

Report on progress

Annual report to United Nations Global Compact

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Communication on progress (COP)

1 Preface

SINTEF became member of UN Global Compact in January 2009, and this is our first communication of progress report. As there are no previous reports to compare for progress, this report will primarily describe the present status and work of SINTEF with regard to UN Global Compacts 10 principles. However, we will primarily concentrate on activities performed during the last 24 months.

SINTEF is an independent research and technology not-for-profit organisation, providing R&D services to clients in Norway and abroad. However, as we have no production or manufacturing activities, the number of suppliers and subcontractors is rather low, and the vast majority of service activities in SINTEF are performed within Norway even for projects with international clients. It should also be mentioned that most of our international clients are companies based in Europe or North America, i.e. countries where the UN Global Compact principles are reasonably well in accordance within the national legislations.

As SINTEF's direct activities by themselves is largely performed in good accordance with the UN Global Compact principles, this COP will mainly describe the content of our research activities for our clients and how the results from this research may have an impact on the global environment and society in a way that will support the ten principles. Here it should also be noticed that SINTEF also have a small research group assisting clients directly in developing and improving their corporate social responsibility (CSR) performance, including studies of the impact of various CSR practices.

2 Statement of continued support – Technology for a better society

SINTEF's vision is "*Technology for a better society*". This vision both inspires and commits us.

Our future will be characterized by new possibilities that will be created by a high level of knowledge and advanced technology, and through closer international cooperation. But it will also be marked by difficult choices, and by major efforts to ensure that our development is sustainable.

Our expectations of the solutions offered by the knowledge society are great. SINTEF has an important role to play, and a responsibility to assume. Our ambition is to make important contributions to sustainable development through our know-how, research and innovation, at both national and international level. This we intend to do in collaboration with our partners in the public and private sectors, and with the political authorities.

In order to perform this task on behalf of the community, SINTEF has developed a value-based strategy as a platform for action. The strategy has been anchored in the goals and values of the organization via a comprehensive process of development. The strategy will act as a set of guidelines for our development and priorities in the years to come and will help us to realise our vision in the course of our daily work.

Working together, we are creating technology for a better society. As a consequence of our struggle to fulfill our vision, SINTEF will continue to actively respect and promote the ten principles of UN Global Compact.



Unni Steinsmo
President of SINTEF

3 Human rights

All activities in SINTEF shall adhere to the principles laid down in our ethical guidelines document. This document states among others that:

- SINTEF shall always ensure neutrality related to all political parties in their activities
- SINTEF shall value all humans equal, and no discrimination will be tolerated, whether on grounds of race, gender, religion, sexual orientation, or age.
- Employees of SINTEF have the right to deny the participation in research project if the content of the projects are in conflict with their personal religious or ethical conviction.
- SINTEF shall strive to achieve a good work environment characterized by equality and equal opportunities.

In order to ensure that these principles are followed, management procedures in SINTEF include the following tools:

- The document “SINTEF statement of corporate business ethics and social responsibility on entry into contracts”, which are used as a addendum to all international contracts to ensure that our clients are not in direct conflict with the ten principles.
- The document “Supplier Evaluation Questionnaire”, which must be submitted and accepted for all major suppliers to SINTEF before contracts of delivery may be signed.
- Participation in national Research Ethics Committees
- SINTEF Ethical Ombudsman, whose responsibility is to investigate whether our ethical principles are followed, and to receive and handle ethical complaints from employees or clients.
- Ethics module in SINTEF internal training courses for new employees and new managers.
- Ethics module easily available from the front page of the SINTEF intranet.

Whenever SINTEF wants to establish a new international office abroad, a risk analysis shall be performed, where ethics and CSR aspects will be part of the analysis. A similar risk analysis will be performed for projects where part of the work will be performed in a country outside EU, Canada or US.

SINTEF also contributes to the improvement of global human rights is our research activities within our research unit ”Global Health”.

3.1 Examples of research activities in Global Health

The research unit ”Global Health” is composed of two groups of researchers, where the first one works on the development of health services for the population in poor countries, and the second sub-unit concentrates on the improvement of life conditions for disabled persons and other vulnerable population groups.

They are currently involved in the following projects:

- In Venezuela and South Africa, we study the effect that large-scale political change has had on health worker policy.
- In Nepal, we explore the acceptability of using volunteer health workers from the perspective of policy makers and the volunteers themselves.
- In Norway, we study people’s experiences of living with a rare disorder and the manner in which they are treated by health and social services.
- In Southern Africa, we study the acceptability of health services and perceptions surrounding sexuality, HIV/AIDS, and health.
- in Sub-Saharan Africa we map the living conditions of vulnerable groups, explore the causes of poor access among groups, both on an individual and a broader social and political level, and collaborate with local groups in the production and distribution of assistive devices.

More details on these research activities may be found in Appendix A.

4 Labour

SINTEF policy on employees focuses on the following principles:

- SINTEF is to be an attractive place to work offering unique prospects for those with the ability and drive to develop their potential
- SINTEF is to ensure that high ethical standards and awareness of Health, Safety and Environment (HSE) are applied to all of its activities
- SINTEF is to offer a work environment in which its staff are respected and appreciated, and where they are given the opportunity to develop their abilities in cooperation with their colleagues
- SINTEF is to offer professional challenges and tasks that have a high value for its customers and society
- SINTEF is to recruit and keep competent people in a global labour market
- SINTEF is to encourage team spirit, creativity and initiative in its scientific groups
- SINTEF is to develop leadership that is explicit, inclusive and inspiring

SINTEF involves their trade union organizations in all discussions regarding issues involving employees and organizational changes. Our employees are organized within 5 different organizations, and SINTEF maintain an identical collective agreement with all of these. In addition to questions of remuneration, the collective agreement regulates issues like

- Equal rights policy
- Recruitment policy
- Advancement policy
- Employee representation in the SINTEF Council and the SINTEF Board

Membership in trade unions is voluntarily, and member lists are confidential. However, the number of member in each of the 5 organizations in SINTEF is public, and shows that 67% of our employees have chosen to become a trade union member.

By the UNIVERSUM evaluation of attractive working sites, the Norwegian University Students within technology has ranked SINTEF among the three most attractive employers for the last three years.

SINTEF employees are strongly involved in the development and implementation of HSE policies. This happens both through their elected HSE representatives, but also through strong awareness and considerations in their research activities. Every second year SINTEF issues a major anonymous inquiry among all employees, in order to evaluate the state of the working conditions and working environment. The result of this inquiry is distributed to all managers in our organizations, and their management performance is subsequently measured by how well they manage to improve conditions based on the inquiry.

SINTEF has also entered into a framework agreement with Norwegian State authorities regarding the integration of employees with temporary or permanent work disability (the "IA treaty"). This agreement requires that attending companies should strive to obtain the following three main goals:

- Reduced sickness absence
- Increased number of disabled employees
- Increased retirement age

Except for a few (<10) representatives at our Houston and Rio de Janeiro offices, all SINTEF employees work in our research facilities in Norway and Denmark. However, SINTEF recruits scientific personnel of all nationalities, and presently persons from 69 different countries work in our organizations. SINTEF provides training courses for employees in Norwegian and English language, in addition to offering Norwegian language courses to our foreign employees.

4.1 SINTEF research on labour conditions and technology management.

SINTEF's research unit on labour research is managing research projects with the aim of supporting and encouraging freedom of organization, right to collective bargaining, and the elimination of discrimination against employees and employee groups. As part of this activity, SINTEF has during the last two years:

- Participated in the governmental committee on corporate democracy and employee participation.
- Participated in the European FP6 project "WORKS" on understanding and development of business-employee co-operation in the EU.
- Participated in the European project "Walqing" on qualitative improvement of working conditions in expanding business sectors.
- Participated in the European research network "EESUN", a network of researchers and consultants working on labour science and employee participation issues.
- Conducted an evaluation of the Norwegian "IA Treaty" for the period 2001-2009.
- Conducted a study on the usability for "adaption guarantees" as a tool to improve increased employment for permanently disabled persons.

5 Environment

The environmental policy document of SINTEF states that our organization shall consider the principle of sustainable development in all their activities, including business management, social responsibility and environmental protection. Both in our research activities and in our daily business management SINTEF shall provide for the adequate protection of our external environment. Our policy shall ensure that our organization is continuously improving its environmental performance.

In short, SINTEF will:

- contribute to the establishment of national and international R&D programmes aimed towards development of environmental-friendly technologies
- increase the emphasis on environmental issues in our development of laboratories and knowledge
- in our own business activity, work for the constant reduction of climate gas emissions and energy consumption, and avoid release of potentially harmful substances to earth, water or air.
- communicate our knowledge and provide terms for society debates on development of national and international environmental policies.

SINTEF has during the last two years worked in order to satisfy the requirements for certification by the international ISO 14001 standard. The first sub-unit of SINTEF will be certified in 2011. SINTEF has also in 2010 invested in new technology for the control and reduction of energy consumption.

However, the major contribution from SINTEF to the fulfillment of the UN Global Compact principles is our extensive research activity within energy and environmental research for our clients. When our clients apply new environmental-friendly technology developed by SINTEF, the global ecological footprint is reduced far more than what is possible by implementation of improved environmental performances within our own activities.

5.1 Examples from SINTEF's research on energy and environment

More details on our research activities may be found in Appendix A.

5.1.1 Research on Industrial Co-processing

SINTEF has developed a strong international activity on "Industrial Co-processing", that is the utilization of industrial and hazardous waste materials in the industrial production of cement and concrete. Following prototype activities in Norway, this research field is now part of strong bilateral agreements between Norway and India/China.

SINTEF is currently involved in the following projects:

- Strategic cooperation with Asian Institute of Technology on Hazardous Chemicals Management
- Strategic cooperation with Ministry of Environmental Protection, China, on Environmentally Sound Management of Hazardous and Industrial Wastes in Cement Kilns

- Strategic cooperation with Central Pollution Control Board, India, on recovery of alternative fuels and raw materials and treatment of organic hazardous wastes in resource and energy intensive industry.

The three mentioned projects will contribute to strengthen the compliance with the Stockholm and the Basel Convention, the Montreal Protocol, the UN framework Convention on Climate Change and the Strategic Approach to International Chemicals Management (SAICM).

5.1.2 Research on environmental-friendly energy and energy materials technology

SINTEF initiates R&D in order to promote cost-effective and environmentally friendly solutions for energy consumption and the supply of power and heating. This contributes to reducing environmental loads, increasing value creation for the companies in this sector and thereby achieving better utilization of energy resources for society.

We also make significant contributions towards increasing the development and recovery of Norwegian petroleum resources in an environmentally friendly and secure manner thanks to new technologies developed for oil companies and the related service industry.

SINTEF is currently involved in six large research centers:

- BIGCCS Research Centre for enabling sustainable power generation from fossil fuels based on cost-effective CO₂ capture, safe transport, and underground storage of CO₂
- NOWITECH (Norwegian Research Centre for Offshore Wind Technology), a centre for pre-competitive research on cost-effective offshore wind farms. Emphasis is on “deep-sea” (plus 30 meters) including bottom-fixed and floating wind turbines.
- CEDREN (Centre for Environmental Design of Renewable Energy), where the aim 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.
- ZEB (The Research Centre on Zero Emission Buildings), a centre for the development of competitive products and solutions for existing and new buildings that will lead to market penetration of buildings that have zero emissions of greenhouse gases related to their production, operation and demolition.
- CENBIO (The Bioenergy Innovation Centre), whose objective is to develop the basis for a sustainable, cost-effective bioenergy industry in Norway in order to achieve the national goal of doubling bioenergy use by 2020.
- The Norwegian Research Centre for Solar Cell Technology aims at further developing the strong, Norwegian photovoltaic industry and substantially contributing towards making solar energy a significant renewable energy source.

SINTEF also executes several other R&D projects for national and international clients connected to:

- development and production of solar cell materials with higher efficiency
- development, design and construction of more effective wind power generator mills
- more effective use of bioenergy
- development of methods and processes for improved CO₂ capture from power plants based on gas and coal combustion
- recycling of materials, in particular recycling of aluminium metal
- improved production of high-grade products from recycled aluminium

5.1.3 Research on clean water technologies and water distribution systems

SINTEF recognizes that the supply of good, safe drinking water is one of the big challenges in the future. SINTEF has developed strong research groups working with development of clean water technologies and safe and efficient water distribution systems. Below we mention briefly some of the project activities within this research field.

SINTEF is currently involved in the following projects:

- Technau - Optimisation of water distribution system operation and maintenance
- CARE-W - Computer Aided Rehabilitation of Water and Wastewater Networks

The technologies developed in the Technau and CARE-W projects is presently applied in major cities in Europe and North America, but SINTEF is planning to enter into a larger cooperation agreement with China in order to implement these technologies in other areas.

6 Anti-corruption

SINTEF executes a strict policy regarding corruption in all its forms. Our ethical guidelines document states that “...*Corruption undermines confidence in a state governed by law and in democratic institutions, weakens ethical and moral values, hinders rationalization and efficiency and undermines all forms of business activity and free competition. Corruption damages our good name and puts SINTEF and the individual at risk. SINTEF distances itself from all forms of corruption and will actively work to ensure that it does not occur in our commercial activity.*”

The document also states that SINTEF will work to prevent practices of minor payment and that SINTEF will compete on a fair and ethical basis within the framework of current rules of competition, and will not prevent others from competing with us.

The anti-corruption ideas are mandatory topics in internal training courses for new employees and new managers, but are also regularly discussion topics on larger management meetings.

In order to further support this policy, SINTEF has since 2007 been a member of the international anti-corruption organization Transparency International.

To make sure that corruption practices are not developed in any parts of the organization, SINTEF encourages whistle-blowing and has established anonymous reporting channels to the ethical ombudsman in SINTEF.

Appendix A

In this appendix we will describe some of our research activities in more detail.

A1. Research on global health

The vision for the activity is expressed as “*Health and welfare for all* “ and is based upon the notion that effective interventions exist for many of the world’s biggest challenges in health and social welfare. However, many people still have no access to essential services, often because of economical, socio-political, or physical constraints. At the Global Health unit we study the barriers to universal access to health and social services and the manner in which high-quality services can be implemented.

1. Increasing access to health and social services

One common barrier faced by people across the world is the severe lack of health workers. Many governments address this problem by training more health workers; enforcing regulations regarding migration and work location, paying particular incentives to health workers working in underserved areas, and shifting certain tasks to lower-level health workers. How are these policies decided? How effective and cost-effective are they? And what are the factors that can help or hinder their success? We are currently involved in the following projects:

- In Venezuela and South Africa, we study the effect that large-scale political change has had on health worker policy.
- In Nepal, we explore the acceptability of using volunteer health workers from the perspective of policy makers and the volunteers themselves.

We develop systematic reviews of the global literature summarizing the effect of using community health workers and the cost-effectiveness of using these workers in vaccination programs.

2. Ensuring the acceptability of health and social services

Many interventions have proven effective in study populations. But for such interventions to be sustainable in the real world, they also need to be socially acceptable, practical and affordable to the men, women and children who use these interventions, for the health care workers who deliver them, and for the policy makers who select and finance them. We are currently involved in the following projects:

- In Norway, we study people’s experiences of living with a rare disorder and the manner in which they are treated by health and social services.
- In Southern Africa, we study the acceptability of health services and perceptions surrounding sexuality, HIV/AIDS, and health.

3. Securing equitable health and social services

Within the same country, access to education, employment, information and health care is systematically lower among certain groups than others. Vulnerable groups include people with disabilities, girls and women, and the very poor, who are often denied equal opportunities to participate in and contribute to their society. Over several years, the unit has strived to raise awareness and find solutions to this issue, for instance through the following projects in Sub-Saharan Africa:

- map the living conditions of vulnerable groups
- explore the causes of poor access among groups, both on an individual and a broader social and political level
- collaborate with local groups in the production and distribution of assistive devices

SINTEF strive to make use of the most appropriate research methods for the question at hand. We are a multidisciplinary team of researchers that make use of both qualitative and quantitative research methods. Our research projects cover global, national, local and individual perspectives, and the quality of our research is dependent on collaboration with international and local policy makers, researchers, local organizations and end users in the countries where we work.

4. Coherence with trends and developments in field

At a time where the Norwegian Foreign Minister launches the concept Health as Foreign Policy, the Prime Minister's special projects include the achievement of the Millennium Development Goals 4 and 5, and the Director General of Health is elected as board member to the World Health Organization, there is a great need for knowledge generating research units like SINTEF's Global Health and Welfare.

The Global Health unit counts itself as among the research groups in the forefront of the field, and the head of the unit is elected as the Vice Chairman of the Norwegian Forum for Global Health Research. Members of the unit is asked for advice on relevant themes in the public sphere, and have on two occasions arranged sessions in large global WHO arrangements.

5. Impact of the Global Health unit's research

Through its basic research, the unit aims to contribute to the world's collective knowledgebase. The direct impact of such research is difficult to gauge within the field of global health, as it often is quite a distance from research results are available until the new knowledge is implemented, and even longer before any impacts can be measured by any certainty.

The basic research activities are crucial to the commissioned research at the unit, primarily because the basic research allows for in-depth scrutiny of phenomena, and for keeping updated in the field. Commissioned research presumes that the researchers are up-to-date with developments within the domain. Applied and commissioned research often generates new ideas and hypotheses that feed into new basic research.

The unit has for more than 10 years been involved in long-term research and development activities in the field of disability and rehabilitation in southern Africa. A solid network and fertile partnerships with research institutions as well as government ministries and civil society emanate from this activity. Key elements in this has been establishment of a regional database on living conditions among disabled people and two operating production lines for manufacturing and assembly of wheelchairs as well as a service delivery system. There are many concrete examples of impact on individual and policy levels from the R & D activities led by SINTEF over this time period. Both the studies on living conditions among people with disabilities and the production of wheelchairs represent innovative R & D. The first has generated the first generation of detailed information about the situation for individuals with disabilities through a participatory research approach that has contributed directly to capacity building, development of new networks and working relationship between civil society (the disability movement) and research institutions. The second has developed a contextually based service delivery system and created sustainable workplaces for individuals with disabilities in Namibia and Zimbabwe.

A2. Research on Industrial Co-processing

SINTEF has developed a strong international activity on "Industrial Co-processing", that is the utilization of industrial and hazardous waste materials in the industrial production of cement and concrete. Following prototype activities in Norway, this research field is now part of strong bilateral agreements between Norway and India/China. Below, we present these activities in some more detail:

1. Strategic cooperation with Asian Institute of Technology

SINTEF has carried out a strategic cooperation with Asian Institute of Technology (AIT) since 2006 on Hazardous Chemicals Management supported by the Norwegian Ministry of Foreign Affairs and the Norwegian Embassy in Bangkok. The ongoing cooperation has been successful in transferring knowledge and building capacity through AIT regular courses and regional seminars, and by carrying out technical cooperation in South East Asia. The cooperation falls within the recommendation of the Strategic Approach to International Chemicals Management (SAICM), an international policy framework to foster the sound management of chemicals was adopted by the International Conference on Chemicals Management (ICCM) in 2006. The Strategic Approach was mandated by UNEP and endorsed by the Johannesburg World Summit on Sustainable Development in 2002 and the New York World Summit in September 2005.

2. Strategic cooperation with Ministry of Environmental Protection, China

SINTEF has been responsible for the Sino-Norwegian project on Environmentally Sound Management of Hazardous and Industrial Wastes in Cement Kilns in China, launched in 2006. The objective has been to prepare the basis for implementation of safe and environmentally sound treatment and recovery of hazardous and industrial wastes in the Chinese cement industry. The project was implemented by Ministry of Environmental Protection MEP/FECO in cooperation with local EPBs, Chinese research institutions and industry. The project have conducted baseline studies and prepared reports on best international practice, conducted training and capacity building and test burns with hazardous materials in several cement plants and prepared standards and guidelines. The project has recently been approved for an extension until 2014. The activities of the second phase will focus on the implementation of the guidelines and standards developed in the first phase to enable the EPBs in issuing local permits for co-processing; to prepare and test guidelines on waste pre-processing and demonstrate practical co-processing over longer periods with available waste categories which creates problems in the daily life in China; to build capacity and disseminate information on pollution prevention from the cement industry of CO₂, mercury and POPs; to prepare the input for a national plan and a strategy for the implementation of large scale co-processing in China; to continue to build capacity and disseminate information of the possibilities and limitations of co-processing by arranging study tours and National and international conferences, and by preparing articles and a instructive video which will be disseminated to the entire Chinese cement industry and all EPBs.

China has thousands of cement plants in operation and the potential for saving energy and resources and for increasing the waste treatment capacity is enormous. The Chinese cement industry produced approximately 1.65 billion ton cement in 2009, more than 50% of the world production, and consumed more than two billion tons of virgin raw materials, close to 180 million tons of coal and around 165 billion kWh of electricity. Cement production release large amounts of dust, NO_x and SO₂ and is according to the US EPA, the third largest source of mercury emissions. Fossil-fuel combustion released around 31.5 billion metric tons of the greenhouse gases worldwide in 2008 and energy use accounted for more than 80 percent according to the International Energy Agency. China is currently estimated to contribute with approximately 7 billion tons, or ~20% of the global release, where a large proportion is coming from the cement industry. Substitution of fossil fuel and raw material with wastes will reduce these emissions significantly. Two Norwegian cement plants are currently substituting 50% of its fossil fuel with wastes; a similar substitution in China could mean a direct reduction of CO₂ emissions in the order of 100 million tons per year or more.

3. Strategic cooperation with Central Pollution Control Board, India

SINTEF is starting four year institutional cooperation with the Central Pollution Control Board (CPCB) within the area of recovery of alternative fuels and raw materials and treatment of organic hazardous wastes in resource and energy intensive industry in India. By integrating co-processing and treatment of wastes in cement and steel production and coal power plants, India can reduce the need for building new and costly waste incinerators and save non-renewable fossil fuels and raw materials. Such practice will reduce the overall green house gas emissions, increase waste treatment capacity and reduce releases of hazardous chemicals. Dedicated incinerators were never built in Norway; all the organic hazardous wastes have been treated in the cement industry, and industry currently substituting more than 50% of its coal with wastes. India needs more capacity for waste treatment; only 12 states have for example facilities for hazardous waste treatment. Hundreds of cement, steel and power plants may however be able to recover a significant amount of the wastes generated. The purpose of the four year project is to build capacity and assist CPCB, State Pollution Control Boards and industry in implementing a safe and sound co-processing and treatment practice in resource and energy intensive industry in India. The project is financially supported by the Norwegian Embassy in Delhi.

This industry-oriented-bilateral project between India and Norway aims to contribute to further increase the utilisation of mineral wastes in Indian cement and concrete industry in an environmental and scientific sound way in order to ensure sustainable energy and resource management. The project will advance the state of the art regarding blended cement and concrete technology as well as providing practical solutions and guidelines. Emphasis will be given to the synergies achieved by using ternary binder systems in concrete mixes as well as the use of appropriate admixtures in order to integrate certain waste materials at higher levels than today's practice. Moreover, focus will also be on internationalization of research in

institutional and industrial level to maintain competence and readiness for technologies to practice and promote sustainable future growth. It aims to use the experiences gained by the Indian partners in close relation with Norwegian partners, in order to take benefits of increased use of mineral wastes. SINTEF Building and Infrastructure will lead the project in cooperation with the Indian partners; NEERI (National Environmental Engineering Research Institute), NCB (National Council for Cement and Building Materials), IITB (Indian Institute of Technology Bombay) and the three Norwegian industrial partners; Borregaard LignoTech, Elkem AS Materials and Norcem AS. This project will also contribute in knowledge building in the climate and environmental sector to encourage sustainable development on economically growing developing country like India by bringing industrial and institution under the BILAT program.

The three mentioned projects will contribute to strengthen the compliance with the Stockholm and the Basel Convention, the Montreal Protocol, the UN framework Convention on Climate Change and the Strategic Approach to International Chemicals Management (SAICM).

A3. Research on environmental-friendly energy and energy materials technology

SINTEF initiates R&D in order to promote cost-effective and environmentally friendly solutions for energy consumption and the supply of power and heating. This contributes to reducing environmental loads, increasing value creation for the companies in this sector and thereby achieving better utilization of energy resources for society.

We also make significant contributions towards increasing the development and recovery of Norwegian petroleum resources in an environmentally friendly and secure manner thanks to new technologies developed for oil companies and the related service industry.

1. BIGCCS Research Centre

The vision of the BIGCCS Centre is to enable sustainable power generation from fossil fuels based on cost-effective CO₂ capture, safe transport, and underground storage of CO₂. The centre develops new knowledge and technology required to accelerate deployment of large scale CCS, through international co-operation. Innovation and value creation is promoted throughout the CO₂ value chain.

The centre is set to achieve goals as 90 per cent CO₂ capture rate, 50 per cent cost reductions and less than 6 percentage points fuel-to electricity penalty compared to state-of-the-art fossil fuel power generation.

2. NOWITECH (Norwegian Research Centre for Offshore Wind Technology)

The objective of the centre is pre-competitive research laying a foundation for industrial value creation and cost-effective offshore wind farms. Emphasis is on “deep-sea” (plus 30 meters) including bottom-fixed and floating wind turbines.

Work is focused on technical challenges including a strong PhD and post doc programme:

- Integrated numerical design tools for novel offshore wind energy concepts
- Energy conversion systems using new materials for blades and generators
- Novel substructures (bottom-fixed and floaters) for offshore wind turbines
- Grid connection and system integration of large offshore wind farms
- Operation and maintenance strategies and technologies
- Assessment of novel concepts by numerical tools and physical experiments.

3. CEDREN (Centre for Environmental Design of Renewable Energy)

The aim 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.

Gaining acceptance for the comprehensive expansion of renewable energy production will therefore require solutions that minimize any negative social and ecological impact. 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.

More information on SINTEF's research on environmental-friendly energy technologies may be found on <http://www.sintef.no/Home/Environment/>.

A4. Research on clean water technologies and water distribution systems

SINTEF recognizes that the supply of good, safe drinking water is one of the big challenges in the future. SINTEF has developed strong research groups working with development of clean water technologies and safe and efficient water distribution systems. Below we mention briefly some of the project activities within this research field.

1. Technau - Optimisation of water distribution system operation and maintenance

The Technau project aims at developing the following:

- guidelines for O&M practices, i.e monitoring, hygienic control, cleaning of pipes)
- methods for analysis of water quality changes in network (how will a contamination develop and spread through the system)
- advanced software for water quality analysis, addressing in particular particle from resuspension, corrosion and biofilm growth
- safety plans (developing systems for risk and safety analysis, including a hazard database)

2. CARE-W - Computer Aided Rehabilitation of Water and Wastewater Networks

The CARE-W project aims at

- enabling municipal engineers to establish and maintain effective management of their water networks.
- developing a rational framework for water network rehabilitation decision-making, including a control panel of Performance Indicators (PI) for rehabilitation and procedures to define the best choice for annual rehabilitation programming and the best strategy of planning rehabilitation investments (at long term, 10 to 20 years)

The technologies developed in the Technau and CARE-W projects is presently applied in major cities in Europe and North America, but SINTEF is planning to enter into a larger cooperation agreement with China in order to implement these technologies in other areas.