

The Centres for Environment- friendly Energy Research (FME)

December 2011



About the Centres for Environment-friendly Energy Research

The Centres for Environment-friendly Energy Research (FME) scheme is an initiative to establish time-limited research centres which conduct concentrated, focused and long-term research of high international calibre in order to solve specific challenges in the field of energy and the environment.

The centres are selected via a thorough process administered by the Research Council of Norway, primarily on the basis of their relevance and potential for innovation and value creation and the scientific merit of their research.

www.forskingsradet.no/fme



High expectations for Norway's Centres for Environment-friendly Energy Research (FME)

Norway now has 11 FME centres that form national teams for research and development in the field of environment-friendly energy. The centres are conducting long-term, world-class research in close cooperation with industry players to reduce greenhouse gas emissions.

The FME centres address a broad range of areas, all central to developing the energy sector of the future. The activities of the eight centres established in 2009 focus on renewable energy, raising energy efficiency, energy planning, and carbon capture and storage (CCS). In 2011 three new FME centres were established which focus on social science-related energy research.

The FME scheme is a direct follow-up of the broad-based political agreement on climate policy achieved in the Storting in January 2008, and of the national R&D Energi21 strategy submitted in February 2008 to the Ministry of Petroleum and Energy. In April 2008 the Research Council of Norway's Executive Board decided to launch a process to establish centres for environment-friendly energy research, and a funding announcement was issued that same year. In 2010 it was decided that additional FME centres would be established in the field of social science-related energy research.

After a thorough assessment of each project – based on feasibility, scientific merit, potential to generate value creation and innovation, and composition of the consortium – eight applicants were selected to become FME centres in February 2009. A new call for proposals was issued in 2010, and three more centres were awarded FME status in February 2011.

The objective of the FME scheme is to establish time-limited research centres which conduct concentrated, focused and long-term research of high international calibre in order to

solve specific challenges in the energy sphere. The selected centres must exhibit higher goals, a longer-term perspective and a more concentrated focus than is required under other funding instruments for the same scientific area.

The make-up of the centres is critical to achieving this objective. The centres bring together Norway's leading research institutions and key players in private enterprise, the public administration and various types of organisations. Uniting the strongest players within a specific area under the aegis of a single centre gives each centre a very high level of overall expertise. The FME centres do not comprise an institution in a single geographic location but rather represent a grouping of entities with unique competencies in relevant areas.

Adequate funding is critical to the centres' success and further development. The centres each receive NOK 8-20 million annually for a five-year period, with the potential for a three-year extension. The Research Council will evaluate each centre individually and determine whether to grant further funding beyond the initial five-year period.

The FME centres are expected to keep on boosting Norwegian energy-related expertise well into the future, with the benefits of their activities extending far beyond the actual lifecycle of the centres themselves. Individually and together, the FME centres will help to provide a secure energy future for Norway and the world at large.



BIGCCS Centre – International CCS Research Centre

Title of centre:

BIGCCS Centre – International CCS Research Centre

Project owner:

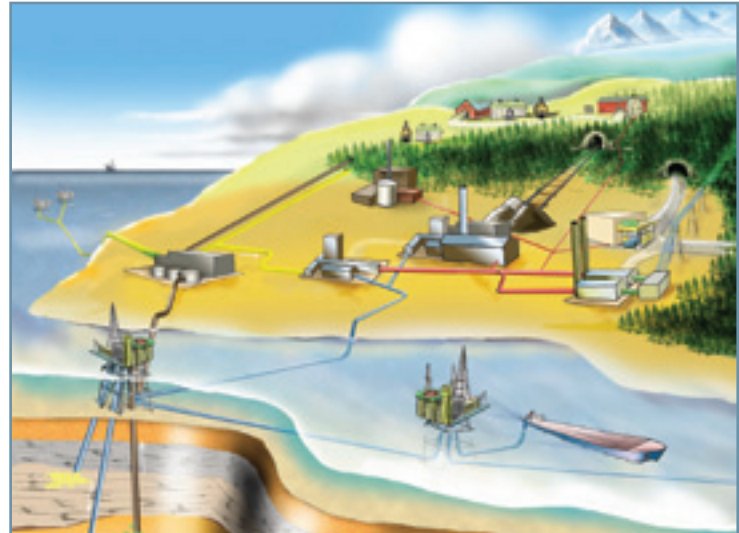
SINTEF Energy Research AS

Partners:

Aker Solutions, British Geological Survey, Center for International Climate and Environmental Research – Oslo (CICERO), ConocoPhillips, DNV, German Aerospace Center (DLR), Gassco, GDF SUEZ, Hydro, Geological Survey of Denmark and Greenland (GEUS), Geological Survey of Norway (NGU), Norwegian University of Science and Technology (NTNU), NTNU Social Research, Shell, SINTEF Petroleum Research, SINTEF Foundation, Statkraft, Statoil, TOTAL, Technische Universität München, University of Oslo.

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The BIGCCS Centre conducts long-term basic research to realise full-scale carbon capture and storage (CCS) for power production and industrial processes. Research activities encompass the entire CO₂ chain, and the centre works to develop knowledge, methods and solutions that lead to:

- At least 90 percent CO₂ capture
- A 50 percent cost reduction from current levels
- CCS with efficiency loss of less than 6 percentage points
- A basis for assessing and qualifying storage sites for CO₂ and quantifying storage capacity in Norway and Europe

The BIGCCS Centre is organised to promote innovation and value creation. It has a graduate-level programme with

18 doctoral and eight post-doctoral fellows and can draw upon the competencies of 22 partners from eight countries. The centre builds on the activities of the SINTEF Group/NTNU research community and its considerable expertise in CCS amassed over a period of 25 years.

The centre's activities give equal priority to research on capture and research on transport and storage. The members of the centre's consortium encompass between them the North Sea, Norwegian Sea and Barents Sea, putting the centre in a unique position to explore storage possibilities in these areas. CO₂ transport is a smaller yet vital thematic area, where research focuses on phenomena associated with the CO₂ stream in relation to materials-related challenges.

The centre is investigating new processes of capture that utilise membranes and sorbents, and is engaged in research in other important areas, including combustion in pure oxygen and combustion of hydrogen. The centre also conducts research on CCS for industrial processes and offshore applications. The centre's industry partners ensure that research activities remain commercially relevant and are actively involved in work on integrated value chains for CO₂.

The BIGCCS Centre has assumed the role of international Centre of Excellence in CCS research in connection with ongoing projects within the consortium and in developing laboratory facilities in Europe.



Centre for Environmental Design of Renewable Energy - CEDREN

Title of centre:

Centre for Environmental Design og Renewable Energy - CEDREN

Project owner:

SINTEF Energy Research AS

Partners:

Research partners: SINTEF Energy Research, Norwegian Institute for Nature Research (NINA), Norwegian University of Science and Technology (NTNU), Freshwater Ecology & Inland Fisheries Laboratory (LFI)/University of Oslo, Norwegian Institute for Water Research (NIVA), Uni Research, International Centre for Hydropower (ICH).

Industry partners: Agder Energi, BKK, E-CO Hydropower, Eidsiva Vannkraft, Energy Norway, Hydro, Sira-Kvina kraftselskap, Statkraft, Statnett, TrønderEnergi.

Partners from the public administration: Norwegian Water Resources and Energy Directorate (NVE), Directorate for Nature Management (DN).

International partners: University of Natural Resources and Life Sciences (Australia), Royal Institute of Technology, Swedish University of Agricultural Sciences and Stockholm Environment Institute (Sweden), National Environmental Research Institute (Denmark), Finnish Game and Fisheries Research Institute (Finland).

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CEDREN generates knowledge to help to ensure that adequate consideration is given to local perspectives when developing future energy technologies to solve global climate challenges. The centre's research activities promote technically and environmentally sound development of hydropower, wind power and power transmission systems in Norway and internationally.

In addition to technical solutions, the centre also develops new knowledge to facilitate the ability of the public administration to implement environmental and energy policy.

CEDREN's vision is to be an internationally recognised research centre for the environmental design of renewable energy – integrating technology, nature and society.

CEDREN will deliver:

- Knowledge about renewable and sustainable energy production
- Innovation and new opportunities for renewable energy solutions
- Outstanding dissemination and targeted communication of processes and results

CEDREN addresses a number of key issues such as: how to develop the

hydropower system as part of a sustainable global energy solution, while minimising the impact of individual hydropower plants on local ecosystems and natural resources; how to adapt hydropower, technically and environmentally, in order to meet the demands of increasing electricity trade with Europe and to balance the greater volumes of intermittent wind power; how to refine methods for analysing the environmental impact of wind power and its transmission; and, how to ensure that such methods and solutions can be utilised in necessary political, industrial economic and management-related processes.



Bioenergy Innovation Centre (CenBio)

Title of centre:

Bioenergy Innovation Centre (CenBio)

Project owner:

Norwegian University of Life Sciences (UMB)

Partners:

Research partners: Norwegian University of Science and Technology (NTNU), SINTEF Energy Research, Norwegian Forest and Landscape Institute, Norwegian Institute for Agricultural and Environmental Research (Bioforsk), SINTEF Foundation, Vattenfall R&D.

Industry partners: Akershus Energi, Norwegian Association of Forest Owners, Agder Energi, Hafslund, NTE Holding, Statkraft Varme, Norske Skog, Vattenfall AB Nordic Heat, Norsk Protein, Waste Management Norway, Norwegian Farmers' Union, Oslo Municipality Waste-to-Energy Agency (EGE), Cambi, Energos, Jøtul, Bionordic, Granit Kleber.

International partners: Stanford University, US Forest Service and University of Minnesota (US), Finnish Forest Research Institute and Åbo Akademi University (Finland), Chalmers University of Technology (Sweden), Technical University of Denmark and University of Copenhagen (Denmark), Vienna University of Technology (Austria), Technical University Bergakademie Freiberg (Germany).

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The objective of CenBio is to develop the basis for a dynamic bioenergy industry in Norway in order to realise the national goal of doubling bioenergy use by 2020. CenBio constitutes the national team for stationary biomass heating and bioenergy production. The consortium consists of seven research institutions and 17 companies, including biomass owners, technology firms and energy companies.

CenBio cooperates with 10 research institutions in Europe and the US on co-publication in leading scientific journals. The centre has 20 students at its own researcher school, where a new joint Master's degree programme between

NTNU and UMB has been established.

The expertise of the centre's consortium encompasses the entire bioenergy value chain: from harvesting and production of virgin biomass and organic waste management, to conversion to heat, power and gas and the use of biomass and ash after their energy has been extracted.

CenBio works to increase both the amount of available biomass and the overall efficiency of the bioenergy chain. The centre identifies opportunities for boosting biomass production, and its biologists and technology experts collaborate on ascertaining the correlations

between biomass quality and new conversion technologies in order to raise efficiency. Documenting the sustainability of various bioenergy chains is a key task which involves identifying the impacts on the environment, the climate, business management and society at large.

The activities of the centre's first two years have led to innovations in the utilisation of ash and heat-accumulating fireplaces, and good progress is being made on raising the efficiency of both small and large-scale incineration plants. CenBio's biogas research shows that new technologies and new mixtures of raw materials can substantially improve methane yield from reactors.



Centre for Sustainable Energy Studies - CenSES

Title of centre:

Centre for Sustainable Energy Studies - CenSES

Project owner:

Norwegian University of Science and Technology (NTNU)

Partners:

Institute for Energy Technology (IFE), Norwegian School of Economics and Business Administration (NHH), Institute for Research in Economics and Business Administration (SNF), SINTEF Group, Sogn og Fjordane University College/Western Norway Research Institute (Vestforsk), University of Oslo (UiO). In addition, the centre has some 20 user partners from industry and the authorities and ten international research partners.

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CenSES generates knowledge to promote a more environment-friendly energy system. The primary objective of enhancing understanding of the economic, political, social and cultural aspects of developing and implementing new, renewable energy and environmental technology.

The centre's activities encompass four research areas:

- Policy making and transition strategies
- Energy systems and markets
- Energy-economic analysis
- Innovation, commercialisation and public engagement

The research in these areas will be integrated in scenarios on various ways

of developing future production and use of energy.

Topics addressed by researchers at CenSES include the following:

- Links between global and regional energy and climate policy
- Policy and framework conditions for restructuring the energy system
- Economic models to study the impact of sustainable energy and technology on society
- Conditions needed to achieve greater innovation and commercialisation of environmental technology in the energy sector

The research staff at CenSES possesses broad expertise in the social sciences.

Roughly 25 active researchers and professors and 60 doctoral and post-doctoral research fellows are funded under the centre's budget and a number of research projects.

CenSES will establish a national graduate-level researcher training school with doctoral and post-doctoral-level studies in social science-related energy topics under the auspices of NTNU, NHH and UiO. The school will cover the centre's entire range of subject fields. Key areas include energy economics, energy policy and energy strategies, as well as technological and scientific studies in the energy sphere. CenSES also offers studies at Master's degree level.



Strategic Challenges in International Climate and Energy Policy (CICEP)

Title of centre:

Strategic Challenges in International Climate and Energy Policy (CICEP)

Project owner:

Center for International Climate and Environmental Research – Oslo (CICERO)

Partners:

Fridtjof Nansen Institute, Department of Political Science at University of Oslo, Laboratory on International Law and Regulation at University of California San Diego (US), The State Innovative Institute for Public Management and Public Policy Studies at Fudan University (Canada), Basque Centre for Climate Change (BC3) (Spain), Faculty of Engineering at Lund University (Sweden), Norwegian Climate and Pollution Agency, Norwegian Water Resources and Energy Directorate (NVE), Norwegian Confederation of Trade Unions (LO), Confederation of Norwegian Enterprise (NHO) (Norwegian Oil Industry Association, Federation of Norwegian Industries, and Energy Norway), Hydro, Statoil, Statkraft, Statnett, DNV.

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CICEP has two primary objectives: to help to devise political instruments and international agreements that can effectively promote restructuring to a more climate-friendly energy system, and to generate new knowledge about the impacts of likely international policy trajectories for key energy markets, Norwegian trade and industry, and the Norwegian authorities.

CICEP seeks solutions that are not only environmentally sustainable but also politically feasible. Separate analyses of the most important actors (the US, the EU, China, India, Brazil, Japan and Russia) form the basis for assessing

what types of international initiatives are likely to gain political support. A key research topic is how countries can influence one another, not only through negotiations and international institutions but also through mutual learning and adaptation. An important task is to identify how agreements between groups of countries and cooperation within individual sectors can facilitate the transition to a more climate-friendly energy system, for example within the international shipping industry, or the development and spread of new technologies such as carbon capture and storage (CCS).

The centre examines promising proposals for international climate policy instruments in order to predict their probable impacts on international energy markets and Norwegian trade and industry. Since developments in the EU are of major significance to Norway, one of CICEP's projects is dedicated to analysing EU developments and the potential and limitations these entail for Norwegian trade and industry and the Norwegian authorities.

CICEP actively disseminates findings to and maintains an ongoing dialogue with its user partners. The centre also reaches out to broader target groups through the media and other channels.



Oslo Center for Research on Environmentally friendly Energy (CREE)

Title of centre:

Oslo Center for Research on Environmentally friendly Energy (CREE)

Project owner:

Frisch Centre

Partners:

Department of Economics at University of Oslo (UiO), Research Department at Statistics Norway and Tilburg Sustainability Centre.

CREE also cooperates with the Institute for Energy Technology (IFE), SINTEF Energy Research, and units participating in research on Environmental Change and Sustainable Energy (MILEN) at UiO, in particular the Centre for Development and the Environment (SUM) and the Faculty of Law. The centre also has several user partners from industry and the authorities.

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The development and implementation of new technology and more environment-friendly forms of energy is an intrinsic part of energy and climate policy. But such activities do not happen on their own; they depend entirely on institutional and financial framework conditions.

CREE collects and generates knowledge about the impacts of framework conditions on energy markets and technological development, including innovation and the diffusion of technology for renewable energy, energy efficiency and carbon capture and storage (CCS). The centre provides a basis for creating better framework conditions and policy instruments to

achieve national and international energy and climate goals.

The centre's main focus is on economic research. It is both fruitful and necessary to view research questions from an economic perspective; however, an adequate basis for energy and climate policy is not established until economic insight is combined with knowledge from other disciplines. Thus the centre cultivates close ties with research groups in other social sciences, law and technology.

The research portfolio is divided into five work packages:

- International climate and energy policy

- Innovation and diffusion
- Regulation and markets
- Evaluation of policy measures
- Next-generation numerical models

The work packages encompass both theoretical and applied research. CREE aspires to be an international leader in its field, while at the same time providing applicable research results to its users. Contact with technology research groups, other social science research groups and users, ensures the relevancy of the centre's research activities. The centre's activities are designed to provide key knowledge to decision-makers in the public and private sectors.



Norwegian Centre for Offshore Wind Energy (NORCOWE)

Title of centre:

Norwegian Centre for Offshore Wind Energy (NORCOWE)

Project owner:

Christian Michelsen Research (CMR)

Partners:

Agder Energi, Aker Solutions, CMR, Lyse Produksjon, National Oilwell Varco, Origo Solutions, Statkraft Development, Statoil Petroleum, StormGeo, Uni Research, University of Agder, University of Bergen, University of Stavanger, Vestavind Offshore, Aalborg University (Denmark).

Key associated partners: Arena Norwegian Offshore Wind (Arena NOW), ForWind and University of Stuttgart (Germany), Technical University of Denmark (Risø DTU), Delft University of Technology (The Netherlands), National Center for Atmospheric Research (NCAR) and National Renewable Energy Laboratory (NREL) (US).

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Foto: Øyvind Hagen/Statoil.

Power production from wind energy at sea represents a major new industrial opportunity for Norway and Norwegian private enterprises. NORCOWE is a cross-disciplinary competence and resource centre working to realise this opportunity.

NORCOWE's ambition is to be a leading, creative environment where research and industry collaborate on developing the foundation for new, innovative solutions for offshore wind power that are both environmentally sound and cost-effective. The centre's activities promote value creation and cost reduction along the entire value chain for offshore wind energy.

Cultivating dialogue and interaction between industry and the research community is another key area of focus. NORCOWE seeks to provide all of its partners with access to knowledge and expertise via meetings, project collaboration and effective exchange of information and documents. The centre will have provided training for 25 PhD candidates and a large number of Master's students in the course of its time as an FME centre.

NORCOWE's partners cover a wide range of subject fields related to offshore wind energy, and several are international leaders in their fields.

The centre encompasses areas such as resource mapping, modelling and measurements of the marine boundary layer (MBL), environmental monitoring, marine operations, operation and maintenance, dynamic response, and layout of wind farms. NORCOWE has expertise in modelling on a range of scales, from fine-scale CFD to the meso-scale.

Geographically, the centre's activities are concentrated in the dynamic offshore community in southern and western Norway. NORCOWE also cooperates with leading European and US wind energy research groups.



Research Centre for Offshore Wind Technology

Title of centre:

Norwegian Research Centre for Offshore Wind Technology (NOWITECH)

Project owner:

SINTEF Energy Research AS

Partners:

Research partners: Norwegian University of Science and Technology (NTNU), Institute for Energy Technology (IFE), Norwegian Marine Technology Research Institute (MARINTEK), SINTEF Materials and Chemistry, SINTEF Information and Communication Technology, SINTEF Technology and Society.

Industry partners: Aker Solutions, Devold AMT, DNV, DONG Energy Power, EDF R&D, Fugro OCEANOR, GE Wind Energy (Norway), Lyse Produksjon, NTE Holding, SmartMotor, Statkraft Development, Statnett, Statoil Petroleum, Vestas Wind Systems, Vestavind Offshore.

Associated partners: Technical University of Denmark (Risø DTU), Massachusetts Institute of Technology (MIT), US National Renewable Energy Laboratory (NREL), Fraunhofer IWES, University of Strathclyde, Delft University of Technology, Energy Norway, Nanyang Technological University, Enova, Innovation Norway, Navitas Network, NCE Instrumentation, Norwegian Wind Energy Association (NORWEA), Norwegian Water Resources and Energy Directorate (NVE).

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NOWITECH combines knowledge about wind power with offshore experience to promote the development of wind farms at deep sea. The objective is to produce new knowledge, methods and technology to form a basis for industrial value creation and cost-effective offshore wind farms.

There is enormous potential for wind power production in deep waters, provided that costs can be reduced to competitive levels. This will require developing offshore wind power technology, a field in which Norwegian industry and research institutions are at the forefront.

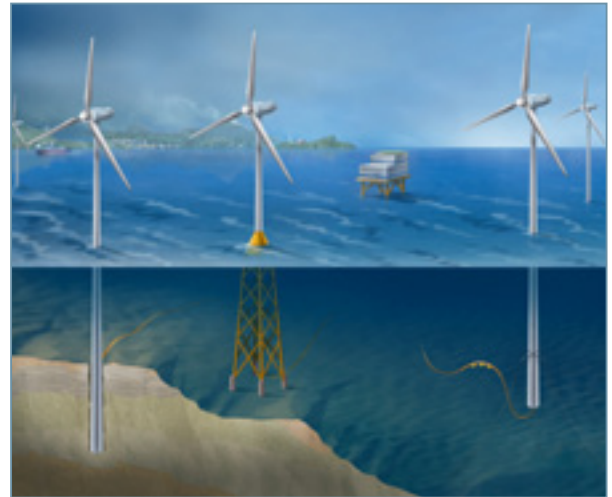
Norwegian companies and research

groups have already designed and delivered foundations for bottom-fixed seabed-based wind turbines in medium-depth waters, as well as developed the HyWind, SWAY and WindSea floating concepts. NOWITECH's activities are vital to continued and steady technological progress.

The centre's partners are international leaders in critical fields such as offshore technology and grid connection. Building on relevant, ongoing R&D activities, NOWITECH utilises its own laboratories such as the ocean basin at MARINTEK, and employs the results of full-scale field trials such as those connected with the HyWind project and the planning

of new infrastructure, like NOWERI (the Norwegian Offshore Wind Energy Research Infrastructure). NOWERI is a floating met-mast and small floating test turbine that will serve as an open research platform. NOWERI will be established in collaboration with NORCOWE.

In addition to conducting R&D, NOWITECH runs an extensive PhD and post-doctoral programme with 25 research fellows (as of 2011). The centre promotes commercialisation through knowledge transfer to industry partners, spin-off projects and establishment of new industrial activities. Several new projects have already been started up, and one new company is under establishment.





The Norwegian Research Centre for Solar Cell Technology

Title of centre:

The Norwegian Research Centre for Solar Cell Technology

Project owner:

Institute for Energy Technology (IFE)

Partners:

University of Science and Technology (NTNU), SINTEF Group, University of Oslo, Elkem Solar, Fesil Sunergy, Innotech Solar, Norsun, Prediktor, REC.

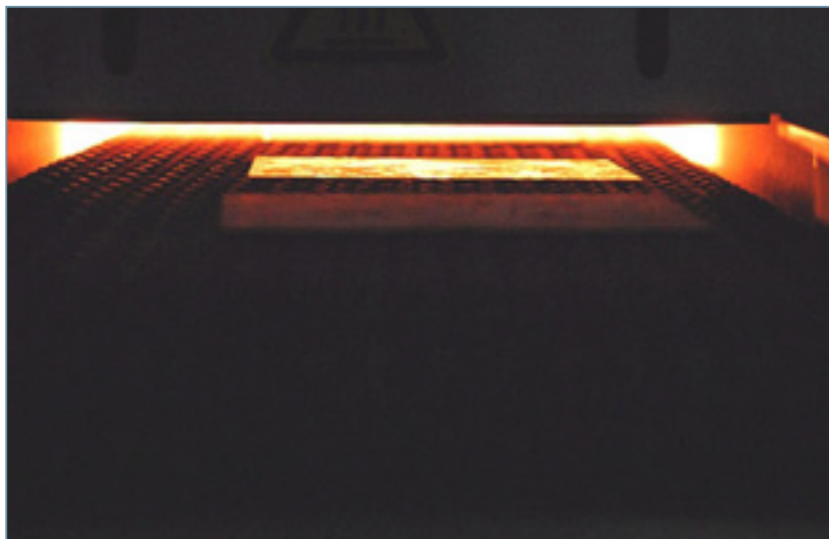
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Large-scale solar power plants, once a futuristic dream, are now producing substantial amounts of renewable electricity in many countries. The combination of rapidly dropping costs and higher efficiency is making solar cells competitive in major energy markets, and a significant industry has emerged. Norway's solar cell industry comprises several leading manufacturers and research groups.

The main objective of the Norwegian Research Centre for Solar Cell Technology is to provide current and future companies in the Norwegian photovoltaic industry with access to world-leading technological and scientific expertise, thereby enabling the industry to

maintain its position as an international leader and to become one of the most important land-based industries in the country.

Research activities focus on the following topics:

- Mono- and multicrystalline silicon
- Modelling of crystalline silicon production processes
- Solar cell and module technology
- New materials for next-generation solar cells
- New characterisation methodologies

The centre brings together the major scientific and industrial players in the field of photovoltaic technology in Norway. Together they form a world-class

community for the synthesis and characterisation of crystalline silicon as well as the modelling, characterisation and synthesis of new materials and process technologies. The centre partners have participated in many research projects in these areas, and have amassed extensive experience over the years.

Education is a vital component of the centre's activities. In addition to maintaining a high level of research activity across institutional borders and investing in laboratories, the centre is providing training for 23 PhD and 21 post-doctoral candidates and has established a national graduate-level researcher training school in photovoltaic technology.



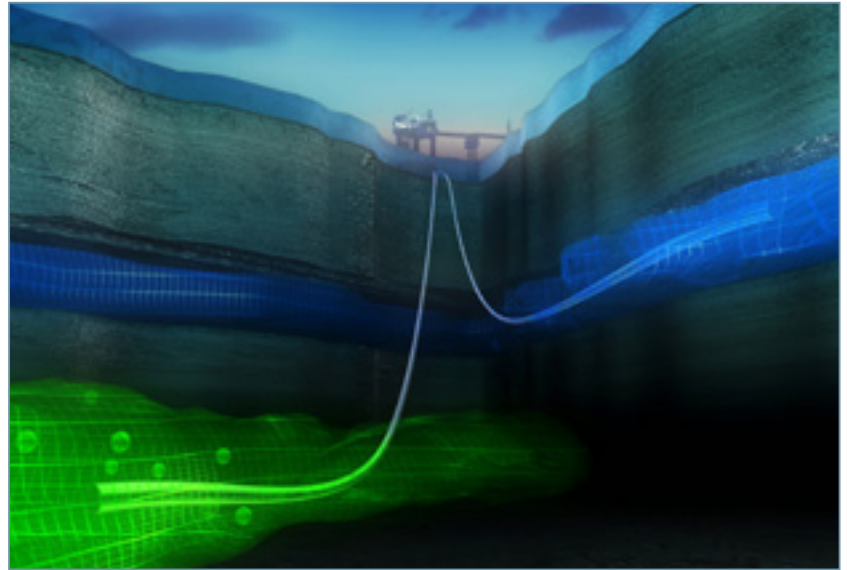
SUBsurface CO₂ storage – Critical Elements and Superior Strategy (SUCCESS)

Title of centre:
SUBsurface CO₂ storage – Critical Elements and Superior Strategy (SUCCESS)

Project owner:
Christian Michelsen Research (CMR)

Partners:
Institute for Energy Technology (IFE), Norwegian Geotechnical Institute (NGI), Norwegian Institute for Water Research (NIVA), Uni Research, University of Bergen, University of Oslo, University Centre in Svalbard (UNIS), CGGVeritas, ConocoPhillips, DONG Energy, RWE Dea Norge, Statoil.

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The development and deployment of technology for carbon capture and storage (CCS) is vital to tackling the challenges arising from climate change. CO₂ capture is a complex, costly process and has been the object of a great deal of R&D, while considerably less emphasis has been focused on CO₂ storage. Although the knowledge and experience gained from oil drilling and recovery may be adapted and applied here, much more knowledge is needed about the impacts of injecting CO₂ underground. This will be critical to achieving international targets of sequestering 15-20 billion tonnes of CO₂ annually.

The SUCCESS centre addresses five key areas related to CO₂ storage:

- In-reservoir behaviour of CO₂ gas
- Sealing properties
- Injection
- Monitoring
- Impact of leakage on the marine environment

The centre has also established a “CO₂ school”, an educational programme whose activities target vital knowledge needs and include fundamental experimental and theoretical studies, analysis of rock samples, development of mathematical models, numerical modelling, and testing in field laboratories.

The SUCCESS consortium possesses high-level expertise in fundamental scientific fields such as structural geology, sedimentology, reservoir characterisation, geomodelling, reservoir modelling, experimental fluid flow and mineral reactions, geochemistry, geomechanics, petrophysics and marine ecology. The centre also collaborates with selected institutions and international research networks. A large number of PhD candidates and post-doctoral research fellows are affiliated with the centre, and there are plans to increase this number even more.



The Research Centre on Zero Emission Buildings – ZEB

Title of centre:

The Research Centre on Zero Emission Buildings – ZEB

Project owner:

Faculty of Architecture and Fine Art, Norwegian University of Science and Technology (NTNU)

Partners:

SINTEF Group, Skanska, Weber, Isola, Glava, Protan, Hydro Aluminium, YIT Building Systems, ByBo, Multiconsult, Brødrene Dahl, Snøhetta, Norwegian Defence Estates Agency, Norwegian Directorate for Public Construction and Property, The Norwegian Housing Bank, Federation of Norwegian Construction Industries, Norwegian Technology, Norwegian National Office of Building Technology and Administration, NorDan.

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This zero-energy building in Switzerland houses the Marché International Support Office, which participated in ZEB's user survey. Architect: Beat Kämpfen...

The centre's vision is to be a national research hub that promotes Norway as a leader in research, innovation and implementation of buildings with extremely low energy requirements and a zero net climate footprint. The main objective is to develop competitive products and solutions for existing and new buildings, both residential and commercial, in order to bring about a market breakthrough for buildings with zero greenhouse-gas emissions associated with their construction, operation and eventual demolition.


ZEB comprises experts in materials technology, construction technology, energy technology, architecture and the social sciences – a breadth of expertise that covers the entire value

chain of industry players in Norway's construction sector. Key focus areas include advanced materials technologies, technologies for adaptive and energy-producing climate shells, energy control and supply systems, energy-efficient use and operation, and concepts and strategies for zero-emission buildings.

ZEB is a historic initiative within the construction industry and a unique endeavour internationally. Over 40 percent of all greenhouse gas emissions in Europe stem from the construction industry, and according to the UN Intergovernmental Panel on Climate Change, this industry is where emissions-reducing measures are most valuable.

The development of zero-emission buildings is therefore a vital environmental measure.

ZEB collaborates on relevant activities with the following prominent international research institutions: VTT Technical Research Centre of Finland, Chalmers University of Technology (Sweden), Fraunhofer (Germany), University of Strathclyde (Scotland), Massachusetts Institute of Technology (US), Lawrence Berkeley National Laboratory (US), Tsinghua University (China), and the Netherlands Organisation for Applied Scientific Research – TNO. In total, the companies in the ZEB consortium account for an annual turnover of over NOK 200 billion and have more than 100 000 employees.



The brochure may be ordered at:
www.forskningsradet.no/publikasjoner

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