The Research Council of Norway

Norway's Centres for Environment-friendly Energy Research (CEERs)

About the Centres for Environment-friendly Energy

The Centres for Environment-friendly Energy Research (CEERs) 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 have been selected via a detailed review process administered by the Research Council of Norway.

Two main assessment criteria formed the basis for the selection of the CEERs: relevance and potential for innovation and value creation, and scientific merit.

www.forskningsradet.no/energisenter

High hopes for Norway's Centres for Environment-friendly Energy Research (CEERs)

In February 2009 Norway's Minister of Petroleum and Energy Terje Riis-Johansen announced the establishment of eight new Centres for Environment-friendly Energy Research (CEERs). The centres form national teams within the areas of offshore wind energy, solar energy, energy efficiency, bioenergy, energy planning and design, and carbon capture and storage.

The CEER scheme is a direct follow-up of the broad-based political agreement on climate policy achieved in the Storting in 2008, and of the national R&D strategy Energi21 of that same year. The Research Council Executive Board approved the launching of the process of establishing the centres in April 2008 and a call for proposals for funding of the centres was issued the following month.

By the September 2008 deadline, the Research Council had received 28 applications – all of them of high quality. After a thorough assessment of each project – based on feasibility, scientific merit, potential to generate value creation and innovation, composition of the consortium, and plans for international collaboration – eight applicants made the grade, earning the CEER designation.

To meet specific challenges

The objective of the CEER 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 sector. 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. One prerequisite for achieving this objective is that the centres consist of distinctive combinations of researchers, research institutions, organisations, industry and private enterprise. Assembling the strongest players within a specific area under the aegis of a single centre ensures that the centre has a very high level of overall competence. CEERs are thus not geographic entities but rather units of expertise that bring together exceptional, relevant, first-rate groups within each thematic area.

Another key to realising such high ambitions is generous funding. The centres will each receive NOK 10-20 million annually for five years, with an opportunity for a three-year extension. The Research Council will evaluate each centre separately and determine whether to grant further funding beyond the initial five-year period.

Expectations are high that in the coming years, the CEERs will substantially boost Norwegian expertise in environment-friendly energy. The hope is that the benefits of their activities will extend far beyond the actual scheme's five-plus-three years. Individually and together, the CEERs will do their part to provide a secure energy future for us all!

BIGCCS Centre – International CCS Research Centre

Title of centre:
BIGCCS Centre – International CCS Research Centre
Project owner:
SINTEF Energy Research AS
Partners:
Norwegian University of Science and Technology (NTNU), Aker Clean Carbon, ALSTOM AG, ConocoPhillips Norge, DNV, DONG Energy, Gassco, Hydro ASA, Schlumberger, Shell, Statkraft SF, StatoilHydro, TOTAL E&P Norge AS, British Geological Survey, Center for International Climate and Environmental Research – Oslo (CICERO), German Aerospace Center (DLR), Geological Survey of Denmark and Greenland (GEUS), Geological Survey of Norway (NGU), Resources for the Future, Sandia National Laboratories, Technische Universität München, and University of Oslo
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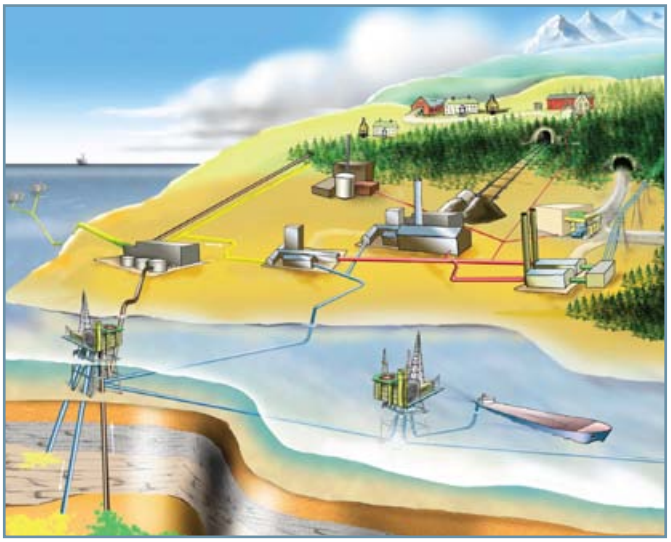

The thematic focus of research activities at the BIGCCS Centre encompasses the entire CO_2 chain. The centre seeks to realise full-scale CO_2 management for power production and industrial processes through long-term, basic research. The centre is working to develop knowledge, methods and solutions that lead to:

- At least 90 per cent CO_2 capture
- 50 per cent cost reduction from current levels
- CO_2 management with efficiency loss of less than 6 percentage points
- A basis for assessing and qualifying storage sites for CO_2 and quantifying storage capacity in Norway and Europe

The centre's activities will promote innovation and value creation. The centre will establish a graduate-level programme with 18 doctoral and eight post-doctoral fellows, and will draw on the know-how of 26 partners from eight countries. The centre builds on the activities of the SINTEF Group/NTNU research community and its considerable expertise in CO_2 management amassed over a period of 25 years. The centre's activities will 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. CO_2 transport is a smaller yet vital thematic area, where research will focus on phenomena associated with the CO_2 stream in relation to materials-related challenges. The centre will investigate new processes of capture that utilise membranes and sorbents, as well as engage in research in other important areas, including combustion in pure oxygen and combustion of hydrogen. The centre will also conduct research on CO_2 management for industrial processes and offshore applications. The centre's industrial partners will ensure that research activities remain commercially relevant and will be actively involved in work on integrated value chains for CO_2. The BIGCCS centre will assume the role of international Centre of Excellence in CCS research in connection with ongoing projects within the consortium and the European Carbon Dioxide Capture and Storage Laboratory Infrastructure (ECCSEL) project.

Centre for Environmental Design of Renewable Energy (CEDREN)

Title of centre:
Centre for Environmental Design of Renewable Energy (CEDREN)
Project owner:
SINTEF Energy Research AS
Partners:
Norwegian Institute for Nature Research (NINA), Norwegian University for Science and Technology (NTNU), Freshwater Ecology and Inland Fisheries Laboratory at the University of Oslo, UNIFOB,. Norwegian Institute for Water Research, International Centre for Hydropower (ICH), Norconsult, SWECO„ Multiconsult, HydroNet (CAN), The University of Life Sciences and Natural Resources (A), Royal Institute of Technology (S), Swedish University of Agricultural Sciences, National Environmental Research Institute (DK), Agder Energi, EBL, Eidsiva Vannkraft, Hydro, Sira-Kvina kraftselskap, Statkraft, Statnett, Directorate for Nature Management (DN), Norwegian Water Resources and Energy Directorate (NVE)
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The objective of the centre is to develop and disseminate effective design solutions for renewable energy production that take adequate account of environmental and societal issues, both locally and globally. The centre will refine and adapt the environmental impact analysis methodology originally developed and implemented for hydropower. These methods will be transferred to other forms of renewable energy production – initially to onshore wind power and power lines, and later to offshore wind power, bioenergy and solar energy. Although renewable energy from water, wind, sunshine and bioresources will be critical in achieving Norway's targeted greenhouse gas reductions, production may entail some negative local effects on the ecology and society, which may trigger public resistance and conflict. Gaining acceptance for the comprehensive expansion of renewable energy production will therefore require solutions that minimise any negative social and ecological impact. At the same time, this expansion must be financially sound and feature technically stable systems. This will call for a coordinated and integrated effort involving a large number of scientific disciplines.

It is the vision of CEDREN to assist in developing solutions such as these. One main challenge of the initial phase is to determine how to adapt and convert the current system of hydropower to new operations that utilise large quantities of non-regulatable power production from wind, both onshore and offshore. Hydropower will be able to provide the necessary output reserve and serve as a stabilising source, but this must be accomplished without unacceptable strain on the environment. The centre will place priority on effectively disseminating research findings to various users in Norway and abroad.

Bioenergy Innovation Centre (CenBio)

Title of centre:
Bioenergy Innovation Centre (CenBio)
Project owner:
Norwegian University of Life Sciences (UMB)
Partners:
R&D: Norwegian University of Science and Technology (NTNU), SINTEF Energy Research, Norwegian Forest and Landscape Institute, Norwegian Institute for Agricultural and Environmental Research (Bioforsk), and Vattenfall (S); *Industry*: Arena Bioenergi Innlandet, Norwegian Association of Forest Owners, Norwegian Forestry Association (NORSKOG), Agder Energi, Eidsiva Bioenergi, Hafslund, Trondheim Energi Fjernvarme, Vattenfall Heat Nordic (S), Norske Skog, Xynergo, Norsk Protein, Nord-Trøndelag Elektrisitetsverk, Norwegian Farmers' Union, Oslo Municipality Waste-to-Energy Agency (EGE), City of Amsterdam Waste and Energy Company (AEB) (NL), Waste Management Norway, Energos, Cambi, Jøtul, Bionordic, and Grant Kleber; *Foreign institutions*: Stanford University (USA), US Forest Service , University of Minnesota (USA), Finnish Forest Research Institute , Chalmers University of Technology (S), Abo Akademi University (SF), Technical University of Denmark, University of Copenhagen (DK), Vienna University of Technology (A), and Technical University Bergakademie Freiberg (D)
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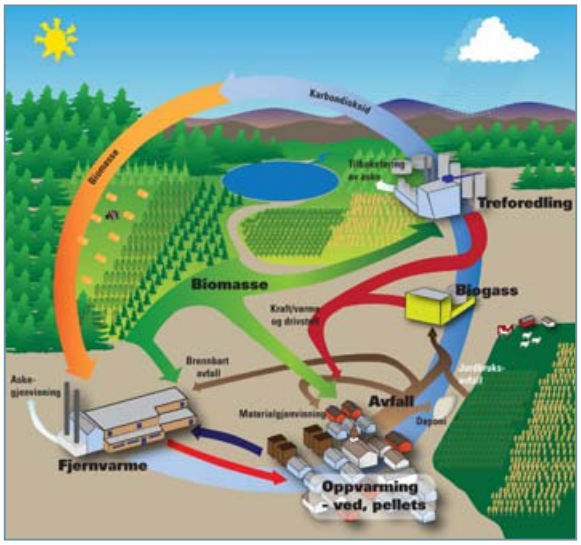

The objective of CenBio is to develop the basis for a sustainable, cost-effective bioenergy industry in Norway in order to realise the national goal of doubling bioenergy use by 2020.

CenBio will constitute the national team for stationary bioenergy use for the coming decade, which will coordinate and integrate expertise from diverse scientific fields. The assembled consortium consists of leading research groups and 18 key bioenergy companies in Norway – both large and medium-sized – as well as trade organisations for bioenergy and two large foreign firms.

The centre will tackle some major challenges. Production of and accessibility to biomass for energy purposes will have to be increased substantially, and must be accomplished with sustainable methods. Competition for land use and for available biomass will only intensify, so great improvements must be made in the efficiency of biomass production, energy conversion and applications of bioenergy so that the targeted increase in exploitable bioenergy will require the smallest possible amounts of limited resources. Flue gas emissions from conversion of biomass to heat must be reduced, while waste and by-products need to be upgraded in order to be ecologically recycled as nutrients. Sustainability – which includes environmental, climatic, economic and societal impacts – will be documented for the entire bioenergy value chain.

The centre's researchers will expand and intensify their networks and collaboration with bioenergy-related activities under EU research programmes, Nordic Energy Research, the International Energy Agency (IEA) as well as with bioenergy projects associated with research and technology agreements between Norway and the USA.

Norwegian Centre for Offshore Wind Energy (NORCOWE)

Title of centre:
Norwegian Centre for Offshore Wind Energy (NORCOWE)
Project owner:
Christian Michelsen Research (CMR)
Partners:
Unifob AS, University of Bergen, University of Agder, University of Stavanger and Aalborg University (Denmark), with support from more than 20 industrial partners and organisations within energy production, offshore technology and wind power technology
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Power production from wind energy at sea is a major new industrial opportunity for Norway and Norwegian private enterprise. The Norwegian Centre for Offshore Wind Energy (NORCOWE) will be a cross-disciplinary competence and resource centre that contributes to realising this opportunity.

Existing commercial solutions for power production from offshore wind are based on traditional (land-based) wind turbine concepts installed on the seabed relatively near the coast and in shallow waters. Floating solutions for deeper waters are being developed, but are still in the experimental phase.

At NORCOWE, key industry players and research groups from Norway pool their efforts with leading stakeholders from Denmark and other countries to create a research community with wide-ranging expertise. 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 will give priority to activities involving technological and environmental challenges within five main areas:

- Wind and sea modelling
- Technology and new concepts
- Localisation and operations
- Wind farm optimisation
- Safety and the environment

The centre will collaborate with industry as well as other research groups and competence centres on gaining access to infrastructure and testing facilities. NORCOWE will also help to foster future personnel resources by educating a significant number of Master's and doctoral candidates.
NORCOWE is a future-oriented centre that targets entirely new industrial areas for which complete technological solutions do not yet exist.

Norwegian Research Centre for Offshore Wind Technology (NOWITECH)

Title of centre:
Norwegian Research Centre for Offshore Wind Technology (NOWITECH)
Project owner:
SINTEF Energy Research AS
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, Statkraft, StatoilHydro, DONG Energy, Vestavind, Lyse, ConocoPhillips, Statnett, Umoe Mandal, Aker Solutions, SmartMotor, ScanWind, Devold AMT, SWAY, ChapDrive, Fugro OCEANOR, Vestas, DNV. Associated partners: National Laboratory for Sustainable Energy at the Technical University of Denmark (Risø DTU), Massachusetts Institute of Technology (MIT), National Renewable Energy Laboratory, Innovation Norway, and Norwegian Wind Energy Association (NORWEA)
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By 2020, an estimated NOK 1000 billions are expected to be invested within the Europe for installation of 50 gigawatts (GW) of offshore wind power. Development is underway but is still in an early stage. Roughly 1 GW of offshore wind power has been installed so far, primarily in shallow coastal waters, using what is known as land-based wind power technology.

There is enormous potential for wind power production in deep waters, provided that costs can be reduced to competitive levels. This requires developing offshore technology, a field in which Norwegian industry and research institutions are at the forefront, designing and delivering sub-structures (jackets, tripods) for bottom-fixed wind turbines in medium-depth waters, for example, and developing the HyWind, SWAY and WindSea floating concepts. A strong initiative such as the establishment of the Norwegian Research Centre for Offshore Wind Technology is vital to ensuring steady progress.

The centre's partners are international leaders in critical fields, including offshore technology and grid connection. The centre will build on relevant, ongoing R&D activities (www.sintef.no/wind), utilise in-house laboratories such as the ocean basin at MARINTEK, and employ the results of planned full-scale field trials such as those connected with the HyWind project.

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

The centre's R&D activities will primarily be precompetitive, and will include establishing a top-notch doctoral and post-doctoral programme. It is essential that the centre is launched at this point in time, as development is in the start-up phase and Norwegian industry still has a competitive advantage thanks to its many years of experience in offshore oil and gas-related activities.

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:
Norwegian University of Science and Technology (NTNU), The SINTEF Group, University of Oslo, Elkem Solar, FESIL Sunergy, Hydro, NorSun, Prediktor, REC, Scatec, Solar Cell Repower and Umoe Solar
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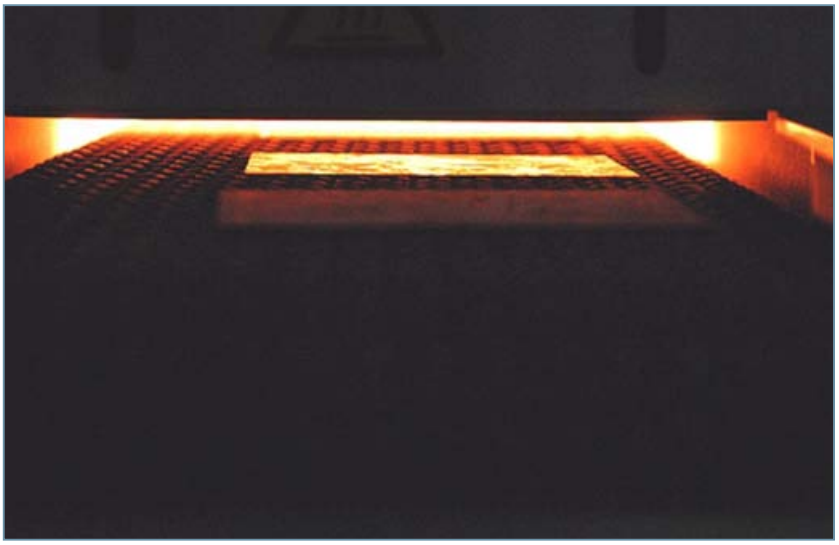

The primary objective of the centre is to provide both current and future players in the Norwegian solar cell industry with access to world leading technological and scientific expertise. In doing so, the centre will help the Norwegian solar cell industry to maintain a leading position in this rapidly growing industry, thereby enabling the solar cell industry to become one of the most important land-based industries in the country. The centre brings together the Norwegian solar cell industry and the major solar cell research environments in Norway. Together, they form a world-class environment for the synthesis and characterisation of crystalline silicon, which is the most essential material for producing solar cells and for the modelling, characterisation and synthesis of new materials and process technologies for the next generation of solar cells. The centre partners have gained extensive expertise in these areas through research projects over many years.

In addition to maintaining a high level of research activity across institutional borders and investing in laboratories, the centre will assume the vital task of educating new researchers. In order to satisfy the recruitment needs of the industry and research community, the centre will educate 23 doctoral and 21 post-doctoral candidates, and establish a national school for researchers in solar cell technology.

The research activities in the centre are grouped into six work packages, five of which involve competence-building: mono- and multi-crystalline silicon, next-generation modelling tools for crystallising silicon, solar-cell and solar-panel technology, new materials for next-generation solar cells, and new characterisation methods. The sixth is a value-chain project that will apply the findings of the other five work packages to produce working solar cell prototypes.

SUbsurface CO_2 storage – Critical Elements and Superior Strategy (SUCCESS)

Title of centre:
SUbsurface CO2 Storage – Critical Elements and Superior Strategy (SUCCESS)
Project owner:
Christian Michelsen Research
Partners:
Institute for Energy Technology (IFE), Norwegian Institute for Water Research (NIVA), Norwegian Geotechnical Institute (NGI), Unifob, University of Bergen, University of Oslo, and University Centre in Svalbard (UNIS)
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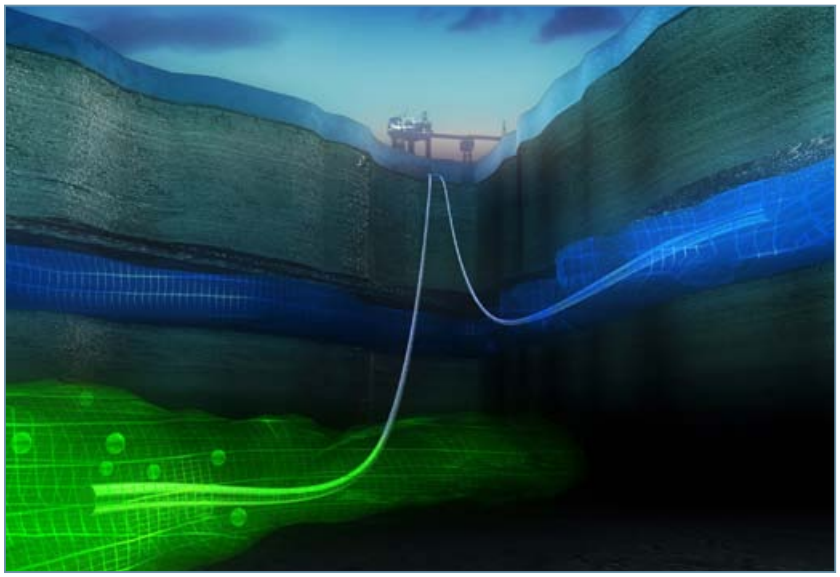

Climate change is one of this century's most crucial challenges. Facing it will require the development and application of technology for CO_2 capture and storage (CCS). CO_2 capture is a complex, costly process on which a great deal of R&D has been conducted. Less emphasis, however, has been placed on CO_2 storage. Although the knowledge and experience gained from oil drilling and recovery is applicable here, much more knowledge is needed about the impacts of injecting CO_2 underground. This will be critical to achieving international targets of sequestering 15-20 billion tonnes of CO_2 annually.

The SUCCESS centre will focus its efforts on four key areas related to CO_2 storage: the in-reservoir behaviour of CO_2 gas; seal properties; monitoring; and the effects of leakage on the marine environment. In addition, the centre will provide an important educational function by establishing a "CO_2 school", whose planned activities will target vital knowledge needs and will include fundamental experimental and theoretical studies, analysis of rock samples, development of mathematical models, numeric modelling, and testing in field laboratories.

The SUCCESS consortium possesses valuable 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 will collaborate with other institutions and international research networks as well.

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:
The SINTEF Group, Skanska, Maxit, Isola, Glava, Protan, Hydro Aluminium, YIT Building Systems, ByBo, Multiconsult, Brødrene Dahl, Snøhetta, Norwegian Defence Estates Agency, Directorate for Public Construction and Property, The Norwegian Housing Bank, Federation of Norwegian Construction Industries, Norwegian Technology, National Office of Building Technology and Administration
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The centre's vision is to become a national research hub that will place Norway at the forefront of research, innovation and implementation of buildings for the future – with extremely low energy requirements and a zero net climate footprint. The primary objective is to develop 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 demolition. The centre will comprise experts in materials technology, construction technology, energy technology, architecture and the social sciences – a breadth of expertise that will cover the entire value chain of industrial players in Norway's construction sector.

Key focus areas will include advanced materials technologies, technologies for adaptive and energy-producing building envelopes, energy control and supply systems, energy-efficient use and operation, and concepts and strategies for zero-emission buildings.

The centre will collaborate on relevant activities with the following prominent international research institutions: VTT Technical Research Centre of Finland, Chalmers (Sweden), Fraunhofer (Germany), University of Strathclyde (Scotland), Massachusetts Institute of Technology (USA), Lawrence Berkeley National Laboratory (USA), Tsinghua University (China), and the Netherlands Organisation for Applied Scientific Research – TNO.

In total, the companies represented in the ZEB consortium account for an annual turnover of over NOK 200 billion and have more than 100,000 employees. ZEB is a historic initiative within the construction industry and a unique endeavour internationally. Over 40 % of all greenhouse gas emissions in Europe are from the construction industry, and according to the UN Intergovernmental Panel on Climate Change, this industry is where emissions-reducing measures are most profitable. The development of zero-emission buildings is therefore a vital environmental measure.

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

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