



NTVA Review 2014

NORWEGIAN ACADEMY OF TECHNOLOGICAL SCIENCES



NTVA IN BRIEF

The Norwegian Academy of Technological Sciences (NTVA) is an independent organization founded in 1955. NTVA is a member of the International Council of Academies of Engineering (CAETS) and of the European Council of Applied Sciences and Engineering (Euro-CASE).

THE GOALS OF NTVA ARE TO:

- Promote research, education and development of technology and natural sciences
- Encourage international cooperation within these fields
- Further the understanding of technology and natural sciences among the authorities and the public to the benefit of Norwegian society and industrial development in Norway.

NTVA's members are scientists and industrial leaders recruited from academic institutions and industries in Norway and abroad. Individuals who have contributed significantly to the technological sciences or in related areas, or whose work has furthered practical applications of technology are eligible for membership. The total number of members was 552 at the end of 2014.

NTVA has an Industrial Council consisting of represen-

tatives of the management of companies and institutions in Norway. The purpose of the council is to support NTVA in fulfilling its missions and to strengthen its relations with society. In 2014, the Council had 39 members.

THE MAIN ACTIVITIES

NTVA hosted 34 events in 2014. Two seminars were held in Trondheim and two in Oslo. On 29 October a symposium on "Medical Technology – Meeting Tomorrow's Health Care Challenges" was held at The Norwegian Academy of Science and Letters in Oslo and had 165 participants. Regular meetings open to the public were held in Bergen (6), Oslo (6), Stavanger (6), Grimstad (1), Tromsø (1) and Trondheim (7). Selected themes from these meetings are reported in this Review.

The annual meeting for NTVA's Industrial Council was held 12 March in Oslo.

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FOREWORD

In 2014 we Norwegians realized that we cannot forever base our welfare on the petroleum industry. The precipitous drop in the oil price was an eye-opener. There is every reason to believe that the petroleum industry will continue to be important for Norway as well as for the world, for decades to come. But the need to develop other industries, old and new, now is a widely accepted starting point. The crucial question is then: Where to go, and how to stimulate positive developments? Our Academy has always been keenly interested in the relevant questions concerning progress in the natural sciences, technology developments, industrial policies and society at large. As an independent, nation-wide organization, with expert members from many fields, we feel that we can offer a fruitful arena for fact-based discussions on these relevant questions.

During 2014 we organized altogether 34 meetings on timely topics in five cities: Trondheim, Oslo, Stavanger, Grimstad and Bergen. Moreover, together with The Norwegian Scientific Academy for Polar Research we organized meetings in Tromsø. We intend to expand our activities in that city.

On October 2nd, the General Secretary and the President of NTVA were granted an audience with His Majesty King Harald V, the high protector of NTVA. As always, His Majesty showed a keen interest in the work of NTVA, and he stated his firm intention to participate in the symposium organized in April 2015 in collaboration with The Norwegian Academy of Science and Letters (DNVA).

By November 1st, Hein Johnson, our General Secretary for more than 17 years, retired. Hein has been instrumental in developing NTVA during these years and has done an outstanding job on a tight budget. The Board expressed its appreciation of his invaluable work by appointing him to



Eivind Hiis-Hauge
President

NTVA honorary membership. We also wish to express our satisfaction with having appointed Lars Thomas Dyrhaug as his successor.

It is with great pleasure we congratulate three of our members who received prestigious prizes during 2014: Thomas Ebbesen was awarded the Kavli prize in nanoscience, and May-Britt and Edvard Moser received the Nobel prize in physiology or medicine. We are proud to count them as members of our Academy.

NOBEL PRIZE LAUREATES AND HONORARY MEMBERS



Edvard Ingjald Moser



May-Britt Moser

On 5 December 2014, the Board decided that two scientists should be appointed to NTVA Honorary Membership.

MAY-BRITT MOSER studied at the University of Oslo and was awarded a degree in Psychology. In 1995 she received a Doctorate in neurophysiology under the supervision of Professor of Medicine Per Andersen. In 1996 she was appointed Associate Professor of biological psychology at NTNU, the Norwegian University of Science and Technology, and in 2000 she was appointed professor of neuroscience. She has made significant contributions to studies of the hippocampus, focused on memory and on spatial orientation. In 2005 she and her husband had a significant breakthrough in their research when they discovered a type of nerve cell in the brain that they called grid cells. These cells are responsible for a sense of direction and the ability to perceive position in an environment. The breakthrough took place while she and Edvard worked at the Centre for the Biology of Memory (CBM), a research initiative that they had established.

May-Britt Moser has been awarded several international research prizes. In 2008 she was awarded the Fernström

Nordic Prize. Moreover, she was awarded the Louisa Gross Horowitz Prize and the Fridtjof Nansen award and medal for outstanding research. In 2014 she was awarded the Karl Spencer Lashley Prize and the Körber Prize.

EDVARD INGJALD MOSER was awarded a degree in Psychology at the University of Oslo in 1990, and in 1995 received a Doctorate in neurophysiology. His supervisor also was Professor Per Andersen. In 1996 he was appointed Associate Professor of biological psychology at NTNU, a position parallel to that of May-Britt Moser. In 1998 he was appointed professor of biological psychology at NTNU, and in 1998 he was appointed professor of neuroscience.

Like his wife May-Britt Moser, Edvard Moser has focused on studies of the hippocampus and charting the actions of grid cells that are responsible for the sense of direction and the ability to orient in an environment. Like May-Britt, Edvard Ingjald has been awarded the Louisa Gross-Horowitz-prisen. That happened in 2013. He also was awarded the Fridtjof Nansen Prize for outstanding research. In 2014 he was awarded the Karl Spencer Lashley Prize and the Köber Prize. In 2008 he was awarded the Fernström Nordic Prize.

Research conducted by the Moser couple contributes to an understanding of how recall arises in the brain and why memory and episodes often are associated with rooms, streets or environments.

The discovery of the cells that comprise the positioning system of the brain has been recognized by the award of the 2014 Nobel Prize in Physiology or Medicine to May-Britt and Edvard Ingjald Moser jointly with their American mentor John O'Keefe.

On the basis of their becoming Nobel laureates, May-Britt and Ingjald Moser have been appointed Honorary Members of the Academy

HONORARY MEMBERSHIP



Ragnhild Sohlberg



Hein Johnson

On 21 May the Board decided that Ragnhild Sohlberg should be appointed to NTVA Honorary Membership.

RAGNHILD SOHLBERG earned a degree in economics from the University of Wisconsin in 1974 and a Doctorate in Public Policy Sciences from the Pardee RAND Graduate School in California in 1980. Her dissertation was on "Defense Manpower Policy Analysis: NATO Ground Forces". In 1974-1982 she held positions in the USA in the Naval Postgraduate School in California, The Federal Energy Administration, The National Science Foundation, and The Office of the Secretary of Defense, and in Sweden at the Swedish Defence Research Establishment. In 1982 she was appointed the director of operational planning at Norsk Elektrisk & Brown Boveri (NEBB; now defunct) and in 1984 was appointed to a similar position in the Norwegian Council for Scientific and Industrial Research (NTNF). From 1985 to 2008, she was deputy director in Norsk Hydro, responsible for strategy (oil and gas), skills and external relations.

Her involvement in NTVA's goals and activities comprise her work for recruiting to the natural sciences and technology, her role in company and organization boards, and her work of years for NTVA.

Recruiting to Mathematics, the Natural Sciences, and Technology (the MNT professions) is an essential component of NTVA strategy. Few NTVA members have contributed so much to this effort as did Ragnhild Sohlberg. When the Confederation of Norwegian Enterprise (NHO) was founded on 1 January 1989, she put forth the result of "The skills needs of trade and industry - let's do something about it." Its principal message was that the need for expertise in the natural sciences is increasing

in all sectors of society, not just in industry, as there are more young people in schools. In turn, that creates a greater need for natural science teachers. So she became involved in the establishment of the Teaching About Science Centres and wrote essays, contacted politicians, and lectured on the topic. Together with lecturers in the Network for Science Teachers in Primary and Secondary Schools, in October 2000 she founded the MNT Forum in Oslo and Akershus Counties. By the time she withdrew from that activity ten years later, she had contributed to arranging more than 40 visits by MNT teachers, mostly secondary school lecturers, to research-intensive companies and research institutes. Some 1000 teachers have taken part in and have been motivated by these events.

Ragnhild Sohlberg has served on 80 Boards Committees in national and international industries, research institutes, education, defence and culture. A person who participates in and contributes to meetings, is well-informed, punctual, well prepared and inventive is said to "deliver". Ragnhild Sohlberg certainly delivers.

On 5 December 2014, the Board decided that the Academy's Secretary General Hein Tore Johnson should be appointed to NTVA Honorary Membership.

HEIN TORE JOHNSON was the first Secretary General of the NTVA, serving from the autumn of 1997 until he retired on 1 November 2014 at the age of 71.

Hein Johnson originally was educated as a biologist at the University of Bergen. For many years he was a secondary school teacher, and he also has been a lecturer at the Teacher Training College at Tromsø. Together with colleagues he has written a textbook on biology, and for a period was the assistant human resources manager at Ulsteinvik Mechanical Works (shipbuilders).

In his tenure as secretary-general, he contributed to professional Academy operations and was a central figure in the establishment of the NTVA branches in Stavanger and in Bergen. Moreover he has several large seminars, including the 2004 Annual Meeting of the International Council of Academies of Engineering (CAETS) held in Stavanger.

Hein Johnson combined open-mindedness and the social with a polished professional, quality-based operation of the Academy. For his long and important service for the Academy he has been awarded an Honorary Membership in NTVA.

NTVA'S SPECIAL AWARD TO ARNE HALAAS



Arne Halaas

The NTVA Special Award is made in recognition of outstanding contributions of new technologies that benefit Norwegian society and promote development of Norwegian business. On 21 May, the Board of the Norwegian Academy of Technological Sciences (NTVA) decided that the 2014 Special Award should go to Arne Halaas, a professor emeritus at NTNU.

In 1969 Arne Halaas earned an MSc in Numerical Mathematics at the University of Oslo. Thereafter he lectured at the University and was a consultant for Bygghdata AS before joining the faculty of NTH (the predecessor of NTNU) in 1972. In 1980-81 he was a guest researcher at the University of Kaiserslautern in West Germany. In 1985 he was appointed Professor at NTH. In 1994-95 he was a Guest Professor at the University of Montpellier (LIRMM) in France. From 1997 to 2002, he was the part-time Chief

Scientist of FAST, a Norwegian company specializing in Fast Search and Transfer.

Arne Halaas has specialized in algorithms and data structures. He early was involved in implementing search algorithms on silicon and was among the pioneers of the field in Norway. He sought professional cooperation in electronics research, as with NTH and Nordic VLSI ASA (a spin-off of SINTEF Elab). From the early 1980s on, he developed several specialized search chips in VLSI. These chips had unique processor architecture and in many ways were ahead of their time. In 1987 he established the Turbit company. He was among the founders of FAST ASA in 1997 and Intragon AS in 2002. His considerable expertise in algorithms and parallel algorithms decisively contributed to the systems developed by the companies. He early contributed to the basic development of AllTheWeb, the FAST search engine. After the turn of the Millennium, AllTheWeb was a leader compared to Google, with which it competed. In 2003, Yahoo acquired AllTheWeb. Eleven years later, Yahoo is still in Trondheim and still growing, with 40 engineers delivering the search technology used by Yahoo's staff of 12,000 in developing solutions for 800 million users round the world. In 2008, Microsoft acquired FAST. It became the Microsoft Development Centre in Trondheim. Today in Norway, Microsoft has a staff of about 230 that specializes in search, machine learning and next-generation interaction. The governing idea of Arne Halaas' research has become a leitmotif in the information access of E-Mails between billions of users round the world as well in the interaction solutions of SharePoint and Office 365. The annual turnover in these products now amounts to more than NOK 40 billion (EUR 4.8 billion).

Many of Arne Halaas' students now are professors, entrepreneurs and company executives. As a Professor in the Department of Computer and Information Science at NTNU, he has been a leader in the development of a study and research community now internationally recognized, and as an entrepreneur has been a role model for innumerable students.

KAVLI AWARD TO THOMAS W. EBBESEN

The Kavli Prizes recognize scientists for outstanding contributions in astrophysics, nanoscience and neuroscience. The first Kavli Prizes were awarded in 2008. On 29 May, the Kavli Foundation announced that Thomas W. Ebbesen would be one of three laureates to receive a Kavli Prize in Nanoscience in 2014.

Ebbesen was born in Oslo in 1954 and grew up in France. After finishing secondary education, he went to the USA, where he studied chemistry and biology at Oberlin College in Oberlin, Ohio. He continued higher education at Université Pierre-et-Marie-Curie in Paris, where he took a doctorate in physical chemistry. Thereafter, he worked at the Notre Dame Radiation Laboratory in the USA. Then he relocated to Japan, where he worked in Tsukuba at the NEC Fundamental Research Laboratories, where he was appointed head of research. In 1999, Ebbesen was appointed Professor on the faculty of Louis Pasteur-University in Strasbourg. Together with Sumio Iijima, Ebbesen discovered nanotubes. He devised a way to produce nanotubes in large quantities, that is in grams. Since then he has specialized in carbon nanotubes.

He has shown that light propagates through holes smaller than the light wavelength. For that discovery he has become the first Norwegian to be awarded a Kavli Prize. He shares the 2014 Prize in Nanoscience with Stefan W. Hell and John B. Pendry. The Prizes were awarded in Oslo on 9 September.

In 2008 Thomas W. Ebbesen was elected to membership in NTVA. Since 1999, he has worked in Strasbourg at the Institute de Science et d'Ingénierie Supramoléculaires (ISIS), which he directed from 2004 to 2012.



Thomas w. Ebbesen

NTVA TECHNOLOGY FORUM 2014

TECHNICAL AND SCIENTIFIC KNOWLEDGE AND CIVIL PROTECTION

The annual NTVA Technology Forum was held in Trondheim on September 11. Its theme was technical and scientific knowledge in the service of civil protection. Its comprehensive programme included essential contributions by both Norwegian and foreign experts.

- DSB “National risk picture 2013” – The threat of catastrophes, with emphasis on natural hazards, Erik Thomassen, Division leader, Norwegian Directorate for Civil Protection (DSB).
- Copenhagen municipality – cloudbursts in 2010 and 2011. On the events and resulting action plans, Jan Rasmussen, Copenhagen Municipality.
- Experience from Dagmar (extreme weather event of December 2011), preparedness and handling natural hazards, Haavard Stensvand, Sogn og Fjordane County chief of preparedness.
- Modelling of major catastrophes, Dance Zurovac-Jevtic, Sirus International Insurance Corp., Stockholm
- Climate changes, Prof. Helge Drange, Geophysical Institute, University of Bergen (UiB)

- NIFS Project “Natural hazards, Infrastructure, Floods and Slides” – Results of cooperation and possibilities, Bjørn Dolva, Project leader, Norwegian Public Roads Administration, and Jean Sébastien L’Leureux, Project leader, Norwegian Geotechnical Institute (NGI)
- Increased climate stress on critical infrastructure and conglomerations of buildings, Berit Time, Senior researcher, SINTEF Building and Infrastructure
- Climate adaption and social planning, Cato Aall, Research director, Vestlandsforskning (an assignment-based research institute in western Norway)
- Panel debate, questions and conclusions, Ove Njå, Professor, Department of Industrial Economics, Risk Management and Planning, University of Stavanger (UiS)

NTNU Professor Jørn Vatn chaired the Forum. On 28 April 2015 an abbreviated and slightly revised version was arranged as a joint symposium with the Norwegian Academy of Science and Letters (DNVA) and the Research Council of Norway.



MEDICAL TECHNOLOGY

– MEETING TOMORROW`S HEALTH CARE CHALLENGES

On 29 October, a symposium on “Medical Technology – Meeting Tomorrow`s Health Care Challenges”, organized jointly by the Norwegian Academy of Technical Sciences (NTVA), the Norwegian Academy of Science and Letters (DNVA), and the Research Council of Norway, was held at the DNVA building in Oslo with 165 participants.

Bent Høie, the Norwegian Minister of Health and Care Services, gave the introductory talk. He said that the Government aims to build a health service for the patients, which will lead to better and safer healthcare. Technological developments such as health apps afford new opportunities. The Government has stated that medical research should be strengthened, especially regarding disease and the prevention of lifestyle disease. There will be a strong focus on innovation, research and technological developments. ICT and eHealth are important tools to achieve better health and a state of the art health and care services. The Minister had high expectations for the outcome of the Health-Care21-Strategy, the first national multi-faceted strategy for research, development and innovation for the health and care services.

Kristin Braa, Peter Nielsen and Ola Titlestad of the University of Oslo discussed emerging research on mobile technology for healthcare, particularly important in developing projects in Africa. By providing access in regions that often lack other infrastructure, mobile

technology offers a significant opportunity to collect, communicate and coordinate health data.

Jan Terje Andersen, Ole Kristian Hjelstuen and Inger Sandlie of the University of Oslo discussed two issues: innovative basic research in molecular biology and the application of the results to make new products in the pharmaceutical industry. They explained how their findings, combined with knowledge generated by others, may revolutionize the way we take medication, dramatically increasing the time between doses of a drug, as well as reducing the dosage needed.

Erik Fosse of Oslo University Hospital observed that new technologies may dramatically change the ways hospitals are organized. The changes challenge the healthcare system. Larger, more specialized clinics with standardized diagnostics and interventions will evolve at the cost of small units that until now have been governed by physicians. Quality assurance according to industrial standards will be adopted. The new, centralized clinics will be governed according to the cost efficient corporate models. Cultural clashes between professions will occur. The conflicts tend to slow the development of new types of health services. While most people want hospital services of industrial standard, they also want to be assured that a doctor is taking care of a treatment.



INTERNATIONAL ACTIVITIES

EUROPEAN COUNCIL OF APPLIED SCIENCES AND ENGINEERING - EURO-CASE

Euro-CASE is an organization of 22 national Academies of Applied Sciences in Europe. It is non-profit and aims to be a European forum for exchange and consultation between European institutions, industries, research institutes and national governments.

The mission of the organization is to pursue, promote and maintain levels of excellence in engineering, applied research and technology and to further science and its practical applications.

Since Euro-CASE was founded twenty years ago, its objective has been to act as an advisory body for the European Commission in technology and the natural sciences. The European Commission has confirmed that they consider the organization as a key advisor.

In 2014, two Board meetings and one symposium were held. In 2014, the NTVA President and Secretary General took part in one Board meeting and the Annual Conference held in Brussels 2-3 December.

In a considerable amount of work was devoted to the Energy Platform and Innovation Platform projects. Sverre Aam, the former CEO of SINTEF Energy, represented NTVA in these activities.

Innovation Platform was established in 2012 to contribute suggestions and recommendations to both the European Commission and to the member countries. Karl Klingsheim of The Technology Transfer Unit at NTNU participated on behalf of NTVA.

INTERNATIONAL COUNCIL OF ACADEMIES OF ENGINEERING AND TECHNOLOGICAL SCIENCES - CAETS

CAETS is an international organization in which many key countries in the global economy are members. NTVA has been a member of CAETS since 1990. The organization now has 26 member countries. NTVA vice president Karl Almås participated in CAETS annual Convocation that took place in Beijing 2-4 June 2014. The meeting was organized under the auspices of The Chinese Academy of Engineering. Xi Jinping, President of the People's Republic of China, held a plenary address. He outlined the impacts of technology on the development of the Chinese welfare state from 1000 years ago and on into the future.

At its annual CAETS Board Meeting, Karl A. Almås was elected to the Board. A Convocation statement called "Engineering and the Future of Mankind" was compiled and adopted. Through its participation in CAETS, NTVA now has contacts with other international academies, including the Chinese Academy of Engineering, CAE.



Karl Klingsheim NTVA, participated in the Innovation Platform panel discussion



Karl Almås greeted President Xi Jinping during the CAETS meeting in China

NTVA IN BERGEN

In 2014, NTVA organized six events in Bergen. At the 23 September meeting, Narve Mjøs, Director of Battery Services & Projects, Maritime Advisory, DNV GL gave a presentation of “Battery-powered ships – a new green business case?”

BATTERY POWERED SHIPS – ECONOMIC AND GREENER

Ships with Li-ion batteries are taking a pole position in the electrification process. Numerous small and large vessels are being built and several are already in operation.

A NEW GREEN BUSINESS CASE

All-electric vessels and hybrid vessels with energy storage in large batteries and optimized power control can significantly reduce fuel costs, maintenance and emissions, in addition to improving responsiveness, regularity and safety in critical situations. Furthermore, they can act as a storage unit for energy harvested from waste-energy recovery, regenerative braking of cranes and renewable energy. Moreover, batteries can improve the effectiveness of gas-fuelled propulsion systems based on LNG or other environmentally-friendly fuels.

Battery hybridization of vessels can provide fuel cost savings of 10% to 30%, with a payback time of three to five years, while all-electric ferries can lead to fuel cost savings of 30% to 80%, depending on the price development of electricity vs. diesel. The payback time for all-electric ferries depends mostly on the onshore investments necessary to provide sufficient power to a vessel.

INDUSTRY, RESEARCH AND AUTHORITIES ARE TAKING ACTION

The world's first Maritime Battery Forum has been established with close to 40 members, including cargo and vessel owners, yards, vendors, research organizations and the DNV GL classification society, all in partnership with Norwegian authorities. Several R&D projects

are ongoing, and more are being initiated, to effectively address maritime safety and business challenges and improve the technical framework. Major maritime power-system providers, such as ABB, Siemens, Rolls-Royce and Wärtsilä, are developing main and auxiliary power solutions. The Viking Lady, an offshore supply vessel in daily operation in the North Sea, is a full-scale “test laboratory”: LNG-fuelled with battery-hybrid propulsion. On board measurements are taken and calculation models are validated with very encouraging results on fuel and emission savings and improved operational performance.

A Green Coastal Shipping programme has been established with the vision that Norway will establish the world's most effective and environmentally-friendly coastal shipping transport running fully or partly on batteries, LNG or other environmentally-friendly fuels.

THE FIRST LARGE ALL-ELECTRIC FERRY UNDER WAY

In Sognefjorden, Norway's deepest fjord, ferries run back and forth between Lavik and Oppedal. The crossing takes just twenty minutes, but is a vital link on the E39 route from Kristiansand to Trondheim. The connection is served by three ferries. Now, for the first time, one of them will not use fossil fuels for propulsion. Fjellstrand produced Ampere, owned by Norled, will make use of its ten tons of lithium batteries and no other energy source to ferry up to 120 cars and 360 passengers across Sognefjorden. When green measures can be designed in a way that makes them economically and/or politically attractive, then real and positive change is possible and even probable.



NTVA IN OSLO

In 2014, NTVA organized eight events in Oslo. At the 1 October meeting, John Olav Giæver Tande, Research Manager at SINTEF Energy Research, gave a presentation of the status of offshore windpower.

John Tande began by remarking that offshore wind energy offers an opportunity for developing new knowledge-based jobs in Norway. The international market is large and growing. In Europe alone, investments for the construction of offshore wind farms over the next ten years are expected to be in the order of NOK 1000 billion. Offshore wind farms can replace fossil-fuel power generation. They will reduce CO2 emissions and will be an important part of a future sustainable energy systems as clean, renewable energy sources that can be developed and operated with minimum negative environmental impacts. Today, offshore wind energy costs more than land-based wind energy. But its technology and market still are only in the initial phase. By 2030, its cost is expected to be reduced to half of the current level.

Norway has an important role to play. Building on our expertise within the energy and petro-maritime industries, we can develop solutions that reduce the costs of offshore wind energy, and thereby accelerate deployment and speed up the phasing out of fossil energy sources. This is a worthy, effective climate initiative. It will require Norwegian investments in R&D. But those investments will be offset many times over through the creation of jobs and the export of goods and services. The timing now is ideal, as the oil and gas industry is downsizing and has excess capacity to explore forward-looking focus areas.

Norwegian entities already are involved in offshore wind energy. Statoil and Statkraft are developing offshore wind farms in UK. Aibel is supplying an offshore HVDC platform for connecting German wind farms. Nexans is a major supplier of power cables, Fred Olsen is engaged in installing offshore wind turbines, and DNV GL is a world leading service provider. Other companies are entering the sector. Kongsberg is developing systems for optimized operation of offshore wind farms. INTPOW (Norwegian Renewable Energy Partners) has identified more than 150 Norwegian companies that are contemplating involvement in offshore wind energy.

Norwegian research communities are of international class, with the two Centres for Environmentally-Friendly Energy Research (FMEs), Norwegian Research Centre for Offshore Wind Technology (NOWITECH) and the Norwegian Centre for Offshore Wind Energy (NORCOWE) that further knowledge and innovation. Norway must now continue the FME scheme and provide industry incentives to develop technology and expertise that can reduce the cost of offshore wind energy and ensure future Norwegian knowledge-based deliveries to the international market. The potential is immense. Offshore wind power is technology for a better world and a win-win situation for Norway.



Three major exports from Norway to the offshore wind sector in 2013: The Aibel's HVDC platform (left, photo: Øyvind Sætre) in final construction phase before being towed to Germany), Nexans submarine power cables (middle, photo: Nexans), and a Fred Olsen installation of wind turbines (right, photo: Fred Olsen Wind Carrier).

NTVA IN STAVANGER

In 2014, NTVA held six meetings in Stavanger. At the October 30 meeting, Jan Holm, Managing Director of Lyse Smart gave a presentation on The Lyse Smart Initiatives in Health and Welfare Technologies. Professor Chumming Rong at the University of Stavanger gave a presentation on the research in the field. A summary of the presentation is presented in the Academy Yearbook.

The Smarty concept means that users shall be able to control the principal functions of a home from an interface. It was triggered by a requirement of the Norwegian Water Resources and Energy Directorate (NVE) that the country's electric energy suppliers install new Automatic Meter Reading (AMR) in all homes. The Lyse Smart Company saw that requirement as a possibility to offer more than installer visits.

Lyse Smart has developed solutions for controlling heating, lighting, intruder alarms, fire alarms and other functions of a home under the Smartly brand name. With the new AMRs and hourly electricity rates, Smartly heating control can contribute to improving and lowering the cost of energy consumption. Consumers can set lighting moods in a house with a single keyin. The fire alarm is the only one on the market with direct connection to the fire brigade, and the intruder alarm is connected to central unit approved by the Norwegian Insurance Approval Board (FG).

Smartly is comprehensive, robust, safe and user-friendly solution of refined design that emphasizes predictability, quality and ease of use. Smartly can interwork together with other smart products. The technology becomes the brain of the new, smart house. A small computer, named Smartly Gateway, is mounted in the distribution panel of the house. The computer is connected to the Internet and via wireless can control the alarm systems, lighting and heating of the house. It reads energy consumption auto-

matically and sends the figures back to the electric energy supplier.

The Fire Brigade recommends directly-connected fire alarms, because they save lives. Smartly has produced the only alarm on the Norwegian market with direct connection to the Fire Brigade. It has a 24-hour alarm central in case of break-in.

Control of lighting has been simplified. Smartly can turn off lighting when you go out and turn it back on again when you return, or dim it to a night mode when you go to bed in the evening. The Smartly heating control feature can cut the average family electric heating cost by up to 20%. Enova, the Norwegian government enterprise that promotes environmentally-friendly production and consumption of energy, offers up to NOK 4000 to support implementation in a home. Smartly provides full control and overview of your total energy consumption.

Based on its research and testing, Lyse Smart also delivers welfare technology products that help the elderly and others with special needs to function well in homes. All functions can be controlled from tablets and smart telephones. The solutions support confidence and relief for residents of homes. Smartly offers user-friendly welfare solutions that promote activity, participation, independence and mastery.

JAN HOLM, MANAGING DIRECTOR, LYSE SMART



NTVA IN TRONDHEIM

In 2014, NTVA organized nine events in Trondheim. At the 21 January meeting, Professor Truls Nordby of The University of Oslo and senior researcher Magnus S. Thomassen of SINTEF gave presentations on the future of cars, hydrogen versus electricity.

MODERN CARS FOR BETTER CLIMATE

Effective transport is part of the modern economy. But transport also is the leading source of environmental and climate challenges facing the world. New zero-emission technologies permit separating transport from the environmental and climate stress that it historically has imposed upon the globe.

In 2011 the global energy consumption of the transport sector was 29,156 TWh and the total CO₂ emission about seven billion tons. Hence the transport sector accounted for 28% of the total energy consumption and 22% of the global CO₂ emission.

Today there's a furious development of new types of motor vehicle powertrains. For cars the developments are striking and several new concepts have been launched. The development of new powertrains for cars also has affected other transport sectors, such as heavy transport, ships and gradually also trains. Common for the development of new propulsion systems is that they increasingly are electric.

In addition to the electrification of powertrains and the phase-in of zero-emission solutions based on batteries and on hydrogen, bio fuels and natural gas are expected to contribute to reducing emissions. Several bio-based fuels (biogas, ethanol, diesel and others) based on biological material or waste are suitable for use in transport. Moreover, there are considerable environmental advantages in replacing diesel with natural gas, particularly in reducing the emission of particles and NO_x.



Nissan Leaf is one of the most popular electric vehicles.



Truls Nordby



Magnus Thomassen

Fossil fuels still account for 99% of the energy used by the transport sector. A part of the national NorWays Study was concerned with real data on Norwegian travel habits and for various scenarios for car use. Assuming that all households with two cars (about 31% of the total) replace their "city car" with an electric car and that rechargeable cars gain an appreciable market share in 2015 to 2035, the emission from cars may go down by 80% by 2050. This reduction assumes a phase in of hybrid and electric cars with batteries or fuel cells.

The electrification of the transport sector will lead to a considerable increase in household electric energy consumption. A complete change to battery-powered electric cars would lead to an electric energy consumption of about 7 TWh, or an increase of about 17% of the household energy consumption in 2013. The increased household electric energy consumption can be expected to be due in part to increased power needs for charging batteries from 4-5 to kW per outlet. These considerable increases in demand will to a great degree occur in the local distribution parts of electric supply networks that are weakest and most expensive to expand. So it's essential that the infrastructure be developed in step with the electrification of the motor vehicle population.

(This text is based on "Mobility increases drive drive social development" by Magnus Thomassen and Steffen Møller-Holst, a chapter in the NTVA 60th anniversary book to be published in the autumn of 2015.)

RESEARCH ON TECHNOLOGY FOR ICY WATERS

A summary of the presentation of professor Sveinung Løset, NTNU for NTVA's Industrial Council in Oslo on March 12.

The presence of sea ice is really what makes a difference in navigation and marine operations in the Arctic. During the last decades the Arctic has experienced one of the most rapid temperature increases on Earth. A consequence of this warming is a reduction of the sea ice extent, particularly in the summer, and decreased ice thickness. Further, the amount of multi-year ice is reduced. This leads to easier access to mineral and hydrocarbon resources in the Arctic and thus increased activity level among oil companies. Going North means also going into deeper waters that are ice covered parts of the year. With respect to oil and gas, this advocates for the use of floating structures or at least structures that can be afloat. For instance, in waters of 80 metres or less a concrete gravity-based structure (GBS) structure may be used both for drilling and production. The GBS could be made mobile by ballasting/deballasting the structure. However, purpose-built floating structures are preferable for deeper waters. These could be ship-shaped or omnidirectional designs.

How can new technology for these waters be qualified? With respect to actions from ice, standards such as ISO 19906:2010 "Petroleum and natural gas industries

-Arctic Offshore Structures" are developed backed up in empirical calculation formulas that are based on experience with historical concepts developed for shallow waters in the Beaufort Sea or similar waters. This leads to conservatism in designs. Moreover, the concepts normally are tested in ice basins. However, the scalability of the results from lab-scale to full-scale are not trivial due to a complexity of parameters that affect a design. With this complexity, theoretical approaches that depend on laboratory scale and full-scale data, and numerical analysis must be developed (Figure 1).

This approach is followed by the Norwegian University of Science and Technology (NTNU), hosting the research-based innovation centre: Sustainable Arctic Marine and Coastal Technology (SAMCoT). The emphasis is on theory development, numerical implementation and full-scale data, attributes that enable our research to contribute to safer and more sound exploration of the icy waters in the Arctic.

Figure 2 shows the icebreaker Oden during a SAMCoT/ Statoil field campaign in 2013.

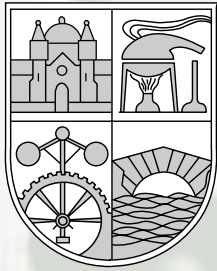
PROFESSOR SVEINUNG LØSET, NTNU



Figure 1. Different approaches and studies at various scales as practiced at SAMCoT.



Figure 2: The icebreaker Oden off NE Greenland.



NTVA Review 2014

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NTVA'S INDUSTRIAL COUNCIL

The NTVA Industrial Council consists of representatives from the industry, public institutions and research institutes. The Council assists NTVA in realizing its objectives and strengthening its links to industry by promoting research, education and innovation to the benefit of Norwegian society.

The annual meeting for the Industrial Council in 2014 was held in Oslo, March 12.

Morten Often, CEO of Store Norsk Gull gave a speech on "Coal and Gold in the Arctic". Sveinung Løset, professor at NTNU, spoke about "Technology in Ice-covered Areas". Ragnhild Rønneberg, Special Advisor at The Research Council of Norway, discussed The Research Infrastructure and the Carbon Capture and Storage (CCS) project on Spitzbergen Island in the Svalbard archipelago. You will find a summary of Løset's presentation on page 15.

The NTVA's Industrial Council has a working committee consisting of seven. Ole Gunnar Selvaag was re-elected and Bjørn Sund, Project Manager at Lundin Norway, was elected as a new member of the committee. Doctor Suzanne Lacasse is the Chairman of the Industrial Council.

The council's executive committee had the following members in 2014:

Suzanne Lacasse, Former Managing Director, Norwegian Geotechnical Institute (NGI), Chairman

Eivind Hiis Hauge, President NTVA, Professor NTNU

Karl Almås, Managing Director, SINTEF Fisheries and Aquaculture

Ole Gunnar Selvaag, Senior owner and a board member in Selvaag Gruppen A/S.

Bjørn Sund, Project Manager, Lundin Norge AS

Lars Holden, Managing Director, Norwegian Computing Center

Hein Johnson, Secretary General, NTVA

Council members:

AS Norske Shell

Christian Michelsen Research AS

Det Norske Veritas AS

EWOS AS

Forsvarets forskningsinstitutt

Fred. Olsen & Co

GE Oil&Gas Norway AS

GE Vingmed Ultrasound AS

Innovasjon Norge

Institutt for energiteknikk

International Research Institute of Stavanger

(IRIS)

Kongsberg Norspace AS

Leiv Eiriksson Nyfotek AS

Lundin Norway AS

MARINTEK

Microsoft Development Center Norway AS

NEXANS Norway AS

Norconsult AS

Norges geologiske undersøkelse

Norges Geotekniske Institutt

Norsk Hydro ASA

Norsk Institutt for luftforskning – NILU

Norsk olje og gass

Norsk Regnesentral

Norsk Romsenter

Norut

Rainpower Norge AS

Rolls Royce Marine AS

Schlumberger Information Technology Services

Selvaag Gruppen AS

Simula Research Laboratory

SINTEF

Statnett

Statoil ASA

Syslab International AS

Tekna

Telenor Norge AS

Ulstein Group AS

Umoe AS

New Council member in 2013:

EWOS AS

Lundin Norway AS

Norsk institutt for luftforskning

Norsk olje og gass

Rainpower Norge AS

Statnett

Telenor Norge AS

Ulstein Group ASA