



norden

Nordic Energy Research

Annual Report 2005





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Chairman's report

HANS JÜRGEN STEHR, HEAD OF DEPARTMENT, THE DANISH ENERGY AUTHORITY

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The Nordic Council of Ministers has placed the Nordic countries on the political agenda as being a global winner region. The Nordic countries have much to build on when engaging in future competition. Our highly developed welfare state rates high on global lists comparing competitiveness, innovation, labour markets, the public sector and welfare. However, well-functioning, sustainable and affordable energy systems are needed if the Nordic countries are to continue being a winner region in the future. Without energy there would be no prosperity and welfare.

Nordic cooperation on energy policy is in many ways keeping ahead of the development of a common European energy policy. The action plan relating to Nordic energy cooperation 2006-2009 is designed to create visible and lasting contributions towards solving the most important and politically most relevant energy policy challenges currently being faced by the Nordic countries. This work is concentrated on three main topics: creating the best possible frameworks for the development of the Nordic energy markets, working to achieve a sustainable energy system and ensuring that the Nordic countries keep ahead of developments in the EU and other international cooperative ventures by engaging in international cooperation.

By adopting a sharper Nordic profile on energy and energy research, the Nordic countries have obtained a unique opportunity to market and strengthen Nordic interests in these areas. Since the Nordic countries, Europe and the world are facing tremendous energy challenges in respect of energy supply, the effects of climate change and economic growth, it is necessary to promote the research and development of new energy technologies and systems. By engaging in energy research, the Nordic countries have contributed towards increased energy efficiency and energy distribution in the form of sustainable energy sources. However, all the forecasts indicate that this is nowhere near enough. The extent of

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Nordisk Ministerråd har sat Norden som global vinderregion på den politiske dagsorden. Norden har meget at bygge på i fremtidens konkurrence. Vores højtudviklede velfærdssamfund scorer højt på verdens ranglister over konkurrenceevne, innovation, arbejdsmarked, offentlig sektor og velfærd. Men en grundlæggende forudsætning for Norden som fremtidens vinderregion hviler på velfungerende, bæredygtige og billige energisystemer. Uden energi ingen velstand eller velfærd.

Det nordiske energipolitiske samarbejde er på mange måder på forkant med udviklingen af en fælles europæisk energipolitik. Handlingsplan for det nordiske energisamarbejde 2006-2009 er målrettet mod at skabe synlige og holdbare bidrag til løsning af de væsentligste og politisk mest relevante energipolitiske udfordringer, Norden står overfor. Arbejdet er koncentreret omkring tre hovedtemaer: at skabe de bedste mulige rammer for udvikling af de nordiske energimarkeder, at arbejde for et bæredygtigt energisystem og at sikre at Norden gennem internationalt samarbejde er på forkant med udviklingen i EU og andet internationalt samarbejde.

Gennem en mere skarp nordisk profil på energi og energiforskning har de nordiske lande en enestående mulighed for at profilere og styrke nordiske interesser indenfor disse felter. I en situation, hvor Norden, Europa og verden står overfor enorme energiudfordringer indenfor energiforsyning, effekter af klimaændringer og økonomisk vækst, er det nødvendigt at fremme forskning og udvikling af nye energiteknologier og -systemer. Gennem energiforskningen har de nordiske lande bidraget til øget energieffektivitet og energispredning i form af vedvarende energikilder. Men alle prognoser siger, at dette langt fra er nok. De fore-

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our forthcoming energy challenges is currently such that an increased and long-term R&D commitment is required.

During the last 20 years the Nordic countries have placed priority on a Nordic commitment to energy research. The Nordic Energy Research Programme was established in 1985 as a programme, and in 1999 it became an institution with its own board under the auspices of the Nordic Council of Ministers.

Over the years the funds granted have been stable and have been granted to a number of priority areas that generally encroach on Nordic energy cooperation in respect of sustainable energy, energy efficiency, well-functioning energy markets and international energy cooperation.

The construction of Nordic Energy Research is remarkable in the European research context, and indeed also in the context of Nordic cooperation. The countries involved have contributed towards this cooperative venture by making direct contributions and they are actively involved in creating as much synergy and interplay as possible between national and international energy research activities.

MANY MILESTONES WERE REACHED IN 2005

Starting with the most recent event, an anniversary conference was held on 13 October 2005, called "New energy solutions, research and developments in the Nordic countries up to 2030", at Schæffergården in Copenhagen. This conference celebrated 20 years of commitment to Nordic energy research, a commitment that has helped to create an extensive knowledge network in the Nordic countries and throughout the world. This sound knowledge base has provided the Nordic energy sector and industry with the opportunity to participate in the development and introduction of new technology and solutions and has helped to maintain the competitiveness of the Nordic energy industry. At the conference there were many contributions from Nordic researchers and officials, and both results and future challenges relating to Nordic energy systems and research were discussed eagerly.

Another major activity involved the completion of a mid-way evaluation of Nordic Energy Research's projects for the period 2003-

stående energiudfordringer har i dag et omfang, som nødvendiggør en øget og langsigtet F&U indsats.

De nordiske lande har de sidste 20 år prioriteret en nordisk indsats indenfor energiforskningen. Nordisk Energiforskningsprogrammet blev etableret i 1985 som program og blev i 1999 en institution med egen bestyrelse under Nordisk Ministerråd.

Bevillingerne har gennem årene været stabile og er blevet bevilliget til en række prioriterede områder, som i det store hele er i indgreb med det nordiske energisamarbejde indenfor vedvarende energi, energieffektivitet, velfungerende energimarkeder og internationalt samarbejde.

Nordisk Energiforskning er som konstruktion bemærkelsesværdig i det europæiske forskningsrum, men så sandelig også i det nordiske samarbejde. Landene har nemlig bidraget til samarbejdet gennem direkte bidrag og er aktivt engageret med at skabe størst mulig synergi og samspil med nationale og internationale energiforskningsaktiviteter.

ÅRET 2005 HAR VÆRET SKELSÆTTENDE PÅ MANGE MÅDER

For at starte med det sidste først, så blev der den 13. oktober 2005 afholdt en jubilæumskonference "Nye energiløsninger, forskning og udvikling i Norden frem mod 2030" på Schæffergården i København. Konferencen var en markering af 20 års satsning på energiforskning i nordisk regi, en satsning, som har bidraget til omfattende vidennetværk i de nordiske lande og internationalt. Denne solide videnbase har givet den nordiske energisektor og industri mulighed for at deltage i udviklingen og introduktion af nye teknologier og løsninger og bidraget til at fastholde den nordiske industris konkurrenceevne indenfor energi. På konferencen var der en lang række indlæg fra forskere og myndigheder i de nordiske lande, og såvel resultater som fremtidige udfordringer for de nordiske energisystemer og energiforskningen blev ivrigt debatteret.

En anden væsentlig aktivitet var færdiggørelsen af en midtvejsevaluering af Nordisk Energiforsknings projekter i pe

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A fundamental prerequisite for the Nordic Region to be a future global winner is well functioning, sustainable and affordable energy systems. Without energy there will be neither prosperity nor welfare.

2006. This evaluation was undertaken by an external consultant, and the results were discussed with the project participants, the management and the board. The evaluation shows that the efforts of the Nordic countries have created comprehensive and professionally strong networks. These networks comprise more than 200 experts from research institutions and industry. Key activities include graduate schools, mobility programmes, workshops and innovation projects. More than 70% of the projects have participants from our neighbouring areas, i.e. the Baltic countries and north-west Russia. Scientific promotion of the results has been good, and the project participants are working purposefully towards promoting them to users and citizens alike.

A third activity involved the formulation and adoption of a new strategy for the period 2007-2010. This new strategy was formulated by engaging in a close dialogue with relevant interested parties in the energy sector and research circles and among the authorities in the Nordic countries. The strategy was presented and adopted by the Nordic energy ministers in Greenland in August 2005. The contents focus on five thematic areas relating to the integration of energy markets, lasting energy, energy efficiency, hydrogen economy and the consequences of climate changes. Measures include capacity and competence projects, innovation projects, policy studies and the development of international networks.

The fourth and final activity has involved consolidating Nordic Energy Research as an institution. On 31 March 2005 our former director, Per Ø. Hjerpaasen, decided to step down in order to take up a position in private industry. Prior to the appointment of a new director, Senior Adviser Mikael Forss was temporarily appointed as Director. On 1 September Birte Holst Jørgensen took up the position as our new Director. She comes from a position as a Senior Researcher at Risø National Laboratories and her duties involve the continued consolidation and marketing of Nordic Energy Research.

Energy and energy research are once again on the political agenda in the Nordic countries and in international circles. By intensifying the Nordic contribution, we all have the opportunity to help in the development of new, sustainable and affordable energy solutions.

rioden 2003-2006. Evalueringen blev foretaget af en ekstern konsulent, og resultaterne blev drøftet med såvel projekterne som med administration og bestyrelse. Evalueringen viste, at den nordiske indsats har skabt omfattende og fagligt stærke netværk. Disse netværk omfatter mere end 200 eksperter fra forskningsinstitutioner og industri. Centrale aktiviteter er bl.a. forskerskoler, mobilitetsprogrammer, workshops og innovationsprojekter. Mere end 70% af projekterne har deltagelse fra nørrområderne, altså de baltiske lande og Nordvestrusland. Den videnskabelige formidling af resultaterne har været god, og projekterne arbejder målrettet med at formidle resultaterne til brugere og borgere.

En tredje aktivitet var formulering og vedtagelse af en ny strategi for perioden 2007-2010. Den nye strategi er blevet formuleret i en tæt dialog med relevante interessenter fra energisektoren, forskerverden og myndigheder i de nordiske lande. Strategien er fremlagt og vedtaget af energiministrene i Grønland i august 2005. Indholdsmæssigt er der fortsat fokus på fem tematiske områder indenfor integration af energimarkeder, vedvarende energi, energieffektivitet, brintøkonomi og konsekvenser af klimaændringer. Virkemidlerne omfatter kapacitets- og kompetenceprojekter, innovationsprojekter, policy-studier og international netværksopbygning.

Den fjerde og sidste aktivitet har været at konsolidere Nordisk Energiforskning som institution. Den 31. marts 2005 valgte den daværende direktør Per Ø. Hjerpaasen at træde stillingen til fordel for en ledende stilling i det private erhvervsliv. Indtil en ny direktør var på plads, blev seniorrådgiver Mikael Forss konstitueret som direktør. Og den 1. september tiltrådte Birte Holst Jørgensen som ny direktør. Hun kommer fra en stilling som seniorforsker på Forskningscenter Risø og har som opgave at arbejde for en fortsat konsolidering og profilering af Nordisk Energiforskning.

Energi og energiforskning er igen kommet på den politiske dagsorden i de nordiske lande og internationalt. Gennem en forstærket nordisk indsats har vi alle muligheder for at bidrage til udvikling af nye, bæredygtige og betalelige energiløsninger.



By intensifying the Nordic trans-national
co-operation, we all have the opportunity
to contribute to the development of new,
sustainable and affordable energy
solutions.

Building on 20 years of Nordic Energy Research

BIRTE HOLST JØRGENSEN, MANAGING DIRECTOR

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In my capacity as the new Director of Nordic Energy Research, I have the privilege of being able to build on the solid foundations created by 20 years of work on energy research. This cooperative venture is part of the Nordic family, and at the same time it has close relations with our neighbouring areas, Europe and the rest of the world. Although energy is a national issue, energy and thus also new energy technologies are a common strategic issue.

Access to adequate and cheap sources of energy is high on the geopolitical agenda. Fossil fuels are limited and will run out at some point in the future. There are many opinions about this, but one thing is certain - known and unknown reserves will be unable to satisfy continued increases in global energy consumption in the long term, not just in the OECD countries, but also in the emerging growth economies in China, India, Brazil, Mexico and South Africa. There is also growing understanding of the fact that only the development of new, sustainable energy technologies will be able to secure future energy supplies and solve the increasing problems caused by greenhouse gases and pollution. New energy technologies can simultaneously represent a way of creating growth and new jobs.

So are the Nordic countries doing enough to find alternative energy solutions? Is enough being invested in research and development in this field, and is optimal use being made of limited resources?

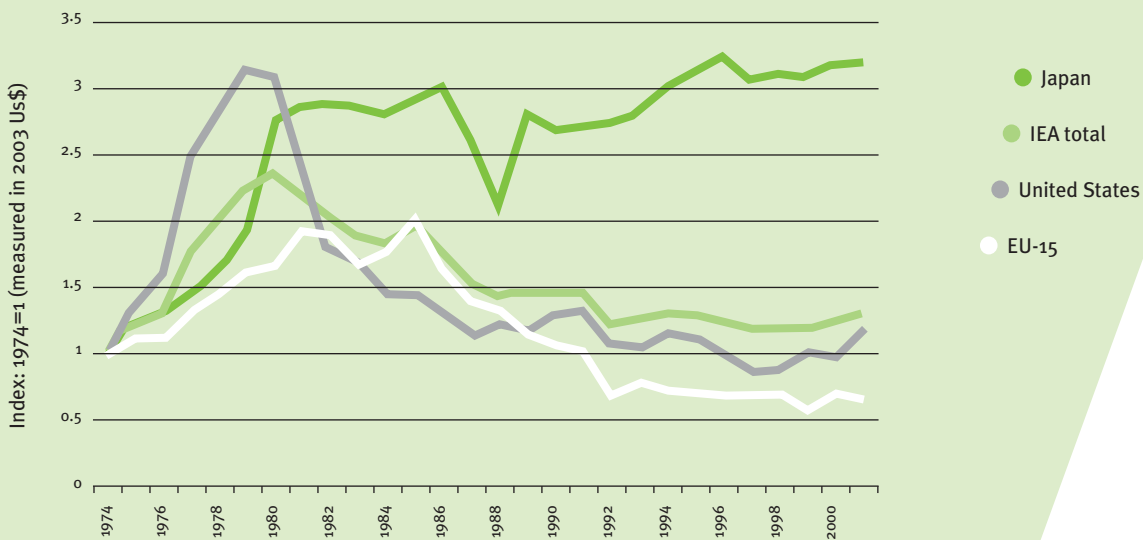
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Som ny direktør for Nordisk Energiforskning har jeg det privilegium at kunne bygge videre på et solidt fundament af 20 års energiforskningssamarbejde. Det er et samarbejde som er en del af den nordiske familie, og som samtidig har tætte relationer til nørømråderne, Europa og verden. Selvom energi er et nationalt anliggende, så er energi og dermed også nye energiteknologier et fælles strategisk anliggende.

Adgangen til tilstrækkelige og billige energikilder står højt på den geopolitiske dagsorden. De fossile brændsler er begrænsede og vil på et eller andet tidspunkt ophøre. Det er der mange meninger om, men det er sikkert, at selv kendte og ukendte reserver ikke på lang sigt kan opfylde et fortsat stigende energiforbrug verden over, ikke kun i OECD landene, men også i de fremadstormende vækstøkonomier i Kina, Indien, Brasilien, Mexico og Sydafrika. Der er også stigende forståelse for, at kun udvikling af nye, bæredygtige energiteknologier kan sikre den fremtidige energiforsyning og løse de stigende problemer med drivhusgasser og forurening. Nye energiteknologier kan samtidig være en måde at skabe vækst og nye arbejdspladser.

Gør vi i Norden så nok for at finde alternative energiløsninger, investeres der nok i forskning og udvikling indenfor feltet, og bruges knappe ressourcer optimalt?

Figure 1. Government energy R&D expenditure index 1974-2001/Offentlige energi F&U udgifter index 1974-2001



Source: Jørgensen, B.H. Key Energy Technologies 2005. <http://www.risoe.dk/rispubl/SYS/ris-r-1533.htm>

DECLINING ENERGY RESEARCH FUNDS

The oil crises that occurred during the 1970s served to kick-start energy research throughout the world. However, since the beginning of the 1980s there has been a drastic drop in public investments in the research and development of new energy technologies. This applies to the USA and the other IEA countries, including the Nordic countries. The only exception is Japan, where public investments have been increased, and most of this contribution has been directed at nuclear research.

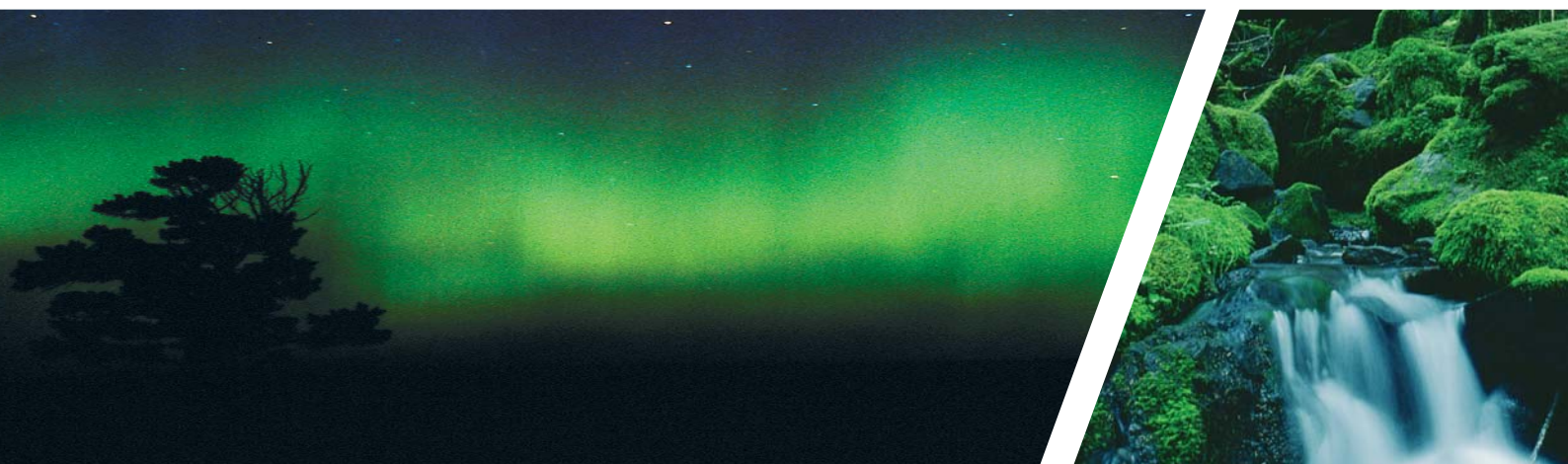
Over time less priority has also been placed on energy research in the EU. Energy research is divided into nuclear research under the 1957 Euratom Treaty and non-nuclear research which includes the EU's framework research programmes. During the first programme period (1983-86), 66% of total research funds were spent on both nuclear and non-nuclear energy research. During

FALDENDE ENERGIFORSKNINGSMIDLER

Oliekriserne i 1970erne kickstartede energiforskningen verden over. Siden starten af 1980erne har der imidlertid været et drastisk fald i de offentlige investeringer i forskning og udvikling i nye energiteknologier. Det gælder USA og de øvrige IEA-lande, herunder også de nordiske lande. Eneste undtagelse er Japan, hvor de offentlige investeringer har vist en fremgang, og størstedelen af denne indsats er målrettet nuklear forskning.

Også i EU er energiforskningen over tid blevet nedprioriteret. Energiforskningen opdeles i nuklear forskning under Euratom-traktaten fra 1957 og så ikke-nuklear forskning, der er inkluderet i EUs rammeprogrammer for forskning. I den første programperiode (1983-86) blev 66% af de samlede forskningsmidler brugt på energiforskning, både nuklear og >>

Greater resources are required for research and development in new energy technologies. This is not just a public concern, but also a pressing concern for the energy sector and the industry.



the 6th programme period (2003-2006), energy research only accounted for 12% of total research funds, and most of this was spent on nuclear research. The budget for the 7th framework programme will probably contain more Euros, but the percentage of total research funds in the programme will be lower than that which applied to the 6th framework programme.

The reason for this declining trend in the IEA countries and the EU has been a mixture of low energy prices, better extraction methods, the discovery of new reserves of fossil fuels and an attitude that the market is solving the problems involved.

However, it is also politically difficult to sell the message about investing in the future when there are currently so many other urgent needs in other areas, e.g. elderly people and the health sector in a modern welfare society with an ageing population. There is also considerable competition with other research areas for limited research funds.

Greater resources are required for research and development in new energy technologies and systems. This is not just a public concern, but also a pressing concern for the energy sector and the industry.

ikke-nuklear. I 6. programperiode (2003-2006) udgør energiforskningen kun 12% af de samlede forskningsmidler, og langt den største del bruges på nuklear forskning. Budgettet for 7. rammeprogram vil sandsynligvis indeholde en stigning i Euros, men procentdelen af de samlede forskningsmidler i programmet vil være mindre end i 6. rammeprogram.

Årsagen til denne faldende tendens i IEA-landene og i EU har været en blanding af lave energipriser, bedre udvindingsmetoder, opdagelsen af nye fossile reserver og en forestilling om, at markedet løser problemerne.

Men det handler også om, at det er politisk vanskeligt at sælge det budskab, at der skal investeres i fremtiden, når der i nutiden er så mange andre påtrængende behov indenfor bl.a. ældre- og sundhedssektoren i et moderne velfærdssamfund med en aldrende befolkning. Der er ligeledes stor konkurrence med andre forskningsområder om knappe forskningsmidler.

Der skal fremskaffes flere ressourcer til forskning og udvikling i nye energiteknologier og -systemer. Det er ikke blot et offentligt anliggende, men i aller højeste grad også et anliggende for energisektoren og industrien.



RESEARCH ORGANISATION

A greater effort is thus required, and at the same time research could be organised in such a way as to ensure that our limited resources could produce the best and most relevant research.

In 2000, state and government leaders defined the challenges faced by the global knowledge economy in the Lisbon Declaration and determined a strategic target whereby the EU should be the leading knowledge region in the world by the year 2010. One important measure would be to increase R&D funding to 3% of GDP per year, with 1% coming from public funds (the so-called Barcelona Declaration of 2001). Another important measure involved establishing a single market for knowledge, the European research area. Most R&D investments are still made at national level and are thus much greater than the EU's R&D framework programmes. In order to make full use of national R&D contributions in order to benefit Europe's overall competitiveness, sustainable economic growth and welfare, it is necessary to limit the fragmentation and overlapping that exists between national R&D programmes (Optimat, 2005²).

There are no limits to the challenges posed by the development of new energy technologies, and economies of scale and scope can be achieved by seeking solutions through transnational co-

ORGANISERINGEN AF FORSKNINGEN

Et større volumen i indsatsen er altså nødvendigt. Samtidig kan forskningen organiseres på en sådan måde, at vi sikrer den bedste og mest relevante forskning for knappe ressourcer.

I 2000 definerede stats- og regeringscheferne i den såkaldte Lissabon-erklæring udfordringerne i den globale videnskabs- og fastsatte som strategisk mål, at EU skulle være den førende videnregion i verden i år 2010. Et væsentligt virkemiddel er at øge F&U midlerne til 3% af BNP per år, hvoraf 1% skal komme fra offentlige midler (den såkaldte Barcelona erklæring fra 2001). Et andet væsentligt virkemiddel er at etablere et indre marked for viden, det europæiske forskningsrum. Størstedelen af F&U investeringer foretages fortsat på nationalt niveau og er således meget større end EU rammeprogrammer for F&U. For at få fuld nytte af den nationale F&U indsats på Europas samlede konkurrenceevne, bæredygtig økonomisk vækst og velfærd er det nødvendigt at begrænse den fragmentering og det overlap, der er mellem de nationale F&U programmer (Optimat, 2005²).

Udfordringerne indenfor udvikling af nye energiteknologier kender ingen grænser, og ved at søge løsningerne i et transnationalt samarbejde kan der opnås stordrift- og samspils- >>

² Optimat. 205. Good Practice Guide. Increasing the Impact of National Research Programmes through Transnational Cooperation and Opening. www.optimat.co.uk.

operation. Modern science is extremely complex and demanding on resources. It is simply impossible for each individual country to be a leader within all relevant research fields, especially small, open economies such as the Nordic countries. Markets are finally becoming increasingly more global, and transnational R&D cooperation is one way of developing and increasing knowledge-based products and service provision on the global market.

One step on the way towards achieving a more extensive European research area involves transnational R&D cooperation, and this is a field in which Nordic research cooperation excels.

NORDIC ENERGY RESEARCH

Although government energy research and development funds in the Nordic countries have also been declining steadily, these countries have, since 1985, made stable public investments in joint energy research projects in respect of priority areas such as lasting energy, hydrogen and fuel cell technologies, energy efficiency, liberalised gas and electricity markets and the effects of climate change.

Nordic Energy Research is seen internationally as being an exemplary transnational energy research cooperative venture, characterised by a number of capital C's:

- **Concentration** of commitment to R&D is necessary, especially for small countries like the Nordic countries with relatively small knowledge communities. We cannot be world champions in everything, but we can be champions in limited R&D areas.
- **Consensus** on such R&D areas of commitment has been arrived at by engaging in participative processes, where many different stakeholders from government, research and energy sectors have discussed and agreed on the most promising Nordic R&D areas.
- **Continuity** in respect of commitment is necessary for developing knowledge and expertise relating to new energy technologies and systems. It takes time and energy to build up, maintain and develop knowledge at the highest level.

fordele. Moderne videnskab er uhyre kompleks og ressourcerekrævende. Det er ganske enkelt umuligt for hvert enkelt land at være ledende indenfor alle relevante forskningsfeltet, det gælder især små, åbne økonomier som de nordiske lande. Endelig er markeder i stigende grad globale, og transnationalt F&U samarbejde er en måde at udvikle og udbyde videnbaserede produkter og serviceydelser på et globalt marked.

Et skridt på vejen til det større europæiske forskningsrum er regionale samarbejder indenfor forskning og udvikling, og her brillierer det nordiske forskningssamarbejde indenfor energi.

NORDISK ENERGIFORSKNING

Selvom de offentlige energiforsknings- og udviklingsmidler også i de nordiske lande har været jævnt faldende, så har landene siden 1985 foretaget stabile offentlige investeringer i fælles energiforsknings-projekter indenfor prioriterede områder så som vedvarende energi, brint- og brændselscelleteknologier, energieffektivitet, liberaliserede gas- og elmarkeder og effekter af klimaændringer.

Nordisk Energiforskning fremstår internationalt som et eksemplarisk transnationalt energiforsknings-samarbejde, der er kendetegnet ved en række store K'ere:

- **Koncentration** af F&U-indsatsen er nødvendig, især for små lande som de nordiske med relativt små videnmiljøer. Vi kan ikke være verdensmestre i alt, men vi kan være det inden for afgrænsede F&U-områder.
- **Konsensus** om disse F&U-indsatsområder er fremkommet gennem participative processer, hvor et bredt udsnit af forskellige interessenter fra myndigheder, forskning og energisektoren har diskuteret og er blevet enige om de mest lovende nordiske F&U-områder.
- **Kontinuitet** i indsatsen er forudsætning for at opbygge viden og kompetencer indenfor nye energiteknologier og – systemer. Det tager tid og kræfter at opbygge, vedligeholde og udvikle viden på højeste niveau.

- **Complementarity** in R&D competency across national boundaries is one way of ensuring both volume and quality when making a commitment. The energy systems, and thus also the innovation systems, in the Nordic countries are different, and this is partially reflected in the knowledge communities.
- **Coordination** of R&D commitment across institutional sectors and boundaries is similarly important for creating a competitive knowledge community.
- **Commitment** towards creating and implementing joint projects and solutions in respect of energy technologies and systems is a common matter that is closely associated with Nordic cooperation on energy and energy technology. 20 years of work under the auspices of Nordic Energy Research is one of the results of such a commitment from each of the five Nordic countries.

While the capital Cs are designed to secure the frameworks for Nordic energy research cooperation, the choice of future Nordic energy research projects will be dependent on a **number of criteria**:

- **quality** in respect of research – internal scientific quality and externally relevant quality are basic criteria.
- **competition** between the best players is something that we consider to be an effective way of selecting the best.
- **customer-oriented** and efficient management of R&D funds is something that we offer to our projects so that researchers do not have to spend unnecessary time on administration instead of research.
- **communication** of knowledge between researchers has always been a basic condition for researchers. At the same time they are all committed to ensuring that such knowledge is also passed on to the users of such. The technologies in question should be taken right out to the market, and they should be socially robust technologies that are widely accepted by society.

Nordic Energy Research has developed strategic frameworks for the development of the foremost knowledge communities in respect of new energy technologies and systems. 2005 has been a decisive bridgehead between 20 years of R&D activities and future commitment to Nordic energy research cooperation.

- **Komplementaritet** i F&U kompetencerne på tværs af nationale grænser er en måde at sikre både volumen og kvalitet i indsatsen. Energisystemerne og dermed også innovationssystemerne i de nordiske lande er forskellige, og videnmiljøerne afspejler delvist dette.
- **Koordination** af F&U indsatsen på tværs af institutionelle sektorer og grænser er ligeledes vigtig for at skabe et konkurrencedygtigt rum for viden.
- **Kommitment** til at skabe og gennemføre fælles projekter og løsninger indenfor energiteknologier og –systemer er et fælles anliggende, som er snævert forbundet med det nordiske samarbejde indenfor energi og energiteknologi. 20 års samarbejde i regi af Nordisk Energiforskning er et resultat af et sådant kommitment fra hvert af de fem nordiske lande.

Mens de store K'ere skal sikre rammerne for det nordiske energiforskningssamarbejde, vil udvælgelsen af de fremtidige nordiske energiforskningsprojekter bero på en række kriterier, altså **små k'ere**:

- **kvalitet** i forskningen – den internt videnskabelige såvel som den eksternt relevante kvalitet – er et grundlæggende kriterium
- **konkurrence** blandt de bedste anser vi som en effektiv måde at udvælge de bedste
- **kunde-orienteret** og effektiv forvaltning af F&U midler er noget vi tilbyder vores projekter, så forskere ikke unødigt skal bruge tid på administration fremfor forskning
- **kommunikation** af viden blandt forskere har altid været et grundlæggende vilkår for forskere. Samtidig har alle en forpligtelse til, at denne viden også formidles til brugerne af denne viden. Teknologierne skal bringes helt ud på markedet, og det skal være socialt robuste teknologier, som er bredt accepteret af samfundet.

Nordisk Energiforskning har udviklet strategiske rammer for udvikling af de fremmeste videnmiljøer indenfor nye energiteknologier og –systemer. 2005 har været et afgørende brohoved mellem 20 års F&U aktiviteter og fremtidige satsninger i det nordiske energiforskningssamarbejde.

Project Portfolio 2003-2006

The project portfolio consists at the end of 2005 of 12 separate but well coordinated projects. Two projects were finalised in 2005, including the REKYL project and Nordic Hydrogen Energy Foresight. One project was finalised in 2004 (Comparison of Nordic Regulatory Models)

All the projects are lead by a steering committee under the leadership of a project leader from a participating Nordic organisation. The steering committees consist normally of representatives/project partners from all Nordic countries, with the exception of some few projects where some single country is not involved.

ONGOING PROJECTS

In the core area Consequences of Climate Changes there are two projects.

Impacts of Climate Changes on Renewable Energy Sources and their Role in the Energy System (CE)

- extensive simulations, scenario descriptions and analyses regarding the future development
- budget 11.4 M NOK
- leader Árni Snorrason, National Energy Authority/Iceland
- main partners from Denmark, Finland, Norway and Sweden

Nordic CO₂ Sequestration (NoCO₂)

- study and development of different potential methods for cost efficient CO₂-emission elimination (capture, transport, storage)
- budget 13.3 M NOK
- leader Anders Lyngfelt, Chalmers University of Technology/Sweden
- main partners from Denmark, Finland and Norway plus Estonia, Lithuania and Northwest Russia

There are two projects in the core area Integration of Energy Markets

Nordic Energy Market Integration, Energy Efficiency and Climate Changes (NEMIEC)

- analysis of effective energy markets in a socio-economic context and of regulatory and policy instruments to promote sustainable solutions.
- budget 16.0 M NOK
- leader Torstein Bye, Statistics Norway
- main partners from Denmark, Finland, Iceland and Sweden

The core area Renewable Energy Resources consists of four projects

Nordic Graduate School of Biofuel Science and Technology (Biofuel GS)

- strengthening of the bioenergy knowledge through intensified cooperation in the Ph.D.-education and research
- budget 17.0 M NOK
- leader Mikko Hupa, Åbo University/Finland
- main partners from Denmark, Norway and Sweden plus Estonia, Latvia and Lithuania

Competitive Solar Heating Systems for Residential Buildings (REBUS)

- coordination of education, research and development in solar heating technology
- budget 13.1 M NOK (7.7 M NOK, 60 %, from Nordic Energy Research)
- leader Simon Furbo, Technical University of Denmark
- main partners from Sweden and Norway plus Latvia

Solar Electricity - from Materials to System Integration

- strengthening of R&D-activities and commercial development in the PhotoVoltaic-area
- budget 14.4 M NOK
- leader Arve Holt, Institute for Energy Technology/Norway
- main partners from Denmark, Finland and Sweden

Large-Scale Integration of Wind Energy into the Nordic Grid

- development of models/model modules to be used as tools and support in planning of big wind power parks
- budget 9.8 M NOK (4.9 M NOK, 50 %, from Nordic Energy Research)
- leader Ola Carlson, Chalmers University of Technology/Sweden
- main partners from Denmark, Finland and Norway

Five complementary projects in the core area Hydrogen technology

Nordic and Baltic Applied Fuel Cell Technology Research Network (Nordic FC-net)

- stimulation of collaboration between Nordic and Baltic interest groups from industry and research
- budget 1.4 M NOK
- leader Preben Vie, Institute for Energy Technology/Norway
- main partners from Denmark, Finland and Sweden

Hydrogen Production – Electrolysis

- development of high stability components and better total processes
- budget 2.0 M NOK
- leader Finn W. Poulsen, Risø National Laboratory/Denmark
- main partners from Norway

Bio Hydrogen

- activities regarding the potential to produce hydrogen via biological processes
- budget 6.0 M NOK
- leader Peter Lindblad, Uppsala University/Sweden
- main partners from Denmark, Finland, Iceland and Norway plus Estonia and Latvia

Integration of advanced hydrogen storage materials and systems (NORSTORE)

- development of advanced materials for H₂-storage and integration of these into the infrastructure
- budget 9.0 M NOK
- leader V. A. Yartys, Institute for Energy Technology/Norway
- main partners from Denmark, Finland, Iceland and Sweden plus Latvia and Russia

New Metal Hydrides for Hydrogen Storage

- strengthening of the cooperation between researchers focusing on development of new, especially light metal, hydride materials for H₂-storage
- budget 4.4 M NOK
- leader Bjørn Hauback, Institute for Energy Technology/Norway
- main partners from Denmark, Finland, Iceland and Sweden plus Lithuania

More details of the project portfolio and the separate projects (own home-pages, organisation, status, progress etc.) can be found on www.nordicenergy.net

Accounts 2005

ANNUAL ACCOUNTS 2005 / REGNSKAB 2005

2005

2004

Revenues / Indtægter (NOK)

Ordinary budget funds from NCM/
Ordinære budgetmidler fra NMR

1 150 000 1 124 000

Project grants from NCM/Projektbevillinger fra NMR

2 419 892 5 684 424

National grants/Nationale bevillinger¹⁾

34 680 567 26 433 331

Other revenues (interest/transfers etc.)/Andre indtægter

4 621 432 3 743 386

Total Revenues / Totale indtægter

42 871 891 36 985 141

Expenses / Udgifter (NOK)

Administrative expenses/Administrative udgifter

5 771 433 1 124 000

Project expenses/Projektudgifter²⁾

37 100 458 35 861 141

Total Expenses / Totale udgifter

42 871 891 36 985 141

Net Profit / Årets nettoresultat

0 0

Assets / Aktiver (NOK)

Trade debtors/Debitorfordringer m.m.

0 150 000

Grants receivable/Projektfordringer

701 514 36 566

Costs paid in advance/Forskudsbetalte omkostninger

3 106 0

Cash at bank/Bankkonto

43 399 563 41 285 213

Total Assets / Aktiver i alt

44 104 183 41 471 779

Liabilities / Passiver (NOK)

Trade creditors/Kreditorgæld m.m.

99 517 11 117 158

Project advance payment/Projektforskud

40 871 303 21 347 016

Accounts payable/Skyldige omkostninger

365 799 254 090

Transfers/Overførte midler

0 8 753 513

Allocation to the institution/Afsætning til institutionen

2 767 564 0

Total Liabilities / Passiver i alt

44 104 183 41 471 779

1)

	Nordic activity	Activities in Baltic states and NW Russia	Total
Denmark	5 700 000	570 000	6 270 000
Finland	4 400 000	440 000	4 840 000
Iceland	275 000	27 500	302 500
Norway	6 300 000	630 000	6 930 000
Sweden	8 325 000	832 500	9 157 500
Total	25 000 000	2 500 000	27 500 000

2) Of which Baltic states/NW Russia / Heraf Baltikum/NV Rusland NOK 3 744 000.

The annual accounts are revised by the Office of the Auditor General in Norway/Regnskabet er revideret af Riksrevisjonen i Norge.

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Nordic Energy Research has developed strategic frameworks for the development of excellent knowledge communities in respect of new energy technologies and systems. 2005 has been a decisive bridgehead between 20 years of R&D activities and future commitment to Nordic energy research cooperation.

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The Nordic Region shall be able to consolidate and develop its position as a leading knowledge region for new, environment-friendly energy solutions and efficient and wellfunctioning energy markets.

Nordic Energy Research's goal is to be conducive in maximising the results of energy-related research and development in the Nordic Region and their adjacent areas.

Nordic Energy Research

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