

2008 Annual Report, The RENERGI Programme (2004-2013)

The year 2008

The focus on research on environment-friendly energy intensified throughout 2008, at the national and international level alike. This was enhanced by the financial crisis, and many countries now see an opportunity to combine measures for counteracting the crisis with instruments for converting to more environment-friendly energy. Published in February 2008, the national R&D strategy, Energi21, was drawn up by R&D groups and the energy industry and sets out national objectives and priorities for energy research. The RENERGI programme plays a key role in following up Energi21, whose priorities will provide valuable direction for the RENERGI programme's future efforts.

The broad-based political agreement on climate policy achieved in the Storting in spring 2008, and the subsequent increase in allocations enabled the RENERGI programme to substantially boost its level of activity in 2008. The year was characterised by the implementation of measures to facilitate this. An additional allocation in the revised national fiscal budget for 2008 allowed for the expansion of a range of research-intensive projects, with the aim of achieving the most rapid possible growth in capacity. Meanwhile, the outcome of the grant application assessment process in autumn 2008 resulted in a near doubling of the project portfolio at the start of 2009 compared to the start of 2008. Also in 2008, the Research Council of Norway designated eight new Centres for Environment-friendly Energy Research (the FME scheme). Starting up in the course of 2009, these centres will have an impact on the RENERGI programme's activities and tasks.

The work programme for the RENERGI programme was drawn up in 2004. Since then, the level of political ambition has risen dramatically with respect to measures and technology for converting to more environment-friendly energy. The national strategy Energi21 and the Storting's agreement on climate policy provide important direction. In order to reflect this, the RENERGI programme's work programme is planned to be revised in the course of 2009.

The priority thematic areas for R&D set out in the Energi21 strategy are: renewable power production, renewable heat, raising energy efficiency, energy systems, and research on markets and framework conditions for converting to more environment-friendly energy. There is consensus that energy systems of the future will consist of many different solutions, and that all these thematic areas are important. The RENERGI programme is following up all of them, as well as providing vital support to projects within the transport sector, with particular focus on developing new forms of fuel (bio, hydrogen) as well as technology for electrification of the vehicle population. Of these priority thematic areas, particularly energy consumption/raising energy efficiency in households and industry can provide reductions in CO₂ emissions in the short term. The other thematic areas are aimed more at promoting the increased use of environment-friendly energy in the longer term. Social science-related research in this context involves generating knowledge about how the energy market functions and about barriers to, framework conditions for and incentives in energy policy.

Primary objective

The primary objective of the RENERGI programme is to develop knowledge and solutions as a basis for ensuring environment-friendly, economically efficient and effective management of the

country's energy resources, a highly reliable energy supply, and internationally competitive industrial development related to the energy sector.

Secondary objectives (5-10 year perspective)

- New technologies, systems and solutions that facilitate energy restructuring by improving the efficiency of energy production, transmission and use, making more energy available and improving system security and flexibility.
- Environment-friendly energy systems that reduce emissions of greenhouse gases and other air pollutants, improve land use, etc.
- New, internationally competitive goods and services related to the energy sector.
- Knowledge and analysis as the basis of the long-term energy strategies of the authorities and industry, public debate and the design of public policy instruments.
- Internationally competitive research communities in high-priority fields that collaborate extensively with international researchers and various types of users.

Overall assessment of objectives, status and scientific challenges

The RENERGI programme is designed to foster the development of the clean energy system of the future. The programme takes a cross-disciplinary approach, drawing on both technology-related and social science-related knowledge. Its projects are intended to establish good cooperation between research communities and trade and industry and build capacity and knowledge in highly relevant fields. Generally, the programme receives grant applications from private enterprise, research institutes, and universities and university colleges. In addition, emphasis is placed on promoting participation in international research programmes.

Securing a sustainable supply of energy in Europe is a key challenge for the EU. According to the Energi21 strategy, Norway shows good potential for remaining an exporter of energy in the future, by means of renewable energy such as hydropower, wind power, osmotic power and ocean energy. The RENERGI programme has projects within all of these areas. The phasing-in of more renewable energy in Norway and Europe entails some weighty challenges regarding the power systems, since production is variable, depending on weather and wind conditions. How to utilise Norwegian hydropower as balance power will be an important issue in the years ahead. Developing this area further and raising production of renewable energy will require technological research as well as research on framework conditions and market mechanisms.

The RENERGI programme is now midway in its programme period, and several projects were concluded in 2008. Normally at this stage, plans would be underway to conclude the programme. However, due to the intense focus on climate challenges and the need for more environment-friendly energy, the programme is instead undergoing major expansion. The RENERGI programme portfolio has been doubled from 2007 to 2009, and eight new Centres for Environment-friendly Energy Research (FMEs) are being established, which will be vital for national efforts and development. This growth is also taking place internationally. Countries around the world are stepping up efforts in this field, with environment-friendly energy as a cornerstone of most initiatives and plans. Norwegian research groups are well-represented in EU programmes in relevant areas.

In 2008 the RENERGI programme invested substantial resources in preparing to expand, following the political signals in the escalation plan of the Storting's climate policy. It is considered essential to achieve the most rapid possible growth in capacity and recruitment to the field. Ensuring adequate follow-up of projects within the entire portfolio, as well as effective interaction between the FMEs and the RENERGI programme portfolio, will be crucial in 2009.

About the projects concluded in 2008

In 2008, 44 projects under the RENERGI programme were concluded (i.e. the final report was submitted during the year). These projects received a total of NOK 152 million in funding from the Research Council of Norway; including private funding, they represent a research investment of NOK 314 million. The concluded projects had project periods of one to five years; the majority had a project period of two to four years. On the whole, Researcher Projects and Knowledge-building Projects with User Involvement had longer project periods than User-driven Innovation Projects.

The research conducted on wind power has created a basis for the construction of two pilot facilities. In ocean energy, efforts have led to patent applications. Much of the research has also been aimed at generating new knowledge to be applied to further processes, while some projects have had the goal of fully realising the construction and testing of prototypes. Projects within the thematic area of transport have been oriented toward applied research, and their findings have successfully provided the foundation for constructing and testing prototypes. This in turn has formed a basis for starting up industrial processes and building filling stations. Five of the projects concluded in 2008 involved International Energy Agency (IEA) participation.

Key figures, 2008

Disposable budget available in 2008: NOK 219 million

Funding allocated in 2008: NOK 182 million

Programme's sources of funding in 2008: Ministry of Petroleum and Energy, Ministry of Transport and Communications, Ministry of the Environment, Ministry of Trade and Industry, Ministry of Agriculture and Food, Fund for Research and Innovation

Funding from external sources for projects in 2008: NOK 200 million

Number of projects: 208 projects, including approximately 50 new projects in 2008

Doctoral fellows: 57.5 man-years, including 20.9 man-years by women

Post-doctoral fellows: 16 man-years, including 3.9 man-years by women

The difference between disposable budget and funding allocated will be carried over as funding available for 2009.

Performance indicators, 2008

Number of doctoral degrees awarded: 17, including 5 by women

Scientific articles, peer-reviewed: 70

Scientific articles, not peer-reviewed: 47

Other publications/communication: 398

Measures targeted toward the general public: 58

Measures targeted toward users: 180

Number of patents: 12

Number of licenses: 2

Number of new companies: 2

Number of new products/processes: 7/6

Number of new methods/models/prototypes: 39

The reported performance targets for several of the indicators are lower than for 2007, despite a somewhat higher level of activity. There is likely an under-reporting of activity figures due to an intense focus on new applications and projects.

The RENERGI programme's project portfolio is divided into seven priority thematic areas

In 2008 the RENERGI programme allocated a total of NOK 182 million in funding, distributed among about 200 projects, of which approximately 170 were pure R&D projects within the priority thematic areas. In addition, funding was allocated to a variety of communication projects, and in the form of pre-project support, support for network-building, as well as support for international cooperative measures and for administration.

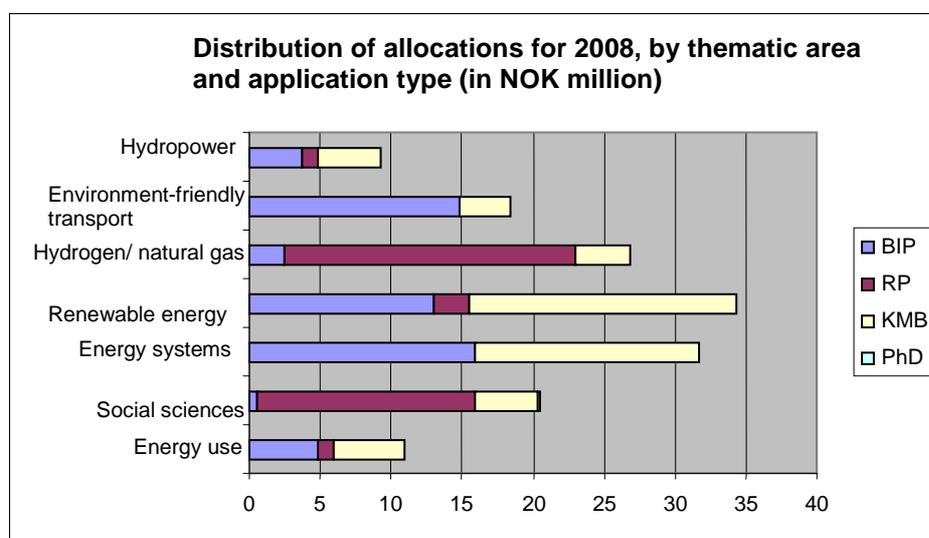


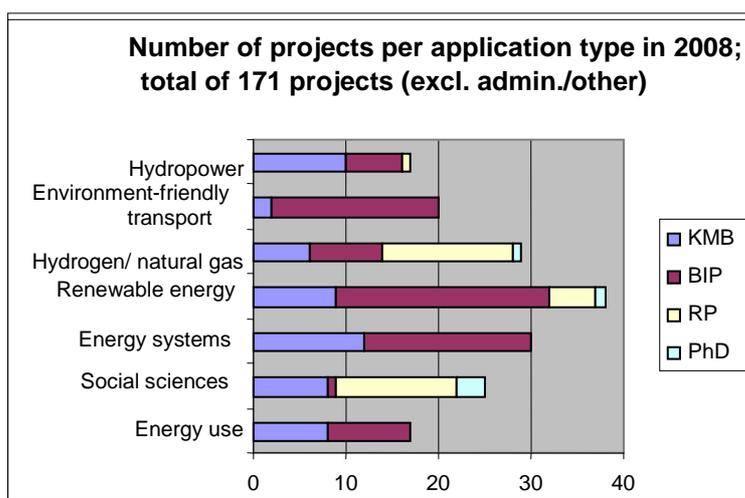
Figure 1. Funding allocated in 2008, by thematic area and application type.

A number of the 200 active projects were in the final phase, so that in 2008 they only had funding carried over from 2007 at their disposal. Of the approximately 130 projects that were

allocated funding in 2008, about 60 projects received under NOK 1 million, while 63 projects received more than NOK 1 million. Eight of the projects were allocated funding of more than NOK 3 million from the Research Council in 2008.

Figure 1 illustrates how funding was allocated by thematic area and application type. There are a particularly large number of User-driven Innovation Projects (BIP) within the areas of environment-friendly transport and energy systems. Within social science research and projects involving hydrogen/natural gas, Knowledge-building Projects with User Involvement (KMB) and Researcher Projects are most numerous.

Figure 2. Number of projects in 2008, by thematic area and application type.



Energy use

At the start of 2008 the programme's project portfolio consisted of 15 projects dealing with energy in buildings, while three projects involved energy use in industry. Assessing the portfolio, the programme board determined that there was a need to enhance the level of industry-oriented activity. The call for proposals for research funding issued in 2008 did not therefore specify any special priority areas, but rather encouraged the submission of grant proposals within the areas of low-energy solutions in buildings and raising energy efficiency in industry. A total of 24 applications were received, and the application assessment process resulted in the approval of two BIP projects and seven KMB projects; the majority of these projects also focused on energy consumption in buildings. Four projects were concluded in 2008 and two more will be concluded in the first half of 2009. One of the projects concluded in 2008 was targeted toward the fisheries industry.

The user-driven projects involve a wide range of participants. SINTEF Energy Research is an active participant in KMB projects, with focus on heating, ventilation and energy control systems in buildings. Recently, greater attention has been directed toward the indoor environment, air quality and noise. SINTEF Building and Infrastructure is also involved in several projects, within areas such as building structure, rehabilitation, and the building as an integrated energy system. To a large extent the projects involving raising energy efficiency in industry deal with different varieties of heat pumps.

Results in 2008: The year was characterised by an increased commitment to and deeper understanding of the importance of raising energy efficiency. In February 2009 Norway's Minister of Petroleum and Energy Terje Riis-Johansen established an expert panel on low-energy solutions whose aim is to make it more attractive to save energy. The establishment of this panel is a result of a newfound appreciation of the value of energy never used. One challenge is to activate industry players, who often demand that energy solutions show a return on investment that is difficult to realise. One of the new FMEs, the Research Centre on Zero Emission Buildings – ZEB, focuses on energy consumption in buildings, which will raise the profile of this field.

The energy market

In 2008 the portfolio comprised 26 projects: one BIP, eight KMBs, 13 Researcher Projects and three doctoral degree projects. Among the ongoing projects, one doctoral degree project, three

Researcher Projects and one KMB will be concluded at the end of 2008/beginning of 2009. Meanwhile, allocations were awarded to eight new projects in December, so the portfolio will provide a sound basis for continued research on social science-related problems regarding the Norwegian energy system, in accordance with the Energi21 initiative and the broad-based political agreement on climate policy achieved in the Storting.

One important change made in 2008 was the transferring of research activities in the field of international environmental treaties from the RENERGI programme to the NORKLIMA programme at year's end, which entailed removing five ongoing projects from the RENERGI programme portfolio.

Results in 2008: Many stakeholders in the social science research community report that they have established successful cooperation – which they intend to maintain – as a result of the FME process. This has strengthened the national network among social science research groups, and they are therefore expected to submit a greater number of grant applications to the RENERGI programme.

Several projects generated exciting findings in 2008, and have published widely in international journals. One example is the project Post-Kyoto Climate Agreements and Technological Innovation, conducted at the Frisch Centre, which has examined international collaboration on developing climate-friendly technology. Researchers have focused on alternatives to the Kyoto Protocol, especially alternatives that emphasise coordinated efforts for technology development. One problem with such agreements is that many countries do not commit to the agreement but nevertheless benefit, without cost, from R&D conducted by others. This undermines their incentive to assist in developing the relevant new technology. The project's findings have shown, however, that the greater the overarching scope of R&D, the lower the costs of using the new technology. These findings contradict the findings of previous research and will likely strengthen all stakeholders' incentives to join the agreement. Another example is the project Designing information measures to promote environmentally sound energy consumption: An interdisciplinary approach. Conducted at the Centre for International Climate and Environmental Research - Oslo (CICERO), the project has investigated how information activities can influence consumers' energy consumption. This project has led to a new project starting in 2009 to perform a comparative analysis in collaboration with French partners.

Challenges ahead: There has been a desire to increase user involvement in social science-related projects. With regard to the RENERGI programme's thematic areas, previous evaluations have recommended that social science-related research questions should be more clearly articulated in the work programme and integrated more effectively into the technological research areas. This has been successful and has led to more resources for social science-related projects, which in turn has enhanced both areas. An internal process is now being carried out in order to gain greater insight into social science-related problems and how the social sciences can contribute to solving the challenges and filling the knowledge gaps within the RENERGI programme in both the short and the long term. This process will be completed in spring 2009.

Energy systems

The thematic area of energy systems addresses further development of infrastructure for supplying energy in Norway. A number of projects (nine BIPs and one KMB) will be concluded at the end of 2008/beginning of 2009. Meanwhile, in December, funding was awarded to seven new BIP projects, four new KMB projects and two new Researcher Projects. Including these, the project portfolio at the start of 2009 consists of 15 BIPs, 11 KMBs and two Researcher Projects. Also associated with the portfolio from the start of 2009 are 22 doctoral and two post-doctoral fellowships. Overall, the portfolio provides a sound basis for the continued development of the

Norwegian energy system, in accordance with the Energi21 initiative and the broad-based political agreement on climate policy achieved in the Storting.

Results in 2008: Projects in the BIP portfolio involve a number of smaller companies that are showing promising results, including Doble TransiNor within condition monitoring, MagTech within voltage regulation in weak transmission grids, SmartGenerator within new generator technology for wind power, and Nortroll within control systems for the electricity grid. In addition, Wärtisilä Norge has developed very compact transformer technology (with capacity up to 5 MW) that is well-suited for connecting wind power to the grid; the company plans to build a new production facility at Stord. Furthermore, Nexans and ABB are engaged in projects of high international calibre involving cables and switchgear/control gear, respectively, which may lead to increased exports from Norway in these areas.

Among participants in the KMB/Researcher Project portfolio, the SINTEF/NTNU research community has consolidated its standing in the international community. For example, the EU project SUSPLAN, initiated in 2008, has 16 participants and is coordinated by SINTEF. SUSPLAN is intended to further develop knowledge acquired from previous projects. The growing participation of key European players in projects within the RENERGI programme portfolio reflects the significant international interest in research being conducted in Norway on energy systems. Many projects have engaged in widespread dissemination of information. The IEA ENARD project and the project Risk-based Distribution System Asset Management have organised larger-scale international conferences in Trondheim and Paris, respectively.

Challenges ahead: Continuing to develop the energy system to realise the vision of Norway as a supplier of renewable energy to Europe will require new market solutions as well as the planning and construction of new infrastructure across national borders. International projects in which participants come together to find common solutions will therefore be critical. Nearly all of the largest Norwegian energy companies are represented in the project portfolio. But the smaller ones, which are most numerous, are not. However, they too will be important in connection with the conversion of energy production to distributed generation and the introduction of electric vehicles in the transport sector, and more.

New sources of renewable energy

Under the programme, renewable energy sources are divided into wind power, solar power, bioenergy, geothermal energy, various types of ocean energy, and hydropower. Norway possesses a great deal of expertise in hydropower; one new research area is how hydropower can be meshed with new renewable energy.

Wind

Norway, with its tremendous wind resources and offshore expertise, is in a position to take the international lead in developing offshore wind power. Offshore wind is a priority area and expansion in this area may contribute substantially to achieving the objectives of the Storting's agreement on climate policy. The project portfolio in 2008 consisted of five BIPs and two KMBs. Topics studied include floating wind turbines, operational safety, wind resource mapping, and the study of risks to birds from wind turbines. No new wind power projects were established in 2008, and three ongoing projects were concluded. There is therefore a need to strengthen the portfolio in the future.

In response to the call for proposals for BIPs with a deadline in autumn 2008, the programme received a large number of grant applications from a variety of companies, indicating that many new companies are being established within the area of wind power. Numerous challenges must be dealt with before offshore wind may be realised on a large scale. One of the first

problems that must be solved is the proper dimensioning of wind turbine foundations, which requires a detailed overview of wind and sea conditions. The main challenge to offshore wind is to reduce the costs of investment and operation.

Including projects allocated funding from 2009, the portfolio consists of 11 BIPs and two KMBs. The focus of the portfolio is now directed toward offshore wind power in deep waters. In addition, two FMEs for offshore wind are being established, which will provide a considerable boost in this area.

Bioenergy

In the area of bioenergy, other countries have come far, especially with regard to large, traditional waste incineration plants, with and without electricity generation. Norway's spread-out settlement patterns call for relatively many small facilities. International cooperation will be essential in this area in order to draw benefit from the knowledge acquired by others.

Norway has abundant biomass; utilising it will be a vital factor in achieving the objectives of the Storting's agreement on climate policy. The greatest challenges in this area lie in developing competitive solutions for small-scale facilities. Although burning biomass is CO₂-neutral, greater environmental benefit may be derived through purification measures and utilisation of waste products. Projects carried out have enhanced Norwegian expertise in this area of research. SINTEF, for example, is the project owner of NextGenBioWaste, the EU's largest research project on bioenergy.

At the Research Council, research activities within the area of bioenergy are divided between two research programmes. Upstream activities such as production, harvesting and logistics are encompassed by the Research Programme on Nature-based Industry (NATUROGNAERING), while the application of biomass for energy purposes is dealt with by the RENERGI programme. Although the stream of grant applications targeting bioenergy has been relatively stable, there was a drop in the number of applications for funding for KMB projects for 2009, due to the fact that the research community was giving priority to the establishment of the FMEs. Funding was awarded to three new BIP projects and one new KMB project, and focus is now directed toward biogas and smaller combined heat and power (CHP) units – priority topics in this area.

Including projects that have been allocated funding for 2009, the portfolio consists of six BIPs and six KMBs. The portfolio primarily involves smaller-scale facilities, divided into incineration, gasification and uses of biogas. The portfolio addresses the use of both clean biomass and waste fractions for purposes of heating and electricity generation.

Ocean Energy

The total number of grant applications targeting ocean energy other than offshore wind was modest for 2009. Funding was awarded to one new BIP project on wave energy, and there are two ongoing BIP projects in this area as well. There are also two ongoing projects on osmotic power, in which Statkraft plays an active role. A pilot facility for osmotic power at Tofte in Hurum will be completed in spring 2009.

Norway has a healthy maritime community, and Enova supports a number of concepts for ocean energy. It is essential that these are followed up via long-term research and competence-building. Several research fellows from the RENERGI programme's pool of doctoral fellowship holders have initiated doctoral studies within this area at the Centre for Renewable Energy at NTNU/SINTEF.

Geothermal

As a result of the call for proposals for 2009, funding was awarded to a new KMB project on geothermal energy. There was no previous portfolio within this area, but interest around it is growing. A centre for developing Norwegian expertise in geothermal energy has been established, and there is major global potential. Norway's advantage within this area lies first and foremost in drilling technology.

Hydropower

Among the ongoing projects, two BIP projects will be concluded at the end of 2008/beginning of 2009. There were fewer projects in the portfolio in 2008 than desired, but in December funding was awarded to seven new projects, including three BIPs. In early 2009 the portfolio will be expanded through the establishment of the FME Centre for Environmental Design of Renewable Energy (CEDREN) and one KMB project.

Results in 2008: Projects in the BIP portfolio have generated a number of findings. Rainpower (previously Kværner Turbin) initiated a project for development of small turbines at the beginning of 2008. Focused on high-efficiency turbine designs, the project has so far proved very promising and may be able to provide a foundation for new value creation. The small company EMT Electromagnetic Technology Research has also made good progress on verifying an idea for reducing algal growth and thereby head loss in pipelines. The project will be continued as a new BIP project and may also be applicable to other sectors, so its value creation potential is large. EBL Kompetanse is particularly active in the portfolio, owning three projects for maintenance and production planning; the SINTEF/NTNU community is playing a key role in carrying these out. Within the KMB/Researcher Project portfolio, the most comprehensive project is the Norwegian Institute for Nature Research's (NINA's) project titled Increased power and salmon production with environmentally designed operation of regulated rivers.

Challenges ahead: The hydropower portfolio has been strengthened as a result of the application assessment process in 2008 and will continue to grow in connection with the FME Centre for Environmental Design of Renewable Energy (CEDREN). A number of doctoral degrees are expected to be completed within this field. At the start of 2009 there are 11 doctoral fellows associated with the portfolio, and this number will climb steeply in connection with CEDREN. Recruiting a sufficient number of new fellowship holders will be a challenge.

Hydrogen

Overall, the activity level in the field of hydrogen was stable in 2008. Major players such as Statkraft and Statoil, however, have slowed their activities – which presents a challenge, since they have been drivers in several larger-scale projects. This slowdown is in contrast to the situation in the EU, where the inception of the JTI for hydrogen (European Industry Grouping for a Fuel Cell and Hydrogen Joint Technology Initiative) signals major European investment in this area.

The portfolio for applied research is characterised by ongoing demonstration projects aimed at the transport sector (see below). The remainder of the projects in the portfolio are primarily KMBs and Researcher Projects targeted toward more research-intensive activity. Basic research is mainly related to production and storage.

Environment-friendly transport

The project portfolio for environment-friendly transport in 2008 was divided between hydrogen and biofuels. Funding awarded to *biofuel projects* under the RENERGI programme increased from NOK 5.3 million in 2007 to NOK 8.4 million in 2008. One of the newly started projects will pilot-test a newly developed process for converting the wood component lignin into a petrol

substitute. Developed in laboratory scale through another project supported by the RENERGI programme, the process could have major significance for the utilisation of wood as a raw material for biofuel.

The bulk of the remaining projects in the biofuel portfolio also focus on second-generation technologies that utilise wood as a raw material. The main focus is currently on what is known as biochemical conversion to renewable petrol substitutes, preferably bioethanol. One of the projects involves constructing a pilot facility for the conversion of landfill gas to synthetic diesel; unfortunately, the Swedish technology partner has been unable to carry out its part, which has stalled the project. There is currently therefore little research being conducted on thermochemical processes that can generate synthetic biodiesel from wood.

Efforts within the area of *hydrogen* are dominated by the various HyNor projects for building a hydrogen highway. The most intense activity in 2008 involved HyNor Drammen, HyNor Oslo and the planning of HyNor Romerike. The filling stations in Drammen and Oslo are planned to be opened in spring 2009. Funding for research activities relating to hydrogen in the transport sector totalled some NOK 22 million in 2008.

International activity

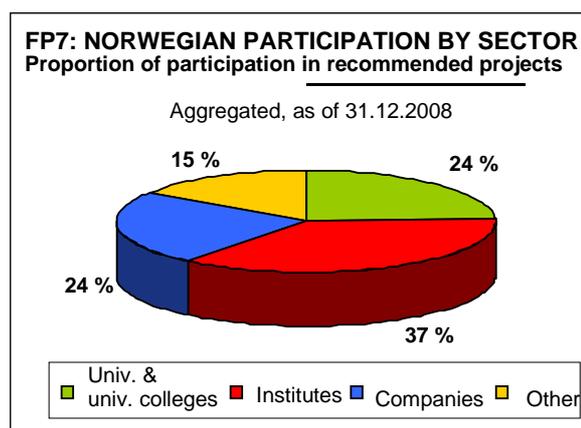
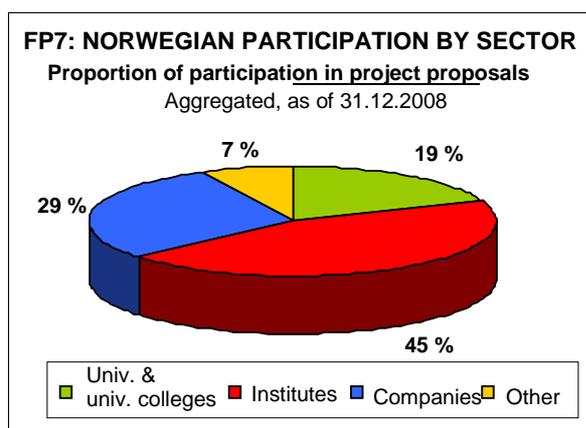
EU collaboration

In the energy sphere, Norwegian research groups have had a good success rate in competing for funding under EU calls for proposals. Aggregate results at the end of 2008 indicate that so far under the EU Seventh Framework Programme, 103 project proposals with Norwegian participation have been submitted. Of these, 26 projects have been recommended for funding, a success rate of 25 per cent. So far, of those 26 recommended projects, nine have earned contracts. There is Norwegian participation in approximately every fifth recommended project under the theme Energy. A total of 21 Norwegian participants had a coordinating role in the applications, i.e. 20 per cent of all applications involving Norwegians. Among the recommended projects are six Norwegian coordinators, a coordinator proportion of 23 per cent. Germany was Norway's most frequent project partner for joint applications, followed by France, the UK, and the Netherlands. Norway collaborates with partners from 25 different countries in the projects recommended so far.

Status of Norwegian project applications and coordinators (*sources: Ecorda and evaluation reports*)

	Submitted project proposals with Norwegian participation		Norwegian coordinators
	Number	Proportion	Number
Recommended	26	25 %	6
Reserve	11	11 %	3
Rejected	66	64 %	12
TOTAL	103	100 %	21

Figures 3 and 4. The pie charts below show the proportion of Norwegian participation in project proposals and recommended projects, respectively.



Communication and dissemination measures

The RENERGI programme organised and/or funded the following communication and dissemination measures in 2008:

Events:

- 2008 Energy Week with the launching of the Energi21 strategy
- National Science Week 2008, whose main topic was environment-friendly energy
- 2nd German Norwegian Conference on Renewable Energy Technology in Leipzig
- 2008 Norwegian Hydrogen Seminar in Bergen
- 2008 Scandinavian Renewable Energy Forum in Lillestrøm

Newsletters and articles:

- Seven issues of the RENERGI programme newsletter distributed to 650 subscribers
- One-page special edition of the RENERGI programme newsletter distributed to everyone in the Ministry of Petroleum and Energy
- Publicity in all six issues of CICERO's *Klima* about the RENERGI programme's projects
- Articles about environment-friendly energy in the National Science Week insert in *Dagbladet*
- Articles about RENERGI programme projects in the Division for Innovation's two inserts in *Dagens Næringsliv*, *Teknisk Ukeblad* and *Kapital*
- Articles from the RENERGI programme at forskning.no
- Opinion articles in *Dagbladet* and *Dagens Næringsliv*
- Press releases about the RENERGI programme's priority thematic areas
- Press materials and other information about the Centres for Environment-friendly Energy Research (FMEs)
- Press materials and other information about Energi21

Websites (an increasingly important channel of information):

- The RENERGI programme
- The Centres for Environment-friendly Energy Research (FMEs)
- The Norwegian Hydrogen Platform
- The Energi21 initiative

Other:

- User survey of the RENERGI programme's project participants and potential applicants
- User survey about ERA-NET INNER
- Updating of fornybar.no, a website run by Enova, the Norwegian Water Resources and Energy Directorate (NVE), Innovation Norway and the Research Council

General activities and processes of the RENERGI programme in 2008

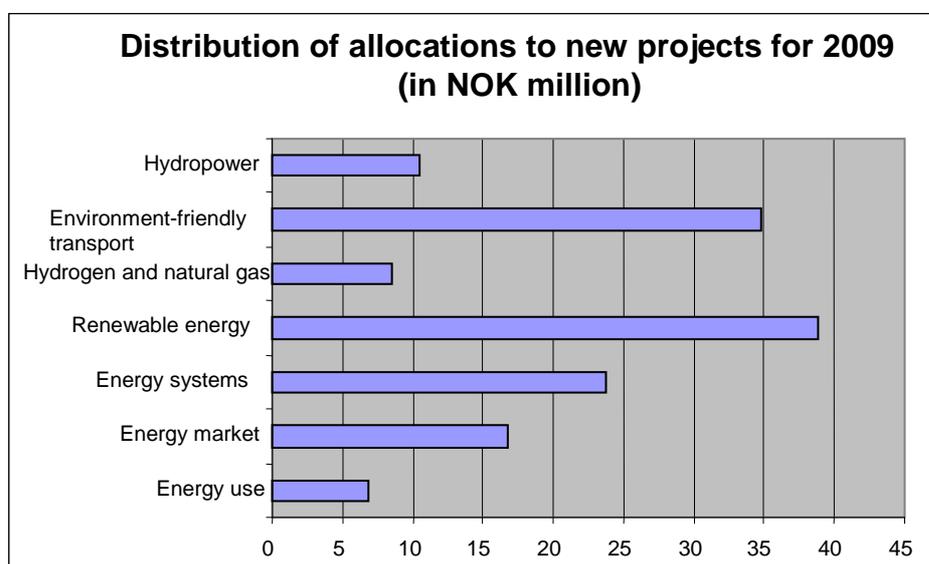
General:

The programme board held six meetings in 2008. A new programme board was appointed in summer 2008. It held three meetings in 2008 and focused its efforts on the application assessment process in autumn 2008. The board will revise the work programme and action plan in spring 2009.

Three larger calls for proposals were issued in 2008:

- Expansion of existing KMBs and Researcher Projects; application deadline of June 2008
- Ordinary call for proposals, KMBs and Researcher Projects; application deadline of June 2008
- Ordinary call for proposals, BIPs; application deadline of October 2008

The KMB projects were assessed by international referees, while most of the BIP projects were assessed by a referee panel. The distribution of projects – BIPs, KMBs and Researcher Projects – awarded funding under the ordinary call for proposals is specified below.



The ordinary calls for proposals for BIPs, KMBs and Researcher Projects resulted in the following distribution of projects with start-up in 2009:

Figure 5. Distribution of new projects by thematic area

The figure illustrates the distribution of new projects (based on grant allocations for 2009). There was a large comparative increase in projects on environmental-friendly transport and in social science-related projects on the energy market.

Special note about expansion of KMBs/Researcher Projects with June 2008 application deadline

In the revised national fiscal budget, the Ministry of Petroleum and Energy allocated NOK 50 million to the Research Council. This allocation was intended for use in preparing and strengthening relevant applicant groups to the FME scheme through expansion of current activity as well as for facilitating an effective process in the early phases of FME preparations. Project funding was awarded for 2008 contingent upon the projects' capacity to rapidly increase their level of activity.

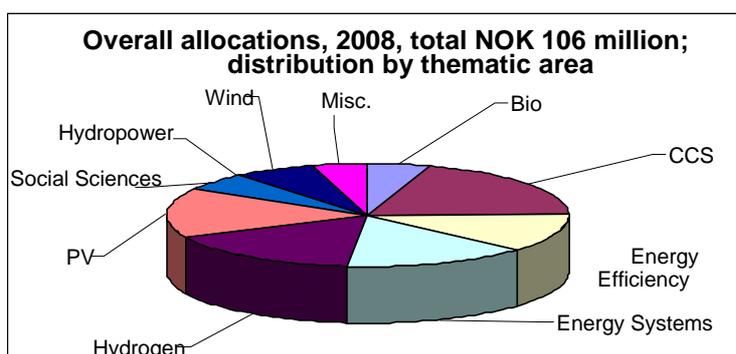
The RENERGI programme board was tasked with allocating funding on behalf of relevant activities and programmes at the Research Council. In order to achieve the quickest possible growth in capacity among the R&D groups, a call for proposals was issued targeting active KMBs and Researcher Projects in relevant areas for potential project expansion. A committee comprising representatives from the boards of involved programmes submitted project recommendations,

while the RENERGI programme board was responsible for final processing and approval of grant allocations.

The call for proposals resulted in the submission of a number of excellent grant applications for project expansion. The RENERGI programme board therefore decided to combine funding from the RENERGI programme with the allocated NOK 50 million, awarding just over NOK 100 million to approximately 40 projects. Funding was allocated to projects under the following programmes/activities: the CLIMIT programme (15 per cent), User-driven Research based Innovation (BIA) (15 per cent), the NANOMAT programme (15 per cent) and the RENERGI programme, plus one Independent Basic Research Project. Figure 6 illustrates the distribution of overall allocations for project expansion by thematic area.

Figure 6. Distribution of overall allocations in 2008 by thematic area. Funding was allocated to projects under several Research Council programmes.

The additional allocation was also used to provide pre-project funding for FME applications. The final distribution of the additional allocation of NOK 50 million was as follows: around NOK 4.5 million went to the FME scheme (pre-projects), NOK 14 million to the CLIMIT programme, NOK 16 million to the NANOMAT programme, and NOK 15 million to the BIA programme. The RENERGI programme's share of these projects was funded by the RENERGI programme.



Designation of new Centres for Environment-friendly Energy Research (FMEs)

Another activity in 2008 was the carrying out of the FME process. A call for proposals for Phase 1 was issued in June with an application deadline of September, and with a December deadline for Phase 2. Although the FME scheme is an independent activity, the RENERGI programme administration was responsible for the process. Since the scheme targets the same research areas as the RENERGI programme, it was necessary for the RENERGI programme board to postpone the final stage of the programme's application assessment process until it was known which research groups had attained FME status. Therefore the programme board did the final processing and approval of grant allocations at board meetings in December 2008 and February 2009.

Six of the eight designated FMEs lie within the sphere of responsibility of the RENERGI programme:

FME	Host institution	Topic
Norwegian Research Centre for Offshore Wind Technology (NOWITECH)	SINTEF Energy Research	Climate-friendly power - Offshore wind
Norwegian Centre for Offshore Wind Energy (NORCOWE)	Christian Michelsen Research (CMR)	Climate-friendly power - Offshore wind
The Norwegian Research Centre for Solar Cell Technology	Institute for Energy Technology (IFE)	Climate-friendly power - Solar
Bioenergy Innovation Centre (CenBio)	Norwegian Univ. of Life Sciences (UMB)	CO2-neutral heating
The Research Centre on Zero Emission Buildings - ZEBNTNU		Raising energy efficiency
Centre for Environmental Design of Renewable Energy (CEDREN)	SINTEF Energy Research	Climate-friendly power - Offshore wind

The two remaining FMEs deal with CO₂ management, with SINTEF Energy Research and CMR as the host institutions.

Highlights and findings from the RENERGI programme in 2008

Projects under the RENERGI programme span a range of priority thematic areas that will be critical for Norway's reaching its objectives for reducing emissions and increasing the use of environment-friendly energy. The projects within the thematic area of energy use/raising energy efficiency and increased utilisation of bioenergy contribute most to reducing emissions in the short term, as they involve improving energy utilisation in buildings and industry. Some of the projects within the thematic area of energy systems have the added purpose of reducing loss during power transmission to achieve concrete savings in energy consumption.

Nevertheless, most of the RENERGI programme's projects involve technology and knowledge aimed at increasing the use of renewable energy in the future. This pertains to the projects on offshore wind, ocean energy, hydrogen and fuel cells, as well as the projects on next-generation biofuels. In addition, there are a sizable number of social science-related projects that examine barriers to and framework conditions and incentives for increasing usage of environment-friendly energy.

Highlights from selected projects

NextGenBioWaste

- EU's largest bioenergy project
- Headed by SINTEF Energy Research

Focus:
Combustion of all organic materials, from municipal waste, from households and industry, to biomass from e.g. forests and agriculture.

Activities:

- Preparation and mixture of fuels
- Conversion technologies
- Processing and utilisation of ash
- Dissemination of information and research findings

Facts

Overall budget: NOK 250 million

Funding from the RENERGI programme:

NOK 5 million to SINTEF

Project period: 2006-2010

Participants: SINTEF (project coordinator), Trondheim Energi Fjernvarme, and 15 European partners.

www.nextgenbiowaste.com



BIOHTPEM – bioethanol fuel cells

- Far higher efficiency potential than the Otto engine
- Allows for use of undried (anhydrous) ethanol for better energy efficiency and cost effectiveness

Facts

Technology Development for Bioethanol-fuelled HTPEM Systems

Project participants: Prototech, NTNU, Weyland, EADS/Airbus

Overall budget: approx. NOK 12 million

Funding from the RENERGI programme: up to NOK 5.5 million

Project period: 2009-2012



High-voltage subsea cables for deep waters

Facts

Project title: Development of high-voltage polymer subsea cables for deep waters

Host institution: Nexans Norway
Project partners: SINTEF Energy Research, NTNU, Statnett and several grid companies

Overall budget: NOK 5 million

Funding from the RENERGI programme: NOK 2.5 million

Project period: Concluded in 2008, to be continued as a new BIP



- A secondary objective of the project is to identify smart systems of polymer cable materials that can replace the metallic casing used in current subsea cable designs in order to prevent water penetration.

- The project has constructed two theoretically promising casing constructions for laboratory testing.

- The project can lay the foundation for creating cost-effective subsea cable systems for use by Norwegian grid companies and for export.

Solar silicon of the future – just around the corner

- Solar-grade silicon is a limiting factor; materials rejected by IT industry are used
- Elkem Solar is developing a purely metallurgical process for producing solar-grade silicon

Facts:

Metallurgical process for producing low-boron silicon for applications in the solar-cell industry

Project participants: Elkem Solar, NTNU, SINTEF

Project period: 2005-2008



CHAPDRIVE – wind turbine gears

- Technology for placing gearbox and generator at the foot of the tower:
 - Dramatically reduces the size and weight of the nacelle at the top of the tower.
- Could be critical for installation of wind turbines of 5-10 MW in open seas

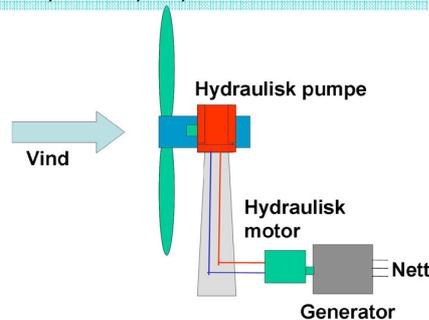
Facts:

Project title: Hydrostatic drive for use in an offshore wind turbine or tidal turbine

Project period: 2007-2008

Funding from the RENERGI programme: NOK 2 251 000

Project participants: Chapdrive, NTNU, SINTEF, IFE, Viva AS.



What influences energy policy decisions?

- Financial models and scenarios to identify optimal energy policy decisions concerning energy production
- How EU decisions influence Norwegian energy policy decisions

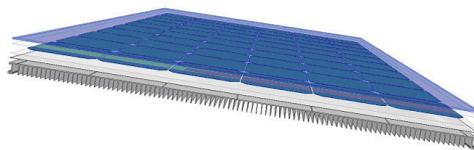
Facts

Project title: Norwegian energy technology innovation and diffusion in a global technology market with international commitments

Host institution: IFE, with the Fridtjof Nansen Institute and Statistics Norway as partners

Funding from the RENERGI programme: NOK 4.8 million

Project period: 2005-2009



Cost-effective refurbishment of existing homes – EKSBO

- Increase wall insulation from 10 cm to 30 cm.
- Retro-insulate floors and ceilings.
- Replace windows to meet passive house standards, install balanced ventilation with efficient energy recycling.
- Replace oil-burning and electric water heaters with a combination of efficient vacuum-tube solar collectors and air-to-water heat pumps.
- These measures would reduce annual energy consumption in homes from an excessive 320 kWh/m² to an impressive 80 kWh/m².

Facts

Project period: 2005-2009

Overall budget: NOK 14.8 million

Funding from the RENERGI programme: NOK 3.6 million

Project partners: NorDan, Villavent, Glava Rockwool, maxit, Isola and others; LOBB, NORDPLAN, SINTEF and others



SWAY – floating wind turbine tower

Facts

Project title: Development of floating wind energy converter for deep water

Host institution: Sway

Overall budget: NOK 5.5 million

Funding from the RENERGI programme: NOK 3 million

Project period: 2005-2008

