bandwidth for Internet access in urban areas is steadily increasing, some rural areas are still suffering from the digital divide. Together with European academic and industrial partners, UiA has developed a Wireless Mesh Networking-based solution for broadband Internet access especially for rural and mountainous regions, hereby filling the gap where xDSL is not available or non-profitable for operators.

Benchmarking of eGovernment services

Automated large-scale evaluation can drive targeted innovations to improve eGovernment. UIA has coordinated pioneering research in the EIAO project co-funded by EU in FP6, and will with 30 partners participate in eGovMon supported by the Research Council of Norway.

Didactics of Mathematics

UIA educates future teachers at all levels in the school system, from primary schools to teacher training colleges. Two development research projects (KUL-projects funded by the Research Council of Norway), LCM and ICTML, aim at developing communities of inquiry comprising didacticians/researchers at UiA and mathematics teachers in schools ranging from primary to upper secondary. A new project "Teaching Better Mathematics" (TBM) is bringing the ideas of co-learning inquiry and community of inquiry to many new schools and kindergartens. A central part of TBM is the establishment of a consortium of university colleges led by UiA, including Bergen, Bodø, Oslo and Sør-Trøndelag.



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The University of Tromsø (UiT) has 6,000 students, a staff of 1,800 and a budget of NOK 1.6 billion, of which some 25% comes from external financing. The curriculum consists of more than 100 study programmes, including language and cultural studies, social sciences, law, economy, marine studies, science and medicine.

UiT's cross-diciplinary fields of focus include biomarine studies, biomedicine, telemedicine and multicultural studies. Northern and Arctic dimensions are prominent, and UiT has more man-labour years dedicated to polar research than all the other Norwegian universities combined.

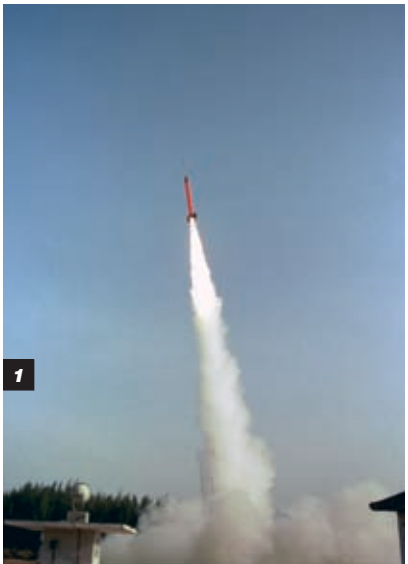
Commercialization

UiT is active in the commercialization of research results and the establishment of research-based competence companies through its technology transfer office (TTO Nord AS). Examples include:

- Orthogenics AS – Diagnosis and treatment of osteoarthritis
- ObexCode AS – Wireless technology solutions
- Praktisk teknologi AS – Box-based sea urchin farming
- Lytix Biopharma AS – New antibiotic against resistant bacteria
- Minerva Sikkerhet AS – Data security

Drugs from the Sea

Cross-disciplinary basic research at UiT has a strong competence within marine bioprospecting. Findings of marine biomolecules from the enormous biological treasure chest found just off the coast of Norway form the basis for biotechnological added value and commercial gains. At UiT two new national infrastructures, Marbank and Marbio, have key roles within marine and medical research and industrial development.



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Northern Lights & Space Physics

Researchers at UiT are among the world's most prominent in Northern Lights research and participate in the international research organization EISCAT (European Incoherent Scatter Radar). From the large radar facilities in Tromsø and at Svalbard, the Northern Lights and dust plasma are studied in the polar atmosphere. Experimental space physics is also carried out at the UiT plasma laboratory.

Energy & the Environment in the North

UiT's new focus within energy and the enviroment produces knowledge about environmentally friendly energy production from renewable and fossilized sources. This is basic knowledge that will have great significance for social and economic development in the northern regions.

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2

1. Researchers at the University of Tromsø carry out rocket experiments with the "MiniDusty" to study electrically charged dust particles in the atmosphere. Pictured here, the launch in India.

2. Searching for unique molecules in marine organisms such as prawn shell, cod liver and king crab holds great potential for future biotechnological added-value in Norway.

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Vestlandsforsking is an independent research institute located in Sogndal. The institute is part of the national research system and has 25 employees. Vestlandsforsking has competence in the academic fields of social studies, natural sciences, technology and the humanities

Research Fields

Usability
- Human computer interface
- Requirements specifications
- Semantic technologies
- Information architecture

Environment
- Alternative fuels
- Sustainable agriculture
- Sustainable mobility
- Industrial ecology
- Local environmental and climate policy

Innovation
- e-Commerce in small and medium-sized businesses
- e-Government and public sector organization
- Infrastructure and networking
- Regional development and business development

Tourism
- Sustainable tourism and geotourism
- Leisure-time consumption
- ICT and tourism

Environmental and Climate Research
This field of research focuses on the local and regional levels of administration as executors of environmental policy, with emphasis on the special challenges related to the goal of sustainable development. During the past decade, local environmental policy in Norway has displayed a shift from following up the Brundtland Commission's report through Local and Regional Agenda 21 to paying increasingly more attention to climate issues. This shift has also been reflected in the project activity undertaken by Vestlandsforsking. In addition, local climate policy has evolved from climate and energy planning, with a one-sided emphasis on emission mitigation, to also being concerned with climate vulnerability. Through the work done on local climate vulnerability, emergency preparedness and civil protection have also become important research topics.

Research Centre for Geotourism & Sustainable Development

Western Norway Research Institute and Sogn og Fjordane University College are the formal founders of the research centre that opened in May 2007 in Sogndal. A main objective of the Centre is to obtain new insight into how more active use of natural and cultural resources may form the basis for increased value added in the Norwegian tourism sector and – at the same time – how to make tourism more sustainable. Terms such as ecotourism, sustainable tourism, quality tourism and geotourism will be pivotal in this work.

Objectives & Fields of Competence
The Centre aims to build national and international top-level competence within research and development in geotourism. The latter, the basis of which is natural and cultural resources, draws on the concept of sustainable development. The primary areas of research will include:
- Sustainable tourism
- Tourism and climate challenges
- Nature and cultural heritage as a basis for experience tourism
- Rural tourism
- Destination development and participatory tourism planning
- Tourism policy and commercial organization
- Information technology and tourism

VOLDA UNIVERSITY COLLEGE

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Volda University College (VUC) has approximately 3,000 students, 230 academic staff members and about 70 technical and administrative personnel. The college has long and proud traditions of higher education dating back to its foundation as a teachers' training college in 1895, and since then has expanded to 4 faculties, 5 Master's Programmes, more than 30 undergraduate study programmes and about 300 study courses offered.

Wide Variety of Academic Fields

Today Volda University College offers study programmes and courses in a wide variety of academic fields, administered by the Faculty of Education & Humanities, the Faculty of Social Sciences & History, the Faculty of Arts and Physical Education and the Faculty of Media & Journalism. Volda University College is widely renowned for its outstanding academic studies in animation, broadcast journalism and documentary film production.

Teaching & Internationalization

VUC offers a great combination of a highly trained academic staff and a small and inclusive learning environment. There is a strong connection between researchers and teaching activities. VUC is internationally oriented and has at present approximately 130 international students and an extensive collaboration with foreign universities.

The college's home is Volda but its perspective is international. Recognizing that the globalization of communications, commerce and education is rapidly gathering pace, VUC is aiming to meet this challenge and is exploring the potential of learning without frontiers. VUC is working intensively to be part of different project within the Life Long Learning Programme Erasmus and other international programs.

Priority Areas for R&D

Selected priority areas for R&D at Volda University College for 2004 to 2008 include developing staff competence, strengthening regional ties and obtaining national accreditation

In the next four years VUC will be instrumental in facilitating research and development activities in the following strategic priority areas for R&D:

- **Welfare Research**
  - Local perspectives on the welfare society
  - Communicative planning
- **The Meeting of Cultures**
  - New Norwegian written culture
  - Religion, philosophy of life and society
  - Region, identity and globalization
  - Dissemination of art and culture
- **Journalism**
  - New media
  - Media ethics
  - Freedom of speech and democracy
- **Educational Research**
  - Educational reforms
  - Didactics
  - Differentiated education

Østfoldforskning

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Østfoldforskning AS, previously known as STØ AS, is non-profit public limited company which is owned by Østfold County Council District, Fredrikstad and Sarpsborg County, Inner Østfold Region Board, Østfold Energi, COWI and the employees. Research activities are concentrated on preventative environmental and industrial and commercial development.

Projects Connected to R&D Networks

Østfoldforsning AS' operations have been directed towards the regional, national and international markets. In the course of 2007 it has carried on with several long-term R&D projects, and most of these are connected to national R&D networks, which mainly comprise projects that have been financed by the Norwegian Research Council's User-Directed Innovation Projects.

Østfoldforskning has received NOK 1.35 million in basic grants for 2007 which have been mainly used for developing technical competence, doctoral work, national and international network building and support for publication.

Development of Strategic Networks

A great deal of resources has been put behind the further development of strategic national and international networks. Regionally, cooperation with Østfold University College and the Norwegian University of Life Sciences (UMB) has been strengthened through VRI. VRI has also contributed to strengthening cooperation with NIBR within regional industrial and commercial development and NTNU through the Edwor Programme. A strategic cooperative effort has been entered into with Aalborg University in regards to doctoral degree studies, guest professors and project work with Gøteborg University.

Important Projects

- **VS 2010/VRI Research Project** – This project is directed towards innovation in the food and packaging industries, which represent two of the bigger industries in the county. The project contributes to increased value creation and a strengthened ability to compete. It has been carried out as an equal cooperation between Østfoldforskning and Østfold University College. The project has worked with the development of part and cooperative based organization models for companies and innovation processes
- **Life Cycle Analysis of Power and Thermal Production Based on Bioenergy** – The goal of this project is to document the environmental and resource conditions connected to power and thermal production based on biomass in Norway. This is done with a background with working to get better insight into the possible environmental consequences of the use of different energy sources and technologies. Five alternative bioenergy plants have been analyzed in regards to four environmental impact categories: the greenhouse effect, acidification, over fertilization and smog formation
- **Bunn til Munn – Efficient Value Chains for Long-Line Caught White Fish** – Mustad Longline and Domstein Fish AS entered into a cooperative agreement to develop systems and solutions for a sustainable catch and packaging/distribution that ensures high quality and environmental and resource efficiency for long-ling caught white fish. This project has received over NOK 10 million in support for a three year period from the Norwegian Research Council's User-Directed Innovation Projects together with research environments Norconserv and TraceTracker. Østfoldforskning leads the project as far as research goes

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At **www.nortrade.com** you will find up-to-date information on more than 4,000 Norwegian manufacturers and exporters within 35 different industries. There you will find a search tool which allows you to perform searches for companies, products or persons in the Norwegian Export Directory.

Thirty Industry Portals

Nortrade also has 30 different industry portals containing information about companies, products and news of current interest.

Send Online Trade Requests

You can send inquiries directly to one or more companies following a product search. You will receive a reply directly from the company.

Subscribe to News Articles

You can subscribe to news from relevant industry sectors and companies free of charge.

Find Relevant Suppliers

Nortrade has a comprehensive presentation of Norwegian research and development companies, complete with company profile pages, product pages, industry codes and news articles, along with e-mail and website links.

norway abroad

The following list provides an overview of the Norwegian embassies, Consulate Generals and Innovation Norway offices located internationally. For more information on Norwegian embassy and Consulate General activities, please visit **www.norway.info**

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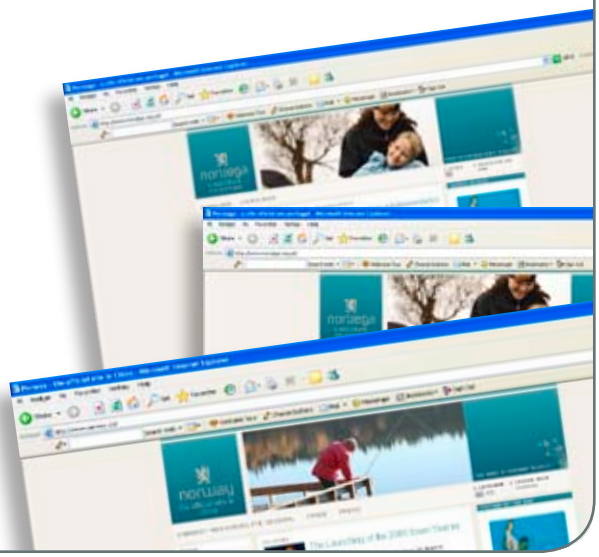

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